

Contents

300	DESCRIPTION.....	1
301	DESIGN CRITERIA.....	1
302	MATERIALS.....	1
302.01	Cement.....	1
302.02	Fly Ash.....	1
302.03	Water.....	1
302.04	Fine Aggregate.....	2
302.05	Coarse Aggregate.....	2
302.06	Mortar.....	3
302.07	Admixtures.....	4
303	MATERIAL STORAGE.....	5
303.01	Storage of Cement and Fly Ash.....	5
303.02	Storage of Aggregates.....	5
304	MIX DESIGN.....	5
304.01	General.....	5
304.03	Changes.....	6
304.04	Acceptance.....	6
305	CONSISTENCY AND QUALITY OF CONCRETE.....	6
306	MIXING AND MIXING EQUIPMENT.....	6
306.01	General.....	6
306.02	Proportioning and Mixing Equipment.....	7
306.03	Ready-Mixed Concrete.....	7
306.04	Hand Mixed Concrete.....	8
307	REINFORCING STEEL.....	8
307.01	Bars.....	8
307.02	Forming of Reinforcement.....	9
307.03	Welded Wire Fabric.....	9
307.04	Fibermesh.....	9
307.05	Shop Drawings.....	9



307.06	Placing	10
307.07	Minimum Clear Cover	10
308	FORMS	11
308.01	General	11
308.02	Removal	13
309	JOINTS	14
309.01	Materials	14
309.02	Expansion Joints	15
309.03	Contraction Joints	15
310	PLACEMENT OF CONCRETE	15
310.01	General	15
310.02	Vibration	16
310.03	Finishing	16
310.04	Curing	17
311	WEATHER PROTECTION	18
311.01	Cold Weather Concreting	18
311.02	Hot Weather Concreting	19
311.03	Rate of Temperature Change	19
312	REPAIRS	19
312.01	Repairs to Newly Placed Concrete	19
312.02	Patching	19
312.03	Bolt Holes, Tie-Rod Holes, and Minor Imperfections	19
312.04	Repairs to Existing Sidewalk	19
313	BACKFILLING	20
314	FLOWABLE BACKFILL	20
314.01	Mix Design	20
314.02	Materials and Production	20
314.03	Placement	21
315	CLEANUP	21
316	INSPECTION AND TESTING	21
316.01	General	21
316.02	Testing Provided by the Contractor	22



317	CONCRETE STRUCTURE DESIGN CRITERIA	23
317.01	Curb and Gutter Section.....	23
317.02	Sidewalks	23
317.03	Crosspans and Curb Return.....	23
317.04	Curb Cuts and Driveways.....	23
317.05	Curb Ramps	24
317.06	Bridges and Major Drainage Structures.....	24
318	MATERIALS.....	24
319	REFERENCES.....	25



300 DESCRIPTION

This section shall govern quality, storage, handling, proportioning, transportation, mixing, placing, and curing of materials for Portland cement concrete construction work within the limits of town property including but not limited to any street, parking lot, or alley right-of-way, or in any part of the water system, sanitary sewer system, or storm drainage system of the Town.

301 DESIGN CRITERIA

Design criteria and construction requirements are described in this Section.

302 MATERIALS

Concrete shall be composed of Portland cement or Portland cement and fly ash, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

302.01 Cement

Portland cement shall conform to ASTM C150, Standard Specifications for Portland Cement, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) or Type III (High Early Strength). In general, cement meeting the requirements of Type II shall be used in concrete that will be in contact with the soil, unless otherwise specified. Cement, which has become partially set or contains lumps of caked cement, shall be rejected.

302.02 Fly Ash

1. Fly ash for concrete shall conform to the requirements of ASTM C618, Coal Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete, Class C or Class F. Class C fly ash will not be permitted where Type II cement is required.
2. Fly ash shall be from a preapproved source. Preapproval shall include submission of a report from the supplier documenting the results of testing the fly ash from the source in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) described in 40 CFR 261, Appendix II. The report shall list the contaminants tested, the results for each contaminant tested, and the allowable levels for each contaminant tested. For any source of fly ash that has not been preapproved, the Contractor shall notify the Design Engineer of the source at least 30-days prior to use in the project. The source must be approved and the approval shall be submitted to the Town Engineer before using their fly ash.

302.03 Water

Water used in mixing or curing shall be reasonably clean and free of oil, salt, alkali, sugar, vegetable, or other substance injurious to the finished product. Water will be tested in accordance with, and shall meet the suggested requirements of AASHTO T26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other



foreign materials.

302.04 Fine Aggregate

1. Fine aggregate will 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 and shall conform to the provisions of Standard Specifications for Concrete Aggregates ASTM C33.
2. The maximum percentage of deleterious substances shall not exceed the following values; as listed in Table 300-1:

Table 300-1 Deleterious Substances, Fine Aggregate	
Substance	Maximum
Coal, Lignite, or Shale	1.0
Clay Lumps	1.0
Material Passing No. 200 Sieve	4.0
Other deleterious substances	2.0
Sum of the above material	5.0

3. Fine aggregate shall be well-graded from coarse to fine and shall conform to the following gradation requirements, as listed in Table 300-2:

Table 300-2 Fine Aggregate Gradation	
Sieve Size	Percent Passing by Weight (%)
	Type AASHTO M 6
3/8-inch	100
No. 4	95 – 100
No. 8	---
No. 16	45 – 80
No. 50	10 – 30

302.05 Coarse Aggregate

1. Coarse aggregates for concrete shall consist of crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having strong and durable pieces. Coarse aggregates shall conform to the requirements of AASHTO M43. Aggregate shall be free from soft, thin, elongated, or laminated pieces, disintegrated stone, organic matter, clay, or other deleterious substances, in accordance with the following section and shall conform to the provisions of Standard Specifications for Concrete Aggregates ASTM Designation C33.
2. The amount of deleterious substances shall not exceed the following limits, as listed in Table 300-3:



Table 300-3 Deleterious Substances, Coarse Aggregate	
Substance	Maximum
Shale or Coal	1.0
Clay Lumps	0.5
Material Passing No. 200 Sieve	2.0
Deleterious substances such as friable, thin elongated, or laminated pieces	1.0
Sum of the above material and other deleterious substances	3.0

- Coarse aggregate for concrete shall have a percentage of wear of not more than 40 when tested in accordance with AASHTO T96 or show a sodium sulfate loss not to exceed 12-percent when tested in accordance with AASHTO T140.
- Coarse aggregate for concrete shall meet the following limits as listed in Table 300-4 for the concrete class specified. Other sizes or combinations of sizes may be used when specified.

