

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

832 - CONCRETE

1. SCOPE

This work shall consist of furnishing materials and installing all components of the concrete structure as shown on the drawings and as specified in Section 26.

Prior to commencing construction, public utilities shall be notified in accordance with N.Y.S. Industrial Code 753.

Construction work covered by this specification shall not be performed between November 15 and the following April 1 unless the site conditions and/or the construction methods to be used have been reviewed and approved by the approving official or designated representative.

2. MATERIALS

Portland Cement shall conform to ASTM C-150, Type I, IA, II or IIA. If Type I or II is used, an added air entrainment agent, conforming to ASTM C-260 shall be used. Cement that is partially hydrated (hardened) or otherwise damaged shall not be used.

Aggregates - Fine aggregates shall conform to ASTM C-33 for grading and quality requirements. Coarse aggregates shall conform to ASTM C-33 for grading and quality requirements and shall be size #467, 57, or 67.

Water shall be clean and free of injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Preformed Expansion Joint Filler shall conform to ASTM D-1752, Type I, Type II, or Type III, unless bituminous type is specified. Bituminous type preformed expansion joint filler shall conform to ASTM D-994, or D-1751.

Joint Sealant shall conform to ASTM C-920, Type S or M, grade P or NS for horizontal joints, grade NS for vertical joints.

Waterstops shall conform to NRCS Material Specification 537 for the types and kinds shown on the drawings or as specified in Section 26.

Reinforcing Steel shall be deformed bars manufactured specifically for concrete reinforcement, shall be grade 40 or higher and shall conform to ASTM A-615, A-616, or A-617.

Welded Steel Wire Fabric shall conform to ASTM A-497, A-184 or A-185. Sheets, not rolls, shall be used.

Set-Retarding Admixtures shall conform to ASTM C-494, Type B (retarding) or Type D (water reducing and retarding).

Water Reducing Admixtures shall conform to ASTM C-494, Type A (water reducing), Type D (reducing and retarding), Type F (high-range reducing) or type G (high-range reducing and retarding).

Superplasticizing Admixtures shall conform to ASTM C-1017, Type I (plasticizing) or Type II (plasticizing and retarding).

Curing Compound shall conform to ASTM C-309. Unless otherwise specified the compound shall be Type 2 (White Pigmented), or other colored pigment.

Evaporation Retardant shall conform to American Concrete Institute (ACI) Specification 302 - "Evaporation Retardant/Monomolecular Film".

Aggregate for Structure Drainfill shall be sand, gravel, or crushed stone or mixtures thereof. It shall be composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with the free-draining properties. Aggregates of crushed limestone shall be thoroughly washed and screened. Unless otherwise shown on the drawings or specified in Section 26, gradation of the drainfill shall consist of material with 100% passing a 3 inch sieve and less than 8% passing a No. 200 sieve.

3. CLASS OF CONCRETE

Concrete for structures shall be classified as follows:

<u>Class of Concrete</u>	<u>f'_c, 28-day Compressive strength</u>	<u>Maximum Net Water Content</u>	<u>Minimum Cement Content</u>
3000	3000 psi	5.5 gallons/bag (Max. w/c = 0.5)	5 bags/cu. yd. (470 lbs./cu. yd.)
4000	4000 psi	5.5 gallons/bag (Max. w/c = 0.5)	6 bags/cu. yd. (564 lbs./cu. yd.)

Concrete for structures shall have a 28-day compressive strength of 4000 psi unless otherwise shown on the drawings or specified in Section 26. The supplier shall be responsible for the design mix and certification of the necessary compressive strength.

4. AIR CONTENT AND CONSISTENCY

The slump shall be 2 to 4 +/- 1 inches and the air content by volume shall be 4 to 6 percent. Admixtures such as superplasticizers, water-reducers, and set-retarders may be used provided they are approved by the approving official or designated representative prior to use in the concrete mix. These slump requirements do not apply after superplasticizer has been added to the concrete.

5. DESIGN OF THE CONCRETE MIX

The concrete shall be provided in accordance with ASTM C-94, Ready Mix Concrete.

A batch ticket shall be provided by the supplier for each load of concrete delivered to the site. The batch ticket shall state the class of concrete and any admixtures used.

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during the consolidation.

At least 10 days prior to placement of concrete, the contractor shall furnish a statement of the materials and mix proportions (including admixtures, if any) to the approving official for approval. The statement shall include evidence satisfactory to the approving official that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix". After a job mix has been approved, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the project designer has approved a revised job mix.

