SECTION 400 CONCRETE WORK

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410.00 GENERAL

All Portland Cement concrete work within any street, parking lot or alley right-of-way or in any part of the water system, sewage system, or storm drainage system of the Town shall meet the requirements of these STANDARDS AND SPECIFICATIONS. Engineering, plans, licenses, permits, inspection, warranties and acceptance will be as detailed in these applicable STANDARDS AND SPECIFICATIONS for the type of construction involved.

Permits will be obtained BEFORE work begins. The Contractor shall call for inspection, giving one (1) working day (twenty-four [24] hours) notice, and inspection will be made before placement of concrete can occur. Inspector's approval to place materials will be obtained by the Contractor AFTER inspection has been made and BEFORE concrete is placed. Notice of rejection shall be given to Contractor in the event any aforementioned conditions given by the Town Engineer are not met, and work shall be halted until such time as corrective action is taken. Copies of the accepted drawings and the permit shall be on the job site and available to the inspector.

420.00 MATERIALS

Concrete will be composed of Portland Cement, aggregate, and water, and shall be reinforced with steel bars or steel wire fabric where required. Admixtures other than air-entraining agents require written permission of the Town Engineer.

421.00 Cement

All cement used in concrete work shall be Portland Cement conforming to the requirements of ASTM C-150, Type I or Type II. In general, cement meeting the requirements of ASTM C 150 Type II cement shall be used in concrete that will be in contact with the soil, unless otherwise allowed or directed by the Town Engineer. Cement, which for any reason has become partially set or which contains lumps of caked cement, shall be rejected.

The Contractor shall be responsible for the proper storage of all cement until it is used. When requested by the Town Engineer, the Contractor will, at his own cost and expense, furnish the Town Engineer with a certificate from the manufacturer or an acceptable testing laboratory for each carload of cement from which cement is taken for use in the work, stating that the cement meets the requirements of these STANDARDS AND SPECIFICATIONS for Portland Cement.

422.00 Fly Ash

Fly ash may be utilized in the design mix when allowed by the Town Engineer. Fly ash shall conform to the requirements of ASTM C 618 for Class C or Class F. The pozzolanic index shall be eighty-five (85) for Class C and Class F fly ash. Class C fly ash will not be permitted where sulfate resistant cement is required.

The Contractor shall notify the Town Engineer of the source of the fly ash for review prior to use in the project. The fly ash to be used on any project shall have been tested by the Contractor for compliance with these specifications. The results of this testing shall be submitted to the Town Engineer prior to its use on the project.

When required by the Town Engineer, the Contractor shall provide the fly ash analysis performed by the fly ash supplier along with the concrete mix proportions.

423.00 Water

Water for concrete will be clean and free from sand, oil, acid, alkali, organic matter, or other deleterious substances and will meet the requirements for mix water as published in ASTM C 94. Water from public supplies or water that has been proven to be suitable for drinking is satisfactory.

424.00 Admixtures

The Contractor will use air-entraining admixtures for all surfaces of exposed concrete. Air entraining admixtures shall meet ASTM C 260. All other chemical admixtures shall meet ASTM C 494.

425.00 Fine Aggregate

Fine aggregate shall be composed of clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate will be well graded from course to fine and when tested by means of laboratory sieves will meet the requirements of ASTM C 33.

Sieve Size	Percent Passing
3/8"	100
#4	95 - 100
#8	80 - 100
#16	50 - 85
#30	25 - 60
#50	10 - 30
#100	2 - 10

426.00 Coarse Aggregate

The coarse aggregate shall consist of broken stone or gravel composed of clean, hard, tough and durable stone and will be free from soft, thin, elongated or laminated pieces, disintegrated stone, clay, loam, organic, or other deleterious matter.