Table 300-4 Coarse Aggregate Gradation			
Sieve Size	Percent Passing by Weight (%)		
	Type No. 6	Type No. 57	Type No. 67
1-1/2-inch	---	100	---
1-inch	100	95-100	100
3/4-inch	90 – 100	---	90 – 100
1/2-inch	20 – 55	25 – 60	---
3/8-inch	0 – 15	---	20 – 55
No. 4	0 – 5	0 – 10	0 – 10
No. 8	---	0 – 5	0 – 5

302.06 Mortar

- Mortar shall be composed of Portland Cement, sand, and water proportioned and mixed as specified in this section. Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions are shown on the plans.
- The proportion of cement to sand, measured by volume, shall be 1:2 unless otherwise specified.
- The maximum size of sand shall not be larger than ½ the size of the recess, holes or spaces where the mortar is to be placed. The mortar shall contain only enough water to permit placing and packing.
- Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent bond between the mortar and the concrete surfaces and shall be kept thoroughly moistened with water for a period of



not less than 24-hours immediately prior to placing mortar.

5. The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces or mortar shall be cured by the water method as provided in Section 310.04 (a), "Curing" for a period of not less than 5-days.
6. Keyways, spaces between structural members, holes, spaces under structural members, and other locations where mortar could escape shall be mortar-tight before placing mortar. No load shall be allowed on mortar that has been in place less than 72-hours unless otherwise permitted in writing by the Town Engineer.
7. All improperly cured or otherwise defective mortar shall be removed and replaced by the Contractor at his expense.
8. When required to prevent color difference, white cement shall be added to produce the color required.

302.07 Admixtures

1. Admixtures to be used in concrete shall be subject to prior acceptance by the Town Engineer. The admixture shall maintain the same composition and performance throughout the work as the product used in the concrete proportioned established in accordance with ACI 211. Admixtures containing chloride ions shall not be used in prestressed concrete or concrete containing aluminum embedments.
2. An air entrainment agent shall be used in all concrete. The agent used shall conform to ASTM C260.
3. The Contractor shall use a water-reducing, set controlling concrete. A water-reducing admixture shall be used in all concrete and shall conform to ASTM Designation C494, specifically Types A, B, C, D, and E.
4. Mineral admixtures shall be limited to fly ash conforming to ASTM Specification C618.
5. Add 100% virgin polypropylene, fibrillated fibers to all concrete as specified on drawings. Volume per cubic yard shall equal a minimum of 0.1% (1.5-pounds per cubic yard). Fiber length shall be graded per manufacturer. Fibrous concrete reinforcement shall be manufactured by Fibermesh Company or equivalent acceptable to the Town Engineer. Product use shall be in accordance with manufacturer's instructions and recommendations.
6. All air-entraining agents shall be reasonably new material, thoroughly mixed and protected at all times from freezing. Admixtures other than air-entraining agents require permission of the Town Engineer. Calcium chloride-based admixtures will not be approved.



303 MATERIAL STORAGE

303.01 Storage of Cement and Fly Ash

Cement and fly ash shall be stored separately and in well ventilated, weatherproof buildings or approved bins that will protect the material from dampness or absorption. Storage facilities shall be easily accessible and each shipment of packaged cement shall be kept separated to provide for identification and inspection. The Town Engineer may permit small quantities of sacked cement to be stored in the open, for a maximum of 48-hours, on a raised platform and under waterproof covering.

303.02 Storage of Aggregates

Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch layer of the stockpile shall not be used without recleaning the aggregate. Where space is limited, walls or other appropriate barriers shall separate stockpiles. Aggregate shall be stockpiled and protected from the weather a minimum of 24-hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Town Engineer shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

304 MIX DESIGN

304.01 General

The Contractor shall submit design mix, laboratory trial mix, and aggregate data for each class of concrete being placed on the project. Concrete shall not be placed on the project before the design mix proportions and data have been reviewed and approved by the Design Engineer and approval shall be submitted to the Town Engineer. The test data shall show the mix design proportions, of all ingredients including cement, fly ash, aggregate, and additives, plus trial mix data including slump, air content, unit weight, yield, water-cement ratio, and 28-day compressive strength results as tested under laboratory conditions. The test data submitted shall be based on tests conducted by the Contractor. The trial mix proportions must produce 28-day compressive strengths at least 115% of the required 28-day field compressive strengths. Each design shall establish the mix proportions and sources of all ingredients. Aggregate test data will include gradations, percent passing the No. 200 sieve, sand equivalent, fineness module, specific gravity, absorption, and LA Abrasion test results. The Contractor shall be responsible for the design mix proportions and all subsequent adjustments necessary to produce the specified design strength.

304.02 Classes of Concrete

Classes of concrete shall be consistent with Table 601-1 *Concrete Table* in the Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction, 2019.



304.03 Changes

The Contractor shall submit a new mix design when a change occurs in the source, type, or proportions of cement, fly ash, or aggregate.

304.04 Acceptance

Review and approval of the design mix by the Design Engineer or Town Engineer does not constitute acceptance of the concrete. Acceptance will be based solely on the test results of the concrete placed on the project.