6. INSPECTING AND TESTING

During the course of the work, the approving official or designated representative may perform quality assurance testing. This testing does not relieve the contractor of responsibility of performance of work according to this specification. The testing personnel shall have free access to the work site to obtain samples. Any tests and inspections will be conducted so as not to interfere unnecessarily with the placement of the concrete.

Any portion of the concreting may be tested to determine uniformity, compliance with requirements for slump and air content, and compressive strength. When a plasticizing admixture is added to the concrete at the site, slump tests may be made both prior to and after the addition of the admixture.

7. REINFORCING STEEL

Reinforcing steel shall be free of loose rust, oil, grease, paint, or other deleterious coatings. This may require wire brushing or sandblasting.

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. In forms, this shall be accomplished by tying temperature and shrinkage steel or special tie bars (not stress steel) to the form "snap ties" or by other methods of tying. In slabs, steel shall be supported by precast concrete bricks, (not clay bricks) metal or plastic chairs. No welding of either stress steel or temperature and shrinkage steel will be permitted. Except for dowel rods, placing steel reinforcement into concrete already in place shall not be permitted.

The following tolerances will be allowed in the placement of reinforcing bars.

1. Minimum protective cover:
 - from formed surfaces - 2 inches
 - from earth surfaces - 3 inches
2. Maximum variation from indicated spacing:
 - 1/12th of indicated spacing

Unless otherwise indicated on the drawings, splices of reinforcing bars shall provide a lap of not less than 32 diameters of the smaller bar. Bars will not be spliced by welding. Splices of sheets of welded wire fabric shall be provided by overlapping 3 cross-wires.

8. HANDLING, MIXING, AND DELIVERY

Concrete shall be uniform and thoroughly mixed when delivered to the forms. For concrete mixed at the site by stationary mixers, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall not be less than 70 nor more than 100. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. FORMS

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and essentially free of holes, dents, sags, or other irregularities.

Forms shall be coated with form oil before being set into place. Opposing forms shall be tied together with commercially produced No. 9 wire "snap" ties for commercially built forms, job built forms, or other approved form types.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly. Weepholes in walls or slabs shall be formed with nonferrous materials.

10. PREPARATION OF FORMS AND SUBGRADE

All concrete structures shall be set on compacted drainfill, undisturbed soil or non-yielding re-compacted material. Drainfill, when specified, shall be placed to the neat lines shown on the drawings.

Over excavation shall be corrected as noted on the drawings or as directed by the project designer or designated representative.

In the event unexpected water is encountered during foundation preparation, a suitable drainage system (temporary or permanent) shall be installed as directed or approved by the project designer or designated representative.

Prior to placement of drainfill as a base for the concrete structure, the subgrade shall be inspected and approved by the project designer or designated representative. The drainfill shall be placed in uniform layers of not more than 8 inches deep prior to compaction. Compaction of each layer of drainfill shall be by 2 passes over the entire surface layer with a hand directed mechanically powered vibrating plate compactor or vibratory roller or by an approved equivalent method.

Prior to placement of concrete, the forms and foundation shall be free of chips, sawdust, debris, standing water, ice, snow, extraneous oil, mortar or other harmful substances or coatings. The temperature of all surfaces, including reinforcing steel, shall be no colder than 40°F. Earth surfaces against which concrete is to be placed shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

11. CONVEYING

Concrete shall be placed in the forms within 1-1/2 hours after the introduction of cement to the aggregate unless an approved set-retarding admixture is used in the mix.

In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85°F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes (use of an approved set-retarder will generally restore allowable hot weather placement time to approximately 1-1/2 hours; however, actual time limits will depend upon the type and amount of set-retarder used and on actual weather conditions).

Superplasticized concrete can be conveyed and placed when the temperature of the concrete is below 90°F (this criterion applies only when the superplasticizer is added at the batching plant) and the slump of the concrete remains within the allowable slump range specified in Section 4 above.

The project designer will allow an appropriate extension of time for concrete placement when the setting time of the concrete is increased a corresponding amount by the addition of an approved admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable, by methods that will prevent segregation of the aggregates or loss of mortar.

12. PLACING

At least 48 hours advance notification of a pending concrete placement shall be given to provide time for inspection. Concrete shall not be placed until the subgrade, forms, and steel reinforcement have been inspected and approved by the project designer or designated representative. No concrete shall be placed except in the presence of the project designer or designated representative.