Coarse aggregate shall be well graded and when tested by means of laboratory sieves will meet the requirements of AASHTO M 43 #67

Sieve Size	Percent Passing
1"	100%
3/4"	90 -100
3/8"	20 - 55
#4	0 - 10
#8	0 - 5

427.00 Colored Patterned Concrete

Where required on the accepted plans, colored patterned concrete shall comply with all applicable portions of this Section 400. In addition, the following shall apply:

A. Minimum twenty-eight (28) day compressive strength of concrete shall be 4,000 psi.
B. Air-entrainment shall be six percent (6%) [± 1%] for maximum aggregate size of three-quarter inch (3/4") or one inch (1") and shall be seven and one-half percent (7.5%) [± 1%] for a maximum aggregate size of three-eight inch (3/8") or one-half inch (1/2").
C. Normal set or retarded set water reducing admixture shall comply with ASTM C 494.
D. No calcium chloride shall be added to the concrete mix.
E. Matching integral color shall be used as a supplement, but not as a color hardener.
F. Color hardener; Specially formulated for installation of pattern concrete, grade "Heavy Duty". Color shall be as noted on the accepted drawings or as approved by the Town Engineer.
G. Color curing compound shall comply with ASTM C 309 and with all applicable air pollution regulations.

When approved by the Town Engineer, reinforcing fibers may be used in the mix design. The fibers must comply with Section 441.00 of these STANDARDS AND SPECIFICATIONS.

430.00 MIXING

431.00 General

All concrete shall be thoroughly mixed in a batch mixer of an approved type and capacity for a period of not less than two (2) minutes after all the materials, including the water, have been placed in the drum. During the period of mixing, the drum shall be operated at the speed specified by the manufacturer of the equipment. The entire contents of the mixer will be discharged before recharge, and the mixer will be cleaned frequently. The concrete shall be mixed only in such quantities that

are required for immediate use. No re-tempering of concrete will be permitted. Hand-mixed concrete will not be permitted except by written approval of the Town Engineer.

432.00 Design of the Mix

432.01 General

Concrete mix information shall be prepared and submitted in accordance with ACI 301 Section 4.2. Proportions shall be submitted to the Town Engineer, along with at least two (2) sets of certified twenty-eight (28) day test results, for review and acceptance. No concrete will be incorporated into the work until the Town Engineer has accepted the proportions.

432.02 Classification

Concrete will conform to the following:

Minimum compressive strength - 28 days*	4000 psi
Minimum cement - sacks/cubic yard	6 = 564 lbs
Maximum water/cement ratio - by weight	.45
Slump - inches	1-4
Air entrainment - % by volume	5-8

* When tested in accordance with ASTM C-31

433.00 Ready-Mixed Concrete

The use of ready-mixed concrete will in no way relieve the Contractor or Developer of the responsibility for proportion, mix, delivery, or placement of concrete; all concrete must conform to all requirements ASTM C-94. The information included on the delivery system should be in accordance with ASTM C-94 section 16.

Concrete shall be continuously mixed or agitated from the time the water is added until the time of use and will be completely discharged from the truck mixer or truck agitator within one and one-half (1-1/2) hours after it comes in contact with the mixing water or with the aggregates. Retempered concrete will not be allowed.

The Town will have free access to the mixing plant at all times. The organization supplying the concrete will have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate. (The contractor will collect delivery, or batch, tickets from the driver for all concrete used on the project and deliver them to the Town Engineer). Batch tickets will provide the following information in accordance with ASTM C-94:

A. Name of ready-mix batch plant
B. Serial number of ticket
C. Date
D. Truck number
E. Name of purchaser
F. Specific designation of job (name and location)
G. Specific class or designation of the concrete in conformance with that employed in job specifications
H. Amount of concrete in cubic yards
I. Time loaded or of first mixing of cement and aggregates
J. Water added by receiver of concrete and his initials
K. Weights of fine and coarse aggregates
L. Type, brand, and amount of cement
M. Type, brand and amount of admixtures
N. Weight (in gallons) of water including surface water on aggregates

440.00 REINFORCING STEEL AND FORMS

The placing, fastening, splicing and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the plans and the latest edition of "CRSI Recommended Practice for Placing Reinforcing Bars". All reinforcing steel shall be epoxy coated. Before being positioned, all reinforcing steel shall be thoroughly cleaned of mill and rust scale and of coatings that will destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement will be re-inspected and, if necessary, cleaned.