305 CONSISTENCY AND QUALITY OF CONCRETE

1. The consistency and quality of concrete should allow for efficient placement and completion of finishing operations before initial set. Retempering shall not be allowed. Concrete shall be workable, cohesive, possess satisfactory finishing qualities, and of the stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements, as specified in Table 300-5. Excessive bleeding shall be avoided, and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.
2. The consistency of concrete will be kept uniform for each class of work and will be checked by means of slump tests. 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 any concrete fails to conform to the proportions of the approved mix design, such concrete will not be incorporated in the work but will be discarded off the project site as waste material at the Contractor's expense. No water may be added at the job site without the permission of the Town Engineer. If approval is obtained and water is added at the job site, slump tests shall be run, and an additional set of test cylinders cast following the addition of the water.

Table 300-5 Classes of Concrete and Specifications			
Class	Air Content	Min 28 Day Strength (psi)	Max W/C Ratio
B	5-8%	4500	0.45

306 MIXING AND MIXING EQUIPMENT

306.01 General

All equipment, tools, and machinery used for hauling materials and performing any part of the work shall be in such condition to ensure completion of the work without delay. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass, and shall be capable of producing concrete meeting



requirements of ASTM C94, Ready-mixed Concrete, and these Standards and Specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed. The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when the specified time of mixing has elapsed.

306.02 Proportioning and Mixing Equipment

1. For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used. These mixers shall be designed to receive all concrete ingredients, including admixtures, in a continuous and uniform rate and mix them to the required consistency before discharging. Mixers shall have adequate water supply and metering devices.
2. Mixing times shall conform to the recommendations of the mixer manufacturer, and shall not be less than 2-minutes after all the materials, including the water, have been placed in the drum. During the period of mixing, the drum will be operated at the speed specified by the equipment manufacturer. The entire contents of the mixer will be discharged before recharge, and the mixer will be cleaned frequently. The concrete will be mixed only in quantities required for immediate use. No retempering of concrete will be permitted.

306.03 Ready-Mixed Concrete

1. Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet the quality requirements specified herein. 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. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant, and mixer truck operations shall include the following:
 - a. A ticket system will be used that includes a copy for the Town Engineer. Each ticket will have machine stamped time/date of concrete batch, weight of cement, fly ash, sand and aggregates; exact nomenclature, and written quantities of admixtures and water. Any item missing or incomplete on the ticket may be cause for rejection of concrete. 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.
 - b. Sufficient trucks will be available to support continuous concrete placements. The Contractor will ensure that adequate standby trucks are available to support placement requirements.
 - c. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of the Town Engineer. When water is added under these conditions, it will be



thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.

- d. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and agitating, and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Town Engineer.
- e. Concrete will 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 1-1/2-hours after batching.
- f. The loading of the transit mixers shall not exceed the capability as shown on the manufacturer's plate attached to the mixer or 63% of the drum volume, whichever is less. The loading of transit mixers to the extent of causing spillage on route to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.
- g. Excess concrete remaining in the drum and washwater shall not be dumped on the project site unless approval of the dump location is first secured from the Town Engineer.
- h. The Town will have free access to the mixing plant at all times for the purpose of inspection.

306.04 Hand Mixed Concrete

Hand mixing of concrete will only be permitted for small placements, or in case of an emergency and only as authorized by the Town Engineer. Hand-mixed batches shall not exceed 4-cubic feet in volume. Material volume ratios shall not be leaner than one part cement, two parts coarse aggregate, one part fine aggregate, and enough water to produce a consistent mix with a slump not to exceed 4-inches. Admixtures shall not be used unless specifically approved by the Town Engineer.

307 REINFORCING STEEL

307.01 Bars

1. Reinforcing steel shall conform to the requirements of the following specifications:
 - a. Deformed and plain billet-steel bars for concrete reinforcement AASHTO M31
 - b. Axle-steel deformed and plain bars for concrete reinforcement AASHTO M53
 - c. Fabricated steel bar or rod mats for concrete reinforcement AASHTO M54



- d. Welded steel-wire fabric for concrete reinforcement AASHTO M55
 - e. Welded deformed steel wire fabric AASHTO M221
 - f. Epoxy coated rebar AASHTO M284
2. Unless otherwise designated, bars conforming to AASHTO M 31 and M 53 shall be furnished in Grade 60 for No. 5 bars and larger and Grade 40 or 60 for bars smaller than No. 5. In AASHTO M 54, bar material conforming to AASHTO M 42 will not be permitted.

307.02 Forming of Reinforcement

1. Reinforcement shall be carefully formed to the dimensions indicated on the approved plans by the cold-bending method. The use of heat in bending bars shall not be permitted. Bars shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Cold bends will be made so that the inside diameter of the bend measured on the inside of the bar is as listed in Table 300-6:

Table 300-6 Bar Bend Diameters	
Bar Size	Inside Diameter
No. 3 through No. 8	6 x bar diameter
No. 9, No. 10, and No. 11	8 x bar diameter
No. 14 and No. 18	10 x bar diameter

2. The inside diameter of bend for stirrups and ties shall not be less than four bar diameters for sizes No. 5 and smaller, and five bar diameters for No. 6 and No. 8 inclusive.

307.03 Welded Wire Fabric

Welded wire fabric for concrete reinforcement will be of the gauge, spacing, dimensions and form specified on the plans or detailed drawings and will comply with ASTM A185, Specifications for Welded Steel Wire Fabric for Concrete Reinforcement or ASTM A497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

307.04 Fibermesh

Approval of the Town Engineer must be obtained prior to using Fibermesh reinforcement in place of Welded Wire Fabric. (See Section 307.03).

307.05 Shop Drawings

Before fabrication of the reinforcement, the Contractor shall prepare complete bending, fabrication, setting drawings, and bar lists covering all required reinforcement steel. Drawings and bar lists shall be submitted to the Design Engineer for review and approval of



general conformity to specified requirements and the approval shall be submitted to the Town Engineer. The Design and/or Town Engineer's acceptance of shop drawings and bar schedules will not relieve the Contractor of fulfilling responsibilities as outlined in the approved plans and these Standards and Specifications.

307.06 Placing

1. The placing, fastening, splicing and supporting of reinforcing steel and bar mat reinforcement shall be in accordance with the plans and the latest edition of "CRSI Recommended Practice for Placing Reinforcing Bars". In case of discrepancy between the plans and the CRSI publication stated above, the plans shall govern.
2. Steel reinforcement shall be accurately placed in the positions shown on the plans and firmly held during the placing and setting of concrete by means of spacer strips, stays, metal chairs or other approved devices or supports. When metal chairs are used, the part of the chair in contact with the form and at least 1-inch from the form shall be hot dip galvanized or plastic coated. Other coatings or treatments will be acceptable when specifically accepted by the Engineer. Precast concrete bricks or other accepted bricks or blocking may be used in structures to support reinforcement in footings or slabs placed on grade; however, the bricks or blocking shall not contact the reinforcement over a distance greater than the depth of a standard concrete brick.
3. Bars shall be securely tied at all intersections except where spacing is less than 1-foot in each direction, when alternate intersections shall be tied. Tying of steel by spot welding will not be permitted unless specifically authorized by the Town Engineer. The placing and securing of the reinforcement in any unit or section shall be accepted by the Town Engineer or a Town Representative before any concrete is placed in any such unit or section. At the time the concrete is placed, the reinforcing steel required shall be free from flaky rust, mud, oil or other coatings that will destroy or reduce the bond.
4. Reinforcing steel, before being placed, shall be thoroughly cleaned of mill and rust scale and of coatings that will destroy or reduce bonding. Reinforcing steel shall be accurately placed and secured against displacement by using annealed wire of not less than No. 18 gauge, or suitable clips at intersections. Where necessary, reinforcing steel shall be supported by metal chairs or spacers, precast mortar blocks, or metal hangers. Splicing of bars, except where shown on approved plans will not be permitted without approval of the Town Engineer.

307.07 Minimum Clear Cover

The minimum clear cover for reinforcing steel is listed in Table 300-7, as specified in ACI 301:

Table 300-7 Minimum Clear Cover



Type	Minimum Cover
Bottom bars on soil bearing foundations and slabs	3-inches
Bars adjacent to surfaces exposed to weather on earth backfill - Greater than 3/4-inch in diameter	2-inches
Bars adjacent to surfaces exposed to weather on earth backfill - 3/4-inches or less in diameter	1-1/2-inches
Interior surfaces - slabs, walls, joints with 1-3/8-inch diameter or smaller	3/4-inches

308 FORMS

308.01 General

1. Whenever necessary, forms will be used to confine the concrete and shape it to the required lines. Forms will have sufficient strength to withstand, without deformation, the pressure resulting from placement and vibration of the concrete. Forms will 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 not had the surface prepared with a commercial form oil, that will effectively prevent bonding and that will not stain or soften concrete surfaces, will not be used.
2. The concrete forms shall be constructed to the lines and dimensions as shown on the detailed drawings and shall be of acceptable material and adequately braced and tied to support all of the loads and pressures of the wet concrete without distortion or leaks, and which will produce a smooth, even surface.
3. The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other approved material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.
4. A water tight form tie with a neoprene seal shall be used on all walls or slabs that form a water holding space. Ties in these walls or slabs shall remain permanently in the concrete.
5. Drawings showing the general design and dimensions for forms for structures need not be submitted to the Town Engineer for acceptance unless the Town Engineer so requests such submittal. Design and construction shall be in accordance with "Recommended Practice for Concrete Formwork" (ACI 347), and "Formwork" (ACI 301, Chapter 4).



6. Before concrete is placed, the surface of the forms shall be oiled with a commercial form oil that will effectively prevent sticking of the concrete to the forms and will not stain the concrete. Form oil shall be approved for potable water applications. All bond breaking materials or processes shall be used only after acceptance by the Town Engineer. Care shall be taken in applying form oil to avoid contact with reinforcement steel. Embedded material which becomes coated with form oil shall be thoroughly cleaned or replaced at the expense of the Contractor. Supporting forms and shores shall not be removed from beams, floors, and walls until these structural units are strong enough to support their own weight and any approved superimposed load which at no time shall exceed the design live load. When the forms are stripped, there shall be no excessive deflection or distortion and no evidence of damage to the concrete, due either to removal of support or the stripping operation. See Table 300-8 for minimum form removal time.
7. Design Criteria:
 - a. The Contractor shall design the formwork for the loads, lateral pressures and allowable stresses outlined in Chapter 1 of ACI 347.
 - b. Form ties: Removeable end, permanently embedded body type (with waterseal washers for liquid retaining structures) in uniformly spaced and aligned vertical and horizontal rows. Ties shall be of sufficient strength and rigidity to support and maintain the form in proper position without auxiliary spreaders. When cones are provided on the outer ends, the permanently embedded portion shall be back a minimum of one inch from concrete surface. Cones shall be finished with non-shrink grout as approved by the Town Engineer.
 - c. Joints shall be keyed and formed unless specified otherwise by the Town Engineer.
8. Erection:
 - a. Erect forms substantially and sufficiently tight to prevent leakage of mortar and braced or tied to maintain desired position, shape and alignment before, during and after concrete placement. At vertical wall joints where forms overlay existing concrete, a mortar tight joint shall be required. Use a bead of silicone caulking or foam joint filler against concrete before placing form or alternate method approved by Town Engineer.
 - b. Provide temporary openings in column and wall forms and at other locations where necessary to facilitate cleaning, to limit the free fall of the concrete to a maximum of 5- feet, to allow compaction of the concrete and to allow inspection. Such openings shall not exceed 10-feet laterally to avoid moving concrete laterally more than 5-feet. If tremies of proper length to limit the free fall are used for depositing concrete in walls then temporary openings are not required.
 - c. After steel reinforcement has been constructed the Contractor shall leave forms such that the Town Engineer or a Town's representative may properly inspect the



reinforcement. No concrete shall be poured without inspection and approval of reinforcement by the Town.

- d. When top of wall will be exposed to weathering, do not extend the forms on one side above the top of the wall; bring to true line and grade. At other locations, bring forms to true line and grade or provide a wooden guide strip at the proper location on the forms so that the top surface can be finished with screed or template.
 - e. Anchor bolts, castings, steel shapes, conduits, sleeves, waterstops, and other materials shall be accurately positioned in the forms and securely anchored. Install conduits in walls and floors between the two mats of reinforcing when present.
 - f. Place chamfer strips in forms to bevel exposed edges and projecting corners. Tool top edges of walls and slabs not indicated for beveling. Form beveled edges for all vertical and horizontal corners of equipment bases and column footings. Chamfer strip shall be 3/4-inch unless specified otherwise.
9. Maximum Allowable Tolerances - Variation from plumb
- a. Lines and surfaces of columns, piers and walls
 - 1) In any 10-feet of length 1/4-inch
 - 2) Entire length 1-inch
 - b. Control joint grooves and other conspicuous lines
 - 1) In any 20-feet of length 1/4-inch
 - 2) In 40-feet or more 3/4inch
10. Maximum Allowable Tolerances - Variation from level or specified grade
- a. Slabs, beams and roof
 - 1) In any 10-feet of length 1/4-inch
 - 2) In any 20-feet of length 3/8-inch
 - 3) Entire length 3/4-inch
 - b. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between supporting members.
 - c. Refer to ACI 301, Table 4.3.1 for additional requirements

308.02 Removal

1. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all live and dead loads. Forms shall remain on beams, slabs and similar sections until 28-day strength is attained. Determine strength from ASTM C900 for pullout test or job cured cylinder breaks. In any case, do not remove forms before the strengths are attained in Table 300-8.



2. Forms will not be disturbed until the following two conditions have all been satisfied:
 - a. The minimum strength has been attained as specified in Table 300-8
 - b. Approval of the Town Engineer

Table 300-8 Minimum Time & Concrete Strength for Form Removal¹		
Type	Min. Time	²Min. Strength
Curb and gutter	2-days	40%*f _c
Side forms for footings and slabs	3-days	50%*f _c
Side forms for non-structural walls, beams, and columns	3-days	75%*f _c
Forms under structural beams and slabs requiring shoring	7-days	100%*f _c
Vertical sides of beams and girders	7-days	100%*f _c
Bottom forms and shoring for slabs, beams and girders: 10 to 20-foot span between permanent supports.	14-days	100%*f _c
Bottom forms and shoring for slabs, beams and girders: over 20-foot span between permanent supports.	21-days	100%*f _c

¹Both the minimum time and minimum strength requirements must be met before forms are removed.

²f_c is the design strength of the concrete.

309 JOINTS

309.01 Materials

1. Joint materials will conform to AASHTO specification according to type as follows:

Table 300-9 Joint Material Specifications	
Type	AASHTO
Concrete joint sealer, hot-poured elastic	M173
Preformed expansion joint filler, bituminous type	M33
Preformed sponge rubber and cork expansion joint fillers	M153
Preformed expansion joint fillers, non-extruding and resilient bit	M213
Interior surfaces - slabs, walls, joints with 1-3/8-inch diameter or smaller	3/4-inches

2. Non-bituminous types shall be placed in widths shown on the accepted plans or 3/8-inch when not specified. Bituminous type shall be used for concrete paving and structural construction where joint sealer is not called for.
3. All concrete alleys require an expansion and contraction joint plan to be submitted to the Town. This plan shall depict the locations of all joints including spacing, type of



joint and construction method (i.e. tooled or sawed).

309.02 Expansion Joints

1. Expansion joints will be provided at the following locations and shall be in place prior to the placing of concrete. Epoxy rebar dowels should be placed per Section 518 and 520.
 - a. At both edges of driveway, in accordance with Detail 500-18.
 - b. Between back of sidewalk and driveway slab or service walk;
 - c. Between new concrete and existing masonry building;
 - d. Between new and existing concrete;
 - e. Minimum every 200-feet in sidewalk;
 - f. Minimum every 200-feet in curb and gutter;
 - e. As shown on the approved plans and standard details; and
 - f. As directed by the Town Engineer.
2. Refer to Detail 500-19 for expansion joint details.

309.03 Contraction Joints

1. Transverse joints shall be placed at maximum intervals of 10-feet to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of 1/3 of the total thickness, but no less than 1-1/2-inches. Contraction joints shall be placed as follows, and in accordance with Detail 500-20:
 - a. Not more than 10-feet and no less than 6-feet apart in curb and gutter.
 - b. Not more than the walk width apart in non-monolithic concrete sidewalk
 - c. At least two joints equally spaced at not greater than 10-foot intervals as applicable in driveways
 - d. As shown on the drawings and details
 - e. As directed by the Town Engineer

310 PLACEMENT OF CONCRETE

310.01 General

1. Prior to pouring the concrete, the Contractor shall remove all trash, pieces of wood,



or other debris, and shall wet areas in which concrete is to be poured prior to concrete placement.

2. Placement shall conform to ACI 301, Chapter 8 "Placing," ACI 306 "Recommended Practice for Cold Weather Concreting," and ACI 305 "Recommended Practice for Hot Weather Concreting." No concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms, and preparation of surfaces involved in the placing have been approved by the Town Engineer. No concrete shall be placed in water, except with the written permission of the Town Engineer; the method of depositing the concrete shall be subject to the Town's approval. All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed. Immediately before placing concrete, all surfaces upon or against which the concrete is to be placed shall be free from standing water, mud, debris, or loose materials. The surfaces of absorptive materials against or upon which concrete is placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The concrete shall be placed by equipment which will prevent segregation or loss of ingredients. The stream of concrete shall not be allowed to separate by permitting it to fall freely over rods, spacers, or other embedded materials.
3. All concrete poured in walls exceeding 5-feet in height shall be spouted or "tremmied" so that the maximum free fall shall be 5-feet.
4. Concrete shall be poured in continuous layers of approximately 12-inches and the total elapsed time between placing of successive layers shall not exceed 30-minutes.
5. All wood blocking, spreaders, and screens shall be removed as the concrete is poured and before the concrete sets.

310.02 Vibration

1. Concrete will be thoroughly vibrated using mechanical vibrating equipment. However, concrete in floor slabs, sidewalks, or curb and gutter, not poured against form linings, will either be tamped or vibrated. Care will 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 309, Guide for Consolidation of Concrete. Vibrators will not be used to move or spread the concrete.
2. Any evidence identifying a lack of consolidation or over consolidation will be sufficient reason to require the removal of the section involved and its replacement with new concrete at the Contractor's expense. The Contractor will be responsible for any defects in the quality and appearance of the completed work.

310.03 Finishing



1. Exposed faces of curbs and sidewalks will be finished to true-line and grade as shown on the plans. Surfaces will be floated to a smooth, but not slippery finish. Sidewalks and curbs will be broomed, or combed and edged, unless otherwise directed 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 3/8-inch) radius. No dusting or topping of the surface or sprinkling with water to facilitate finishing will be permitted.
2. Immediately following the removal of the forms, all fins and irregular projections will be removed from all exposed faces. All construction and expansion joints in the completed work will be left carefully tooled and free of mortar and concrete. The joint filler will be left exposed for its full length with clean and true edges.
3. Immediately after removing the forms, the form ties shall be cut back 3/4-inch from the surface and patched with 1:2 cement-sand mortar. All honeycombs, voids, and other defects shall be so patched. The surfaces shall then be thoroughly wetted and rubbed with a No. 16 Carborundum stone or equal abrasive brining the surface to a paste. The rubbing shall be continued sufficiently to remove all form marks and projections, producing a smooth, dense surface without pits or irregularities. After setting sufficiently, the surface shall then be rubbed with a No. 30 Carborundum stone until the entire surface is of a smooth texture and uniform in color. Only exposed surfaces in habitable areas need be rubbed. Surfaces to be waterproofed or hidden from view shall be patched, but not rubbed.

310.04 Curing

1. Fresh concrete will be adequately protected from weather damage and mechanical injury during the curing periods. It shall be the Contractor's responsibility to determine the necessity for undertaking protective measures. The minimum for curing period shall be 5-days.
2. Immediately after placing fresh concrete, all concrete shall be cured by one of the following methods. The Town Engineer shall review the curing method proposed by the Contractor.
 - a. *Water Method:* All surfaces other than slabs shall be protected from the sun and the whole structure shall be kept wet for a period of at least 5-days following concrete placement. All concrete slabs shall be covered as soon as possible with suitable material so that concrete is kept thoroughly wet for at least five days. The concrete surface shall be kept moist at all times by fogging with an atomizing nozzle until the covering is placed.
 - b. Membrane Forming Curing Compound Method:
 - i. Curing compounds shall be white-pigmented, liquid, membrane forming compounds that shall conform to AASHTO M148 Type II, Class B. Membrane curing compound shall not be used on construction joints.
 - ii. The rate of application of curing compound will be as directed, but shall not



be more than 200-square feet per gallon. All concrete cured by this method shall receive two applications of the curing compound. The first coat shall be applied immediately after stripping of the forms. If the surface is dry, the concrete shall be thoroughly wet with water and the curing compound applied just as the surface film of water disappears. The second application shall be applied after the first application has set. During curing operations any unsprayed surfaces shall be kept moist with water.

- iii. When using a curing compound, the compound shall be thoroughly mixed within an hour of use. If the use of curing compound results in a streaked or blotchy appearance, its use shall be discontinued. Water curing shall then be applied until the cause of the defective appearance is corrected.
- c. Form Method: When cured using the form method, concrete shall be protected by forms for at least 5-days. Forms shall be kept moist as necessary during the curing period to insure that the concrete surface remains wet.
- d. Blanket Method: Electrically heated curing blankets or insulation blankets may be used in cold weather to maintain specified curing temperatures and to retain moisture in concrete. Blankets shall be lapped at least 8-inches and shall be free of holes. Blankets shall be secured at laps and edges to prevent moisture from escaping.

311 WEATHER PROTECTION

311.01 Cold Weather Concreting

1. Placing of concrete in cold weather will be in accordance with ACI 306R, Cold Weather Concreting. Concrete shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent frost will not be allowed. Concrete that has been frozen shall be completely removed and replaced as directed by and to the satisfaction of the Town Engineer. The temperature must be 40-degrees Fahrenheit and rising before any concrete is placed.
2. No concrete shall be placed, regardless of the present temperature, when the weather forecast calls for freezing temperatures before final set of the concrete, unless special means of heating and protection are approved in writing 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.
3. During cold weather conditions, concrete less than seventy-two hours old shall be protected in accordance with ACI 306R Table 3.1.
4. Heated enclosures may be used in lieu of protection requirements cited above. If used, such enclosures shall be maintained for at least 7-days.



311.02 Hot Weather Concreting

Except by written authorization from the Town Engineer, concrete will not be placed if the temperature of the concrete cannot be maintained at 90-degrees Fahrenheit or lower. The placement of concrete in hot weather shall comply with ACI 305, Hot Weather Concrete. Retempering of concrete shall not be allowed.

311.03 Rate of Temperature Change

Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5-degrees Fahrenheit in any 1-hour or 50-degrees Fahrenheit in any 24-hour period.

312 REPAIRS

312.01 Repairs to Newly Placed Concrete

After stripping of the forms if any concrete is not formed as shown on the accepted plans, 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. It will then be removed and replaced by the Contractor at the Contractor's expense, unless the Town Engineer gives written permission to patch the defective area. In this case, patching will be done as described in the following paragraphs.

312.02 Patching

Defects that require replacement or repair are those that contain honeycomb, damage due to stripping of forms, joints, and bulges due to movement of forms. Ridges and bulges will be removed by grinding. Honeycombed and other defective concrete not affecting the integrity of the structure will be chipped out and patched with a non-shrink, non-metallic grout with a minimum compressive strength of 5,000-psi in 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.