The concrete shall be deposited as close as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner that prevents segregation of aggregates and excessive laitance.

Concrete placed against sloping surfaces or on sloping subgrades shall start at the lowest elevation and work upwards to the highest elevation.

Slab concrete shall be placed to design thickness in one continuous layer. Formed wall concrete shall be placed in horizontal layers not more than 24 inches high. The maximum layer thickness shall be 5 feet if high range water reducing agents are used. Concrete shall not be dropped more than 5 feet vertically (12 feet if high range water reducing agents are used) unless suitable equipment is used to prevent segregation. Hoppers and chutes, pipes, or "elephant trunks" shall be used to reduce free fall heights.

Immediately after placement, the concrete shall be consolidated by spading and vibrating or spading and hand tamping to ensure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. Excessive vibration which results in segregation of materials will not be allowed. Vibration will not be used to make the concrete flow in the forms.

If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the placement of concrete will be discontinued and a construction joint will be made.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the project designer or designated representative.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be re-tightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the project designer or designated representative.

Surfaces shall be kept moist for at least 1 hour prior to placement of the new concrete.

14. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Expansion joints shall be free of mortar and concrete. Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed. Joint filler shall be left exposed for its full length with clean and true edges.

Contraction or "control" joints shall be formed in fresh concrete either by hand-tooling or by saw-cutting. Joints shall be formed as soon as is practical after concrete finishing, but in no case later than 8 hours after concrete has been placed, unless approved by the project designer. Control joints in slabs shall be formed to a depth of 1/4 of the slab thickness. Control joints in walls and curbs shall be formed to a depth of 1/8 of the wall thickness on each side.

If specified, horizontal and/or vertical joints shall be sealed with a suitable joint sealer after the concrete has thoroughly hardened, according to the manufacturer's recommendations.

15. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal water stops shall be soldered, brazed, or welded. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized, as recommended by the

manufacturer.

16. REMOVAL OF FORMS

Forms shall not be removed before the following minimum time intervals.

<u>Concrete Item</u>	<u>Time</u>
Beam bottom forms and temporary supports	14 days
Roof or deck slabs	14 days
Columns	7 days
Bearing walls (with side or vertical load)	24 hrs.
Non-bearing walls (with no side or vertical load)	24 hrs.
Sides of beams and ground slabs	24 hrs.

Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

17. FINISHING FORMED SURFACES

Immediately after the removal of forms:

- a. All fins and irregular projections shall be removed from the exposed concrete surfaces.
- b. Where holes were produced on the surfaces by the removal of form ties, cone-bolts, or she-bolts, and where minor areas of the concrete surface are "honeycombed," the areas shall be cleaned, wetted and filled with a dry pack mortar consisting of 1 part portland cement, 3 parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade to provide positive drainage and to prevent "bird baths" from forming. Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

In areas not subject to cattle or vehicular traffic, concrete surfaces shall be provided with a broom finish. In areas subject to cattle or vehicular traffic, concrete shall be provided with a grooved finish. Grooving shall consist of 3-5" c-c spacing x 1/2-3/4" wide x 1/4-3/8" deep grooves.

The addition of dry cement or water to the surface of screeded concrete to expedite finishing will not be allowed.

Joints and edges on surfaces that will be exposed to view shall be uniformly chamfered or finished with a molding tool.

19. CURING

Concrete shall be prevented from drying for at least 7 days after it is placed. Exposed surfaces shall be kept moist during this period by fog spraying or by covering with continuously moistened canvas, burlap, straw, sand or other approved material unless the exposed surfaces are sprayed with a curing compound. Forms left in place during the curing period shall be kept wet.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continued application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed.

Curing compound shall be white pigmented and applied in a uniform layer over all surfaces requiring protection at a rate of not less than 1 gallon per 150 square feet.

Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete or joint sealer, such as construction and control joints, shear plates, reinforcing steel and other embedded items. If control joints are formed prior to the placement of curing compound, care shall be taken not to spray compound in the groove.

If the curing compound membrane is damaged during the curing period, including being exposed to heavy rain or running water within 3 hours of application, the damaged area shall be re-sprayed at the rate of application specified above.

Surfaces covered by the membrane shall not be trafficked unless protected from wear.

20. REMOVAL AND REPLACEMENT REPAIR

Major areas of concrete that are "honeycombed" shall be cleaned, reformed, placed and cured.