Reinforcement shall be carefully formed to the dimensions indicated on the accepted plans by the cold bending method. Cold bends shall be made so that the inside diameter of the bend measured on the inside of the bar shall be as follows:

Bar Size	Grade 60
#3 through #8	6 bar dia.
#9, #10, and #11	8 bar dia.
#14 and #18	10 bar dia.

The inside diameter of bend for stirrups and ties shall not be less than four bar diameters for sizes #5 and smaller, and five bar diameters for #6 and #8 inclusive. Reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans will not be used. Heating of reinforcement will not be permitted.

Reinforcing steel will be accurately placed and secured against displacement by using annealed iron wire of not less than No. 18 gauge, or by suitable clips at intersections. Where necessary, reinforcing steel will be supported by metal chairs, spacers, precast mortar blocks, or metal hangers. Splicing of bars, except where shown on the plans, will not be permitted without approval of the Town Engineer.

Welded wire fabric for concrete reinforcement shall be of the gauge, spacing, dimensions, and form specified on the plans or detailed drawings and will comply with "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" (ASTM A-185) or "Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement" (ASTM A-497).

Contractor shall submit to the Town Engineer shop drawings of the reinforcement for his review and acceptance. The Town Engineer' acceptance of shop drawings and bar schedules will not relieve the Contractor of fulfilling his responsibilities as outlined in the plans and specifications of the contract.

Unless otherwise shown on the plans, the minimum clear cover for reinforcing steel will be the following, which is specified in ACI 301, Sec. 5.5:

Bottom bars on soil bearing foundations & slabs .....3 inches

Bars adjacent to surfaces exposed to weather on earth backfill:
For bars more than 3/4" in diameter .....2 inches
For bars 3/4" or less in diameter ..... 1-1/2 inches

Interior Surfaces: slabs, walls, joints with 1-3/8" diameter or smaller ..... 3/4 inches

Whenever necessary, forms will be used to confine the concrete and shape it to the required lines. Forms shall have sufficient strength to withstand, without deformation, the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete will conform to the shapes, lines, grades and dimensions indicated on the accepted plans. Any form which is not clean and has had the surface prepared with a commercial form oil that will effectively prevent bonding and that will stain or soften concrete surfaces must not be used.

Plywood forms, plastic coated plywood forms, or steel forms shall be used for all surfaces requiring forming which are exposed to view, whether inside or outside any structure. Surfaces against backfilled earth, interior surfaces of covered channels, or other places permanently obscured from view, may be formed with forms having sub-standard surfaces.

Forms will not be disturbed until the concrete has hardened sufficiently to permit their removal without damaging the concrete or until the forms are not required to protect the concrete from mechanical damage. Minimum time before removal of forms after placing concrete will be one (1) day for footings and two (2) days for all other concrete except in curbs, gutters, and sidewalks.

441.00 Fibrous Reinforcing

When shown on the accepted plans or approved by the Town Engineer, fibrous reinforcing may be utilized. Fibrous concrete reinforcement shall be one hundred percent (100%) virgin polypropylene fibrillated fibers specifically manufactured for use as concrete reinforcement, containing no reprocessed olefin materials. The fibers shall have the following physical characteristics:

A. Specific gravity - 0.91
B. Tensile strength - 70,000 to 110,000 psi
C. Fiber length - per manufacturer's recommendation for specific use (three quarters inch [3/4"] for sidewalks)

Add fibrous concrete reinforcement to concrete materials at the time the concrete is batched in the amounts recommended by the manufacturer (1.5 lb./cubic yard for sidewalks) or as indicated on the accepted plans.

Concrete shall be mixed in strict accord with the fibrous concrete reinforcement manufacturer's instructions and recommendations to assure uniform and complete dispersion.

450.00 PLACING CONCRETE

451.00 General

Before depositing concrete, debris will be removed from the space to be occupied by the concrete and the forms, including any existing concrete surfaces, shall be thoroughly wetted. Concrete shall not be placed until all forms and reinforcing steel have been inspected and accepted by the Town Engineer. Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods that prevent separation or loss of ingredients. \ The concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling.
It will be deposited in continuous layers, the thickness of which generally will not exceed twelve (12) inches. Concrete shall be placed in a manner that will avoid segregation and will not be dropped freely more than five (5) feet. If segregation occurs, the Town Engineer may require the concrete to be removed and replaced at the Contractor's expense. Concrete will be placed in one continuous operation, except where keyed construction joints are shown on the plans or as approved by the Town Engineer. Delays in excess of thirty- (30) minutes may require removal and replacement of that pour, as determined by the Town Engineer.

452.00 Vibrating

Concrete shall be thoroughly compacted or vibrated. All concrete will be compacted by internal vibration using mechanical vibrating equipment, except that concrete in floor slabs, sidewalks, or curb and gutter, not poured against form linings, will be either tamped or vibrated. Care must be taken in vibrating the concrete to vibrate only long enough to bring a continuous film of mortar to the surface. Vibration will stop before any segregation of the concrete occurs. Mechanical vibrators will be an approved type as specified in ACI Publication 309, Chapter 5. Vibrators shall not be used to move or spread the concrete.

Any evidence of lack of consolidation or over-consolidation will be regarded as sufficient reason to require the removal of the section involved and its replacement with new concrete at the Contractor's expense. The Contractor shall be responsible for any defects in the quality and appearance of the completed work.

453.00 Workability

The consistency of concrete will be kept uniform for each class of work and will be checked by means of slump tests. The workability of the concrete will be varied as directed by the Town Engineer. At all times concrete will have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels and tie-bars by the construction methods which are being used without excessive spading, segregation or undue accumulation of water or laitance on the surface. If, through accident, intention, or error in mixing, any concrete fails to conform to the proportions of the approved mix design, such concrete will not be incorporated in the work but shall be discarded off the project site as waste material at the Contractor's expense. If approval is obtained and water is added at the job site, slump tests will be run and test cylinders cast following the addition of the water. Any expense incurred in excess of ordinary tests will be borne by the Contractor.

454.00 Colored Patterned Concrete

Special concrete mix with integral color shall be placed and screeded to the proper grade, and floated to a uniform surface in the normal manner for slabs on grade.

While the concrete is still plastic, the imprinting tools shall be applied to make the desired patterned surface. The pattern shall be matched at imprint edges and joints.

Color Curing Compound, thinned in the proportion of one (1) part cure to one (1) part mineral spirits (paint thinner), shall then be applied uniformly with a roller or sprayer. The coverage shall be approximately six hundred (600) to six hundred fifty (650) square feet per gallon of un-thinned curing compound. At times when the air temperature is at or near freezing, the slab shall instead be cured using a suitable curing blanket and, if possible, the slab shall later be sealed with the Color Curing Compound at such time as the air temperature is above freezing.

Use blankets and/or heaters as may be necessary to maintain the concrete at or above fifty -(50) degrees Fahrenheit for three (3) days after placement.

The surface shall be cleaned to remove any residual materials.

460.00 JOINTS

461.00 Materials

Joint materials will conform to AASHTO Specifications according to type as follows:

Concrete joint sealer, hot-poured elastic ..... M 173
Preformed expansion joint filler (Bituminous Type) ..... M 33
Preformed sponge rubber and cork expansion joint fillers ..... M 153
Preformed expansion joint fillers - non-extruding & resilient bitum. ..... M 213

Non-bituminous types shall be placed in widths shown on the accepted plans or three-eighths inch (3/8") when not specified. Bituminous type shall be used for concrete paving and structural construction where joint sealers are not called for.

462.00 Spacing

462.01 Expansion Joints

Expansion joint material will be provided at the following locations and will be in place prior to the placing of concrete:

A. at each end of curb return;
B. between back of sidewalk and driveway slab or service walk;
C. between new concrete and existing masonry buildings;
D. as shown on the drawings;
E. as directed by the Town Engineer;
F. between new and existing concrete.

462.02 Contraction Joints

For Curb, Gutter & Sidewalks: Transverse joints will be placed at maximum intervals of ten (10) feet to control random cracking; joints will be sawed or tooled to minimum depth of one-fourth (1/4) of the total thickness (no less than one and one-half [1 ½] inches).

For Concrete Trails greater than 5’ (feet): Transverse joints will be placed at maximum intervals of ten (10) feet to control random cracking; joints will be sawed to minimum depth of one-fourth (1/4) of the total thickness (no less than one and one-half [1 ½] inches).

462.03 Tool or Saw Joints

Tool or saw joints will be spaced as follows:

A. Not more than ten (10) feet nor less than five (5) feet apart in curb and gutter and combination curb-walk
B. Not more than ten (10) feet nor less than five (5) feet apart in sidewalk
C. At least two joints, equally spaced at not greater than ten (10) foot intervals as applicable in driveways
D. As directed by the Town Engineer

470.00 FINISHING AND CURING

Exposed faces of curbs and sidewalks shall be finished to true-line and grade as shown on the plans. Surface will be floated to a smooth but not slippery finish. Sidewalk and curb will be broomed or combed and edged, unless otherwise indicated by the Town Engineer. After completion of

brooming and before concrete has taken its initial set, all edges in contact with the forms will be tooled with an edger having a three-eighths inch (3/8") radius.

No dusting or topping of the surface to facilitate finishing will be permitted.

Immediately following the removal of the forms, all fins and irregular projections will be removed from all surfaces except from those that are not to be exposed or are not to be waterproofed. On all surfaces, the cavities produced by form ties, honeycomb spots, broken corners or edges, and other defects, shall be thoroughly cleaned, moistened with water and carefully pointed and trued with a mortar consisting of cement and fine aggregate. The surface must be left sound, smooth, even, and uniform in color. Mortar used in pointing will not be more than thirty -(30) minutes old. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. Curing processes described herein may be used at the option of the Town Engineer. The selected curing process shall be started as soon as it can be done without injury to the concrete surface. The use of a membrane-curing compound is recommended. The following curing procedures may be used subject to the approval of the Town Engineer:

A. ponding (for slabs or footings)
B. spraying
C. wet burlap, earth, or cotton mats
D. waterproof paper or polyethylene plastic cover

Membrane curing compound will not be used when the concrete surface will be painted. The type of membrane curing compound chosen shall not permanently discolor the concrete surface. Where membrane-curing compound is not used, the curing process will be carefully adhered to as follows:

A. Surfaces being wetted by ponding, spraying, or wetted material will be kept completely wetted, with an excess of free water on the surface, at all times for the first seventy-two (72) hours. After this period, but for the remaining four (4) days, a wetting schedule will be followed whereby the concrete is wetted on a schedule approved by the Town Engineer.
B. Surfaces being protected by waterproof paper or polyethylene plastic cover will receive special attention during the first seventy-two (72) hours to insure there is actually free moisture on the surface of the concrete under the waterproof surface. The Town Engineer may require the removal of the cover and a wetting of the surface when, in his judgment, there is insufficient moisture for curing. After the first seventy-two (72) hours the cover will be kept tightly in place for the remainder of the curing period.

480.00 PROTECTION

481.00 Cold Weather Concreting

During extreme weather conditions, placing of concrete will be permitted only when the temperature of the concrete placed in the forms shall not be less than 50 degrees F nor more than 90 degrees F. To maintain this temperature range, the Contractor shall provide acceptable heating apparatus for heating the aggregates and the water. Cold weather placement of concrete shall follow the requirements and recommendations of ACI Manual 306.

Concrete may be placed when the air temperature in the shade is 35 degrees F, **and rising**.

No concrete shall be placed, regardless of the present temperature, when the weather forecast promises freezing weather before final set of the concrete unless special means of heating and protection are used, which must be approved by the Town Engineer. Protection against freezing is the Contractor's responsibility regardless of the weather forecast or climatic conditions at the time of placing.

Small structures and slabs may be protected by completely covering fresh concrete with blankets. Large structures or vertical walls will be protected against freezing by enclosing the structure and heating with salamanders, heaters, or other devices capable of providing uniform and even heat throughout the structure. Heaters must be vented so that combustion gases are exhausted outside the enclosure in order to avoid carbonation of the fresh concrete.

Cold weather is defined as a period when, for more than three (3) consecutive days, the following conditions exist:

A. The average air temperature is less than 40 degrees F, and
B. The air temperature is not greater than 50 degrees F for more than one half of any 24 hr. period.

Concrete placed in cold weather will be protected from extreme temperatures as follows:

A. A temperature of at least 50 degrees F for the first seventy-two (72) hours will be maintained.
B. After the first seventy-two (72) hours and until the concrete is seven (7) days old; it will be protected from freezing temperatures.
C. Concrete adjacent to heaters or salamanders will be insulated from direct heat of the unit that may dry it out prior to being properly cured.
D. Temperatures will be measured by maximum and minimum thermometers furnished by the Contractor and installed adjacent to the concrete.

Concrete slabs will not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing is not allowed. Concrete that has been frozen will be completely removed and replaced as directed by, and to the satisfaction of, the Town Engineer.

482.00 Hot Weather Concreting

Except by written authorization, concrete will not be placed if the temperature of the plastic concrete cannot be maintained at 90 degrees F or lower. The placement of concrete in hot weather shall comply with ACI 305.

490.00 MISCELLANEOUS

491.00 Repairs

After stripping of the forms, if any concrete is found to be not formed as shown on the accepted plans or is out of alignment or level, or shows a defective surface, it will be considered as not conforming with the intent of these STANDARDS AND SPECIFICATIONS and will be removed and replaced by the Contractor at his expense unless the Town Engineer gives written permission to patch the defective area. In this case, patching shall be done as described in the following paragraphs. Defects that require replacement or repair are those that contain honeycomb, damage due to stripping of forms, loose pieces of concrete, bolt-holes, tie-rod holes, uneven or excessive ridges at form joints, and bulges due to movement of the forms. Ridges and bulges will be removed by grinding. Honeycombed and other defective concrete that does not affect the integrity of the structure shall be chipped out, and the vacated areas will be filled in a manner acceptable to the Town Engineer. The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5,000) psi in twenty-eight (28) days. All repair areas treated with an epoxy-bonding agent will have the approval of the Town Engineer before the repair filling is placed.

Bolt-holes, tie-rod holes, and minor imperfections as approved by the Town Engineer, will be filled with dry-patching mortar composed of one (1) part Portland cement to two (2) parts of regular concrete sand (volume measurement) and only enough water so that after the ingredients are mixed thoroughly, the mortar will stick together on being molded. Mortar repairs will be placed in layers and thoroughly compacted by suitable tools. Care will be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. The mortar mix proportions described above are approximate.

An approved mix will be prepared by a commercial testing laboratory to insure that grout has a twenty-eight (28) day compressive strength equal to that of the area on which it is placed. All costs for mix design and the Contractor will pay testing. Those areas with excessive deficiencies as determined by the Town Engineer will be removed and replaced at the Contractor's expense. Where repairs are made in existing sidewalks, all edges of the old sidewalk allowed to remain will be sawcut to a minimum depth of one half (½) the existing thickness of concrete. No rough edges will be permitted where new construction joins the old section. Unless directed by the

Town Engineer, no section less than five (5) feet in length will be placed or left in place. Where new sidewalk construction abuts existing sidewalks, the work will be accomplished so that there is no abrupt change in grade between the old section and the new work.

492.00 Cleanup

The exposed surfaces of the concrete will be thoroughly cleaned upon completion of the work, and the site will be left in a neat and orderly condition.

493.00 Backfilling

When side forms are removed and the concrete has gained sufficient strength, the space adjoining the concrete shall be promptly backfilled with suitable material, properly compacted, and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill will be level with the top of the concrete for at least two (2) feet and then sloped as shown on the accepted plans or as directed by the Town Engineer. The Contractor, at his expense, will repair existing pavement that is damaged during construction. The first two (2) feet of patching to match existing asphalt or concrete will be the Contractor's responsibility.

494.00 Testing

494.01 General

The requirements of this section will apply to testing services for all concrete curb and gutter, sidewalk, pavement, slope paving, retaining walls, structures, and for all miscellaneous concrete testing.

Concrete materials and operations will be tested as directed by the Town Engineer and as herein stipulated. The required testing services will be performed by a designated testing agency acceptable to the Town Engineer and all testing agencies will meet the requirements of ASTM E329.

A representative of the testing agency will inspect, sample, and test material and production of concrete as required by the Town Engineer. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency will report such deficiency to the Town Engineer and the Contractor.

The testing agency shall report all test and inspection results to the Town Engineer and Contractor immediately after they are performed. All test reports will include the exact location of the work at which the batch represented by a test was deposited. The report of the strength test will include detailed information on storage and curing of specimen prior to testing, the project number, and the location of the concrete (curb, manhole, inlet, sidewalk, paving, etc.).

The testing agency or its representative is not authorized to revoke, alter, relax, enlarge or release any requirements of these STANDARDS AND SPECIFICATIONS, nor approve or accept any portion of the work.

494.02 Tests Provided by the Contractor

The following services shall be performed by the designated testing agency at the expense of the Contractor or Developer:

A. Conduct strength test of the concrete during construction in accordance with the following procedure: Secure composite samples in accordance with AASHTO T141; mold and cure specimens from each sample in accordance with AASHTO T23. The maximum time between sampling and casting the cylinders or beams shall be forty-five (45) minutes. If they cannot be returned to the laboratory and cast within the forty-five (45) minutes, they will be cast in the field and transported to the laboratory in twelve (12) to twenty-four (24) hours. One test series will be taken per fifty (50) cubic yards (or fraction thereof) of the concrete placed per day, or as directed by the Town Engineer.

1. Field cured test series:
   Four (4) cylinders; one (1) to be broken at seven (7) days; one (1) to be broken at fourteen (l4) days; one (1) to be broken at twenty-eight (28) days; one (1) to be held or as directed by the Town Engineer.
2. Lab cured test series:
   Four (4) cylinders; One (1) to be broken at seven (7) days; two (2) to be broken at twenty-eight (28) days*; one (1) to be broken at fifty-six (56) days if necessary.
   **If the specified strength is <u>not</u> obtained at twenty-eight (28) days, one (1) cylinder is to be broken at fifty-six (56) days.*

B. Determine slump of the concrete sample of each strength test whenever consistency of concrete appears to vary, or when directed by the Town Engineer, in accordance with AASHTO T119.

C. Determine air content of the concrete sample for each strength test in accordance with AASHTO T152 (pressure method), T196 (volumetric method), or T121 (gravimetric method).

D. Sample additional concrete at point of placement, and perform other testing or inspection service as required.

E. When required by the Town Engineer, the Contractor or Developer will provide concrete mix designs, the results of which will be immediately reported to the Town Engineer. When pumped concrete is to be used, a separate mix design will be required. Mix designs will be in accordance with ACI 211 and 304, as applicable.

F. Additional testing and inspection required because of changes in materials or proportions.

G. If the work fails to pass inspection or previous tests fail to meet specifications, additional tests will be taken as directed by the Town Engineer.

H. Core samples will be obtained and tested when samples of fresh concrete were not obtained and tested in accordance with the provisions of these STANDARDS AND SPECIFICATIONS. Obtaining and testing cores will be in accordance with ASTM C42. Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least eighty-five percent (85%) of the specified strength f'c, and if no single core is less than seventy-five percent (75%) of the specified strength. Core holes will be filled with low slump concrete or mortar. Cores may be tested in the dry condition in accordance with ACI 301.

I. Failure of the Contractor to furnish testing as herein described will be sufficient cause for rejection of the work in question.

494.03 Test Result Submittals

The testing agency shall submit field test results to the contractor upon completion of sampling and testing. Those field results shall be submitted to the Town of Erie Town Engineer at the time of testing completion. The testing agency shall submit laboratory test results to the owner with a copy sent to the Town of Erie Town Engineer upon completion of laboratory testing.

494.04 Responsibility and Duties of the Contractor

The Contractor will provide the testing agency with the following:

A. Any labor necessary to assist the designated testing agency in obtaining and handling samples at the project or from other sources of material.

B. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site as required by AASHTO T23.

The use of testing services shall not relieve the Contractor of the responsibility to furnish material and construct in full compliance with these STANDARDS AND SPECIFICATIONS.