312.03 Bolt Holes, Tie-Rod Holes, and Minor Imperfections

Bolt-holes, tie-rod holes, and minor imperfections as approved by the Town Engineer will be filled with dry-patching mortar composed of 1 part Portland cement to 2 parts of regular concrete sand (volume measurement), and only enough water to allow the ingredients to be cohesive. 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.

312.04 Repairs to Existing Sidewalk

Where repairs are made in existing sidewalks, all edges of the old sidewalk allowed to remain will be sawcut to the full depth of the concrete. No rough edges will be permitted where new construction joins the old section. Unless directed by the Town Engineer, no section less than 6-feet in length will be placed or left in place. Where new sidewalk



construction abuts existing sidewalk the work will be accomplished so that there is no abrupt change in grade between the old section and the new work. Existing and new sidewalk shall be doweled together.

313 BACKFILLING

After forms have been removed and the concrete has gained at least 80% specified design strength, the space adjoining the concrete will 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 2-feet and then sloped as shown on the accepted plans, or as directed by the Town Engineer.

314 FLOWABLE BACKFILL

1. This section specifies requirements for design, materials, production, and placement of low strength, flowable pozzolanic backfill, also known as flowfill, flowcrete, or fly ash slurry. Flowable backfill is an alternative to conventional compacted earth backfill. Typical applications for this type of backfill are as follows:
 - a. Utility trenches
 - b. Bridge abutments, retaining walls, etc.
 - c. Structural (foundation subbase, subfooting, pipe bedding, etc.)

314.01 Mix Design

1. A mix design shall be prepared in a testing laboratory by a Colorado Registered Professional Engineer competent in the field of materials engineering. In lieu of a mix design, documentation of field test data may be submitted. Samples of the mix, with its formula, shall be made available to the Town for testing prior to construction. Town reviewed mixes may be considered prequalified for subsequent usage. Flowability and strength requirements shall be as follows:
 - a. Slump: 7-inches minimum
 - b. 28-day Strength: 30 - 90-psi
 - c. 90-day Strength: 35 - 95-psi

314.02 Materials and Production

Flowable backfill shall be produced from a job mix formula as specified above. When coarse aggregate is used, 100% shall pass the 1-inch sieve, and it shall comprise not more than 40-percent of the total aggregate content. Other aggregate products such as aggregate base, crushed rock, pea gravel, or reject sand which has not more than 20% passing the No. 200 sieve and is free of organic material and other deleterious substances,



may be accepted by the Town Engineer if a flowable, workable mix can be produced without segregation of the aggregate.

314.03 Placement

1. Before depositing flowable backfill, debris shall be removed from the space to be occupied by the flowable backfill. Vibratory or other compaction equipment shall be used only when necessary to fill inaccessible voids.
2. Flowable backfill shall be allowed to cure for 24-hours before placing permanent pavement on it. Traffic shall not be allowed on flowable backfill during the first 6-hours after placement. Temporary pavement or fill can be used after a 6-hour initial set.

315 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.

316 INSPECTION AND TESTING

316.01 General

1. It is the responsibility of the contractor to contact the Town Engineer a minimum of 48-hours (two full working days) in advance of the required inspections which include:
 - a. Subgrade – The Town Engineer shall verify that the material which concrete shall be placed on as shown on the approved plans is not frozen, excessively wet, or excessively dry at the surface and meets compaction requirements.
 - b. Forms – The Town Engineer shall verify that the forms are set to proper alignment, braced adequately, and set for required thickness.
 - c. Reinforcing steel – The Town Engineer shall verify that the rebar is properly placed and spaced, at least 50% of the intersections are tied, and proper distances from surface grade and forms are maintained.
 - d. Concrete Delivery and Testing – The Town Engineer shall confirm that mix design submittals meet Town of Frederick requirements and that the contractors testing/sampling frequency and minimum/maximum air temperatures comply with these STANDARDS and SPECIFICATIONS
 - e. Cure and Flush – The Town Engineer shall verify that finished concrete is properly cured and finished.
2. 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.
3. 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 E 329, Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
4. 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.
 5. The testing agency will 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 specimen prior to testing, the project number, and the location of the concrete (curb, manhole inlet, sidewalk, paving, etc.).
 6. The testing agency or its representative is not authorized to revoke, alter, relay, enlarge, or release any requirements of the Standards and Specifications, nor approve or accept any portion of the work.
 7. Finish shall be true flat planes within 1/4-inch in 10-feet, as determined by a 10-foot long straight edge placed in any direction on the slab.

316.02 Testing Provided by the Contractor

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

Table 300-11 Concrete Testing			
Test			Frequency
Compressive Strength			<ul style="list-style-type: none"> ▪ As often as needed for quality control, as determined by the Town Engineer. ▪ Make 5 cylinders for each pour of 20-cubic yards or more, but not less than one set of tests and 5 cylinders for each structure or project component or as directed by the Engineer. ▪ Flatwork and C&G make 5 cylinders for each pour of 40-yards or more. ▪ All concrete pours must make a minimum of 5 cylinders.
Qty	Time	Cure	
1	HOLD	field	
1	HOLD	lab	
1	7-day	lab	
1	14day	lab	
1	28-day	lab	
Slump			<ul style="list-style-type: none"> ▪ 1 per set of cylinders taken ▪ 1 per truck for first 3 trucks of every pour and until 3 trucks test consistently ▪ Often as needed for quality control ▪ As directed by the Town Engineer
Air Content			<ul style="list-style-type: none"> ▪ 1 per set of cylinders taken ▪ 1 per truck for first 3 trucks of every pour and until 3 trucks test consistently



- | | |
|--|--|
| | <ul style="list-style-type: none">▪ Often as needed for quality control▪ As directed by the Town Engineer |
|--|--|

2. When the work fails to pass inspection or previous tests fail to meet specifications, additional tests shall be taken as directed by the Town Engineer.
3. Testing or sampling not completed as specified may be cause for rejection of the concrete, which shall be removed and replaced at the Contractor's expense. Alternatively, and only at the discretion and direction of the Town Engineer, core samples may be obtained. Obtaining and testing cores will be in accordance with ASTM C42, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, and paid for by the Contractor. 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 85% of the specified strength, and if no single core is less than 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.

317 CONCRETE STRUCTURE DESIGN CRITERIA

317.01 Curb and Gutter Section

All curb and gutter shall be constructed as identified on the approved plans, and in accordance with the standard details included in the back of Section 500.

317.02 Sidewalks

Sidewalks shall be 6-inch thick and constructed to the dimensions shown on the approved construction plans and in accordance with the standard details included in the back of Section 500. All areas of sidewalk that will be crossed by driveways will be constructed with 6-inch thick concrete in residential areas and 8-inch thick concrete in commercial areas.

317.03 Crosspans and Curb Return

Crosspans and curb return shall be constructed as shown in the standard details included in the back of Section 500. Where unusual conditions prevail, additional reinforcing steel and special joints may be required by the Town Engineer.

317.04 Curb Cuts and Driveways

1. Curb cuts shall be provided at all driveway locations and at additional locations, as shown on the approved plans. Construction of curb cuts shall be as shown on the detail drawings. Spacing will be as shown on the approved plans and/or as approved by the Town Engineer. Curb cuts should not be used for commercial, industrial or high volume residential driveways. In general, when the number of parking spaces serviced by the driveway exceeds 10, radius returns are required.
2. Where curb cuts are allowed based on traffic considerations, concentrated storm



water runoff must not be discharged across the sidewalk. These flows must be directed to a sidewalk chase section, constructed in accordance with the detail included in the back of Section 500. If this is not possible due to grading restraints, radius returns and a crossspan shall be used.

317.05 Curb Ramps

1. State law requires that pedestrian ramps be installed at all intersections and at certain mid-block locations for all new construction of curb and sidewalk [CRS 43-2-107(2)]. Pedestrian ramps shall be constructed in accordance with all current ADA Regulations. Pedestrian ramps may be shown at all curb returns or called out by a general note on the development and construction plans, but must be shown (located) on all "T" intersections. Whenever referencing a pedestrian ramp, call out the specific detail drawing to construct that ramp. The ramp portion shall have a truncated dome in accordance with the most current ADA standards.
2. Drainage structures shall not be placed in line with pedestrian ramps. Location of pedestrian ramps shall take precedence over location of the drainage structure.

317.06 Bridges and Major Drainage Structures

1. All culvert pipe, box culverts, and bridges which will ultimately be maintained by the Town shall conform to the following:
 - a. AASHTO "Standard Specifications for Highway Bridges"
 - b. Colorado Department of Transportation's "Standard Specifications for Road and Bridge Construction"
 - c. Colorado Department of Transportation's "Bridge Manual," Volumes I and II.
2. All structures shall be designed to an HS-20 loading.
3. Testing of concrete for major structures shall be in accordance with Section 316 of these Standards and Specifications.
4. All box culverts and bridges shall have the year of construction permanently indented on the downstream headwall face in legible numbers. The numbers shall be 3-inches high by 1-1/2-inch wide and approximately 3/8-inch deep in the headwall face.
5. All box culvert and bridge designs shall be certified by a Professional Engineer registered in the State of Colorado who is competent to perform such designs.

318 MATERIALS

1. *Bed Course Material:* Bed course material for sidewalks, curbing, and bikeways shall consist of cinders, sand, slag, gravel, crushed stone or



- other material of such gradation that all particles shall pass through a sieve having 3/4-inch square openings.
2. Reinforcing Steel: Reinforcing steel shall conform to the requirements of Section 307-Reinforcing Steel of these Standards and Specifications.
 3. Joint Filler: Joint filler shall conform to the requirements of Section 309, Joints, of these Standards and Specifications.
 4. *Concrete*: Unless otherwise indicated, concrete for curb, gutter, sidewalk and bikeways shall be 4500-psi at 28-day strength. All crosspans and sidewalks/bikeways greater than and including 8 feet wide shall be constructed of 4500-psi concrete at 28-day strength along with fibermesh reinforcement. All other structures shall be CDOT Class D unless otherwise indicated.

319 REFERENCES

Standards Referenced in Section 300:	
Standard	Title
AASHTO M6	Fine Aggregate for Portland Cement
AASHTO M26	Water for Use in Concrete
AASHTO M31	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
AASHTO M33	Preformed Expansion Joint Filler for Concrete, Bituminous Type
AASHTO M43	Sizes of Aggregate for Road and Bridge Construction
AASHTO M53	Axle-Steel Deformed And Plain Bars for Concrete Reinforcement
AASHTO M54	Welded Deformed Steel Bar Mats For Concrete Reinforcement
AASHTO M55	Steel Welded Wire Reinforcement, Plain, For Concrete
AASHTO M148	Curing Compounds for Concrete
AASHTO M153	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
AASHTO M173	Concrete Joint Sealer, Hot Poured Elastic Type
AASHTO M213	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
AASHTO M221	Steel Welded Wire Reinforcement, Deformed, for Concrete
AASHTO M284	Epoxy-Coated Reinforcing Bars: Materials and Coating Requirements
AASHTO T96	Resistance to Degradation of Small Size Course Aggregate by Abrasions and Impact in the LA Machine
AASHTO T140	Compressive Strength of Concrete Using Portions of Beams Broken in Flexure
ACI 211	Concrete Mix Design
ACI 301	Specifications for Structural Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Standard Practice for Consolidation of Concrete
ACI 347	Recommended Practice for Concrete Formwork
ASTM A185	Steel Welded Wire Reinforcement, Plain, for Concrete



ASTM A615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C33	Standard Specifications for Concrete Aggregates
ASTM C94	Standard Specifications for Ready-Mix Concrete
ASTM C150	Standard Specifications for Portland Cement
ASTM C260	Standard Specifications for Air-Entraining Admixtures for Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as Admixtures in Concrete
ASTM C900	Standard Test Method for Pullout Strength of Hardened Concrete
ASTM E329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