21. CONCRETING IN COLD WEATHER

Concrete shall not be mixed or placed when the daily atmospheric temperature is less than 40°F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be permitted.

The temperature of the concrete at the time of placing shall not be less than 50°F and shall be maintained at temperatures not less than 40°F for a period of 3 days.

Concrete placement will not be permitted between November 15 and April 1 unless procedures for cold weather concreting are provided. Such procedures include:

- a. Use of warm (50°F or more) concrete
- b. Adequate protection from the weather - including the use of artificial heat to prevent the temperature of the concrete from falling below 40°F for a period of 3 days.

Regardless, concrete placement will not be permitted when the temperature during placement and the following 24 hours is predicted to fall below 32°F.

22. CONCRETING IN HOT WEATHER

The concrete supplier shall apply effective means to maintain the temperature of concrete below 90°F during mixing and conveying. Concrete with a temperature above 90°F shall not be placed.

The Contractor shall keep the subgrade (if exposed) and reinforcement cool and damp by fog spray or other means prior to concrete placement.

Placement times for concreting in hot weather shall be reduced as shown in Section 11.

After concrete placement, exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing and after finishing. If concrete is placed during hot and windy weather, the project designer may require use of an Evaporation Retardant prior to finishing and curing.

During periods of hot weather, the Contractor shall schedule concrete placement early in the day and/or reduce placement sizes, to avoid concrete placement in the mid-day heat, and to possibly avoid some of the special requirements listed above.

23. BACKFILLING NEW CONCRETE WALLS

Backfilling and compaction of fill adjacent to new concrete walls shall not begin in less than 14 days after placement of the concrete. If backfilling can be accomplished on both sides of the wall simultaneously, then it shall not begin in less than 7 days after placement of the concrete.

Heavy equipment will not be allowed within 3 feet of a new concrete wall. Provide Compaction within 3 feet of the wall by means of hand tamping or small hand directed power equipment.

The backfill material shall meet the requirements and gradation as shown on the drawings or as specified in Section 26. The backfill shall be placed in uniform layers of not more than 8 inches deep prior to compaction. Compaction of each layer of backfill shall be by 2 passes over the entire surface layer with a vibrating plate manually directed power compactor or by an approved equivalent method.

24. STRUCTURES INSTALLED ACCORDING TO STANDARD DETAIL DRAWINGS PREPARED BY OTHERS

Structures shall be installed exactly as shown on the Standard Detail Drawings approved by NRCS. Two copies of the drawings and specifications for each project shall be provided to NRCS prior to construction. All materials furnished and installed shall conform to the quality and grade noted on the drawings and specifications.

Modifications of the structure outside the limits shown shall not be made without prior review and approval by NRCS. The supplier/contractor who submitted the original Standard Detail Drawings shall be responsible for making changes. Sufficient documentation to allow adequate review of the proposed modification shall accompany any request for a change.

At the completion of the project, the supplier/contractor shall furnish written certification that all aspects of the installation are in conformance with the requirements of the Standard Detail Drawings approved by NRCS, and a copy of a set of concrete cylinder test breaks for both floors and walls.

All warranted structures and equipment shall be in writing with the warranty provided to the landowner prior to the projects final acceptance. All structures and equipment installed shall have written operation and maintenance instructions and shall be provided to the landowner prior to the projects final acceptance.

25. MEASUREMENT AND PAYMENT

Method 1

For items of work for which specific unit prices are established in the contract, the volume of the concrete will be measured and computed to the nearest 0.1 cubic yards along the neat lines shown on the drawings. Measurement of concrete placed against the sides of an excavation without the use of intervening forms will be made only to the neat lines or pay limits shown on the drawings. No deductions will be made for chamfers, rounded or beveled edges or for any void or embedded item that is less than 5 cubic feet in volume. Payment for the concrete will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing, and other appurtenances necessary and incidental to completion of the work, including bedding and backfill materials, reinforcing steel, joint filler, waterstops, dowels or dowel assemblies and shear plates, or other items not listed for payment elsewhere in the contract.

Method 2

For items of work for which specific lump sum prices are established in the contract, the quantity of concrete will not be measured. Payment for concrete will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing, and other appurtenances necessary and incidental to completion of the work, including bedding and backfill materials, reinforcing steel, joint filler, waterstops, dowels or dowel assemblies and shear plates, or other items not listed for payment elsewhere in the contract.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 26.

26. ITEMS OF WORK AND ADDITIONAL CONDITIONS: