USDA

United States Department of Agriculture

Contractor Information Package

HUA and WSF Design

Maloney – Crawford County, PA

Natural Resources Conservation Service
PRACTICE SPECIFICATION
WASTE STORAGE FACILITY
(Code 313)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the waste storage structure as outlined in this specification and the drawings.

Construction work covered by this specification shall not be performed between December 1 and the following March 15 unless the site conditions and/or the construction methods to be used have been reviewed and approved by the Engineer or his/her designated Representative.

2. MATERIALS

All materials used shall conform to the quality and grade noted on the drawings, set forth in Section 9, or as otherwise listed below:

PORTLAND CEMENT shall be Type I, IA, IL, II or IIA and conform to ASTM-C150, unless otherwise set forth in Section 9. Type IS Portland blast-furnace slag cement, Type IP Portland-pozzolan cement, or Type IL Portland-limestone cement shall conform to the requirements of ASTM C595 and may be used unless prohibited by the specifications. If Type I, IL, or II is used, an air-entrainment agent shall be used.

CONCRETE AGGREGATE shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

WATER used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acid, salt, organic matter or other deleterious substances.

REINFORCEMENT BARS shall be grade 40 or higher, and shall conform to ASTM- A615, A616, or A617. Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

CONCRETE ADMIXTURES shall conform to ASTM-C260 for air-entrainment, and ASTM- C494, type A, D, F or G, for water- reduction and set-retardation, and type C or E for non- corrosive accelerators.

POZZOLAN shall conform to ASTM-C618, Class F, except loss of ignition shall not exceed 3.0 percent.

CURING COMPOUND shall meet the requirements of ASTM-C309, Type 1-D or Type 2 Class A or B or as otherwise required in Section 9.

MASONRY COMPONENTS shall meet the requirements of ASTM-C90 & C270 and placed in accordance with ACI-530.

PRECAST CONCRETE units shall comply with ACI-533 and PennDOT publication 408 Section 714.

PREFORMED EXPANSION JOINT FILLER shall conform to the requirements of ASTM-D1752, Type I, II, or III, unless bituminous type is specified, in which case it shall conform to ASTM-D994 or D1751.

JOINT SEALERS shall conform to the requirements for ASTM-C920, Federal Specification SS-S-210A, or Federal Specification TT-S-227, as appropriate for the specific application.

WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601 and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal (bentonite) waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS- S-210A. Non-colloidal waterstops shall only be used if approved by the Engineer.

METALS shall conform to the following

standards: Structural steel - ASTM-A36

Carbon steel - ASTM-A283, grade C or D; or A611, grade D; or A570, grade C or D
Aluminum alloy - ASTM-B308, B429, B221, B210, B211, or B209

Bolts - ASTM-A307; zinc coating shall conform to ASTM-A153, B633 (cond. SC3), A165 (type TS).

Screws - wrought iron or medium steel Split or tooth-ring connectors - hot-rolled, low carbon steel conforming to ASTM- A711, grade 1015

WOOD shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 9. Use preservative-treated wood when wood members are exposed to animal waste or elements that deteriorate wood. Preservative-treated wood must meet the applicable American Wood Protection Association (AWPA) Standards or have an evaluation service report (ESR) prepared by an organization recognized by the International Code Council (ICC). Treated wood in contact with animal wastes or as critical components that are difficult to replace, shall meet AWPA UC4B or equivalent for heavy-duty ground contact.

FASTNERERS. Aluminum fasteners, connectors, or cladding must not be used in direct contact with treated wood unless specifically allowed by the preservative manufacturer. Use hot-dipped galvanized or stainless-steel bolts, washers, nuts, nails, and other hardware which meet American Society for Testing and Materials (ASTM) specifications A153 for fasteners and ASTM A653 coating designation G185 for sheet metal connectors, or ASTM A240 for Type 304 or 316 stainless steel, except as noted below. Fasteners and connectors of other materials may be used if specifically allowed by the preservative manufacturer. All fasteners, connectors, and any other metal in contact with Alkaline Copper Quaternary (ACQ), Copper Azole (CA), Micronized Copper Azole (MCA), or Dispersed Copper Azole (μCA-C) treated wood shall be stainless steel if AWPA Use Category UC4B applies or if constant, repetitive, or long periods of wet conditions may occur. All fasteners, connectors, and any other metal in contact with wood treated with Ammoniacal Copper Zinc Arsenate (ACZA) or any other preservative containing ammonia must be stainless steel.

DRAINFILL AGGREGATE shall meet the requirements of Penn DOT, Publication 408, Section 703, fine and coarse aggregate. The size and gradation shall be as specified in the additional conditions of this specification or on the drawings.

3. FOUNDATION PREPARATION AND CONDITIONS

All trees, brush, fences, and rubbish shall be cleared within the area of the structure, including any appurtenances, and borrow areas. All material removed by clearing and excavation operations shall be disposed of as directed by the Owner or his/her Representative. Sufficient topsoil shall be stockpiled in a convenient location for spreading on disturbed areas. All structures shall be set on undisturbed soil or non-yielding compacted material. Over excavation must be corrected as noted on the drawings or as directed by the Engineer or his/her designated Representative.

In addition to uniformity, the existing subgrade material must have sufficient strength to support the structure and its associated loads. Organic soils shall be removed. A compacted base course (layer of drainfill placed below the concrete prior to placement of concrete) may be used to improve the stability of the foundation or to control the movement of water. In addition, geosynthetics with an AOS between 20 and 100 may be used to further separate and/or stabilize the foundation. These items shall be as noted on the design or in Section 9.

Surface and subsurface drainage systems shall be installed and operating adequately to remove water from the foundation to allow for proper structure placement.

Concrete shall not be placed until the subgrade, forms and steel reinforcements have been inspected and approved by the Engineer or his/her designated Representative. Notification shall be given far enough in advance to provide time for the inspection.

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, standing water, ice, snow, extraneous oil, mortar or other harmful substances or coatings.

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.

4. CAST-IN-PLACE CONCRETE STRUCTURES

a. Concrete 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.

Care shall be taken to prevent form oil from coming in contact with steel reinforcement. All waterstop joints must be welded or otherwise made watertight, unless otherwise note on the design or in Section 9.

b. Concrete Mix

Concrete for structures shall have a 28-day compressive strength of at least 4000 psi, unless otherwise specified on the drawings or in Section 9. Upon request by the design engineer, the contractor shall be responsible for providing the concrete design mix, material certifications, and test result documentation. Current certification of the design mix by Penn DOT may be accepted in lieu of additional testing. Concrete order shall not be placed until the design mix has been approved by the design engineer.

The slump shall be 3 to 6 inches (without superplasticizers, if any); the air content by volume shall be five to seven percent of the volume of the concrete. Admixtures such as superplasticizers, water-reducers and set-retarders may be used provided they are approved by the Engineer prior to concrete placement and are used in accordance with the manufacturer's recommendations. Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2 to 4-inch slump before the addition. The slump shall not exceed 7½ inches with the addition of superplasticizer. The W/C ratio shall follow the requirements of the appropriate ACI.

Cementitious material may include fly ash meeting ASTM C-618 which may be substituted up to 25% by weight of total cement, or Ground Granulated Blast Furnace Slag meeting ASTM C-989 may be substituted up to 70% by weight of total cement unless otherwise note on the design of in Section 9.

c. Mixing and Handling Concrete

In general, concrete shall be transported, placed, and consolidated in accordance with ACI- 304, of which some specific interpretations are set forth below.

The supplier shall provide a batch ticket to the Owner or Technician with each load of concrete delivered to the site. The batch ticket shall state the class of concrete, any admixtures used, time out, and the amount of water that can be added at the site and still be within the design mix limits.

Concrete shall be uniform and thoroughly mixed when delivered to the job site. The Contractor shall test slump and air entrainment as necessary to ensure that the concrete meets the requirements of this specification. Variations in slump of more than one inch within a batch will be considered evidence of inadequate mixing and shall be corrected or rejected. No water in excess of the amount called for by the job design mix shall be added to the concrete.

For concrete mixed at the site, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes.

Concrete shall be conveyed from the mixer to the forms as rapidly as practical by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall be placed in the forms within 1- 1/2 hours after the introduction of cement to the aggregate. In hot weather or under conditions when temperature of the concrete is 85°F or above, or conditions contribute to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and completion of truck discharge shall not exceed 45 minutes unless an approved set-retarding admixture is used in the mix.

Concrete shall not be dropped more than 5 feet vertically unless special equipment is used to prevent segregation.

Super plasticized concrete shall not be dropped more than 12 feet unless special equipment is used to prevent segregation.

Slab concrete shall be placed at the design thickness in one layer. Formed walls shall be placed in layers not more than 24-inches high, unless superplasticizer is used, in which case the maximum layer shall be 5 feet. Each layer shall be consolidated to insure a good bond with the preceding layer.

Immediately after placement, concrete shall be consolidated by spading and vibrating, or by spading and hand tamping. It shall be worked into corners and angles of the forms and around all reinforcement and embedded items in a manner that prevents segregation or in the formation of "honeycomb." Excessive vibration that results in segregation of materials will not be allowed. Vibration must not be used to make concrete flow in forms, slabs, or conveying equipment.

If the surface of a layer in place will develop its initial set, i.e., will not flow and merge with the succeeding layer when vibrated, a construction joint shall be made. Construction joints shall be made by cleaning the hardened concrete surface to exposed aggregate by sandblasting, air/water jetting, or hand scrubbing with wire brush, and keeping the concrete surface moist for at least one hour prior to placement of new concrete.

Concrete surfaces do not require extensive finishing work; however, the surface shall be smooth and even with concrete paste worked to the surface to fill all voids. The concrete surface must be watertight. Careful screeding (striking-off) and/or wood float finishing shall be required, unless otherwise shown on the drawings. Exposed edges shall be chamfered, either with form molding or molding tools.

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

d. Reinforcing Steel Placement

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 or wire shall be supported by precast concrete bricks (not clay bricks), or metal or plastic chairs. Concrete bricks supporting steel and wire must be full and not broken (unless bricks are manufactured with creases or indentations meant to be broken). 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 shown on the drawings:

1. Maximum reduction in cover: from formed and exposed surfaces – ¼ inch from earth surfaces - ½ inch
2. Maximum variation from indicated spacing: 1/12th of indicated spacing

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the Engineer. Unless otherwise required, welded wire fabric shall be spliced by overlapping sections at least one full mesh dimension plus two inches. All reinforcement splices shall be in accordance with the design.

Reinforcing steel shall not be welded, unless approved by the Designer. The ends of all reinforcing steel shall be covered with at least 1-1/2 inches of concrete.

e. Curing

Concrete shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap, straw, sand or other approved material unless they are sprayed with a curing compound. Wooden 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 continuous 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. Concrete shall be wet cured or remain in forms until immediately before patching, repairs, or finishing is performed. Curing compound shall not be allowed on any rebars.

Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied, or otherwise damaged, shall be resprayed.

Any construction activity which disturbs the curing material shall be avoided during the curing period. If the curing material is subsequently disturbed, it shall be reapplied immediately.

Steel tying or form construction adjacent to new concrete shall not be started until the concrete has cured at least 24 hours.

Vehicles, overlying structures, or other heavy loads shall not be placed on new concrete slabs for at least three days, unless the concrete strength can be shown to be adequate to support such loads.

f. Form Removal and Concrete Repair

Forms for walls and columns shall not be removed for at least 24 hours after placing the concrete. When forms are removed in less than seven days, the exposed concrete shall be sprayed with a curing compound or be kept wet continuously for the remainder of the curing period. Forms which support beams or covers shall not be removed for at least seven days, or 14 days if they are to support forms or shoring.

Forms shall be removed in such a way as to prevent damage to the concrete. Forms shall be removed before walls are backfilled. Columns shall be at least seven days old before any structural loads are applied. Column base brackets shall not be loaded until the supporting concrete is at least seven days old. Drilling and setting column base brackets shall not be performed until supporting concrete is at least seven days old.

Concrete repairs including crack repairs shall be considered by the engineer on a case-by-case basis.

Where minor areas of the concrete surface are "honeycombed," damaged or otherwise defective, the area shall be cleaned, wetted and then filled with a dry-pack mortar or other approved repair products as approved by the design engineer. Dry-pack mortar shall consist of one- part Portland cement and three parts sand with just enough water to produce a workable paste or refer to the Portland Cement Association's *Design and*

Control of Concrete Mixtures (PCA) manual. All form tie holes shall be patched (both the sides of walls). Concreting in Cold Weather shall be performed in accordance with ACI- 306R or equivalent measures to adequately protect concrete from freezing risks. In addition, the contractor shall provide a written plan at least 24 hours in advance of placing concrete in cold weather and shall have the necessary equipment and materials on the job site before the placement begins.

g. Concreting in Hot Weather

Concreting in hot weather shall be performed in accordance with ACI 305.

The supplier shall apply effective means to maintain the temperature of concrete below 90 degrees Fahrenheit during mixing and conveying. Exposed surfaces shall be continuously moistened by means of
fog spray or otherwise protected from drying during the time between placement and finishing and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

h. 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, except that walls that can be backfilled on both sides simultaneously may be done so within seven days.

Heavy equipment shall not be allowed within three feet of a new concrete wall. Provide compaction near the wall by means of hand tamping or small, manually-directed equipment.

5. WOOD STRUCTURES

All framing shall be true and exact. Timber and lumber shall be accurately cut and assembled to a close fit and shall have even bearing over the entire contact surfaces.

Nails and spikes shall be driven with just sufficient force to set the heads flush with the wood surface. Deep hammer marks in the wood shall be considered evidence of poor workmanship and may be sufficient cause for rejection of the work.

Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread. Holes for bolts shall be bored with a bit no more than 1/16" larger than the bolt diameter to achieve a snug fit without forcibly driving the bolt.

Washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with wood.

All joints shall be fastened with the number, type, and size of fasteners specified, at the locations or spacing specified.

If field cuts of pressure-treated wood expose untreated interior wood, the untreated surfaces shall be covered with two coats of a liquid preservative, as approved by the Engineer.

Wood structures shall be backfilled within the limits shown on the drawings by placing material in uniform lifts not to exceed nine inches. Compaction within three feet of walls shall be accomplished by means of hand tamping or small manually-directed equipment.

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

Natural Resources Conservation Service
Practice Specification
Access Road (Code 560)

1. SCOPE

The work shall consist of construction of the Access Road at the location, and to the dimensions and grades, shown on the drawings and as staked in the field.

2. SITE PREPARATION

All trees, stumps, roots, brush, weeds, and other objectionable material shall be removed from the work area and disposed of as directed.

All unsuitable material shall be removed from the roadbed area prior to placing fill or surfacing materials.

The roadbed shall be graded to the required elevations. All areas which require filling will be scarified prior to placement of fill. All fill shall be compacted according to the specified method with the appropriate equipment or to the specified density.

3. SURFACING

Aggregate for the subbase shall be clean and free from deleterious substances.

GEOTEXTILE shall meet the requirements as outlined in NRCS Design Note 24 and NRCS Material Specification 592 or as otherwise stated in Section 6.

Gradation shall be such that a stable base will be formed. Placement of the surface course shall be in accordance with sound highway construction practices.

4. SEEDING

All disturbed areas shall be revegetated as designated on the drawings.

5. EROSION CONTROL

Construction operations shall be carried out in such a manner that erosion and air and water pollution will be minimized. State and local laws concerning pollution abatement must be followed.

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

USDA United States Department of Agriculture

Natural Resources Conservation Service
Practice Specification
Roof Runoff Structure (Code 558)

1. SCOPE

The work shall consist of furnishing, fabricating, and installing all components of the roof runoff structure(s) as outlined in this specification and as shown on the drawings.

2. MATERIALS

GUTTERS, DOWNSPOUTS, AND SUPPORTS shall be made of aluminum, galvanized steel, wood, or plastic, and the size and type set forth in Section 4, or as shown on the drawings. Aluminum gutters and downspouts shall have a nominal thickness of at least 0.027 and 0.020 in (0.07 and 0.05 cm), respectively. Galvanized steel gutters and downspouts shall be at least 28 gauge. Wood gutters shall be redwood, cedar, cypress, or pressure-treated, and shall be clear and free of knots. Plastics shall contain ultraviolet stabilizers. Supports shall have sufficient strength to withstand anticipated water, snow, and ice loads. The type of supports for manufactured gutters and downspouts shall be determined by the manufacturer's requirements, given the type of installation and type of gutter or downspout.

DRAIN FILL for subsurface drains and driplines shall meet the size and quality requirements of PennDOT Publication 408, Section 704, Type A, Coarse Aggregate, with gradation as shown in Section 4 or in the drawings.

DRAIN PIPE for subsurface drains and drip lines shall be perforated corrugated polyethylene (PE) pipe and fittings meeting the requirements of ASTM F405 or ASTM F667.

APPURTENANCES, such as storage tanks, guard pipe, flush diverters, etc., if required, shall be of the materials set forth in Section 4 and/or the drawings.

3. INSTALLATION

Gutters and drainpipes shall be installed at the locations and grades shown on the drawings. Gutter supports shall have maximum spacing of 48 in (120 cm) for galvanized steel and 24 in (60 cm) for aluminum or plastic. Joints shall be made watertight with the use of mastics or by welding. Dissimilar metals shall not be in contact with each other. Wood gutters shall be mounted on fascia boards using furring blocks that are a maximum of 24 in (60 cm) apart.

Gutters shall be hung so that the outer edge of the gutter is below the projection of the roof line as shown on the drawings. Roof edges shall be nearly level. Replacement or repair of structure members may be necessary to provide a nearly level and uniform roof edge.

Downspouts shall be securely fastened at the top and bottom, with intermediate supports that are a maximum of 10 ft (3 m) apart.

Drain pipe shall be installed in accordance with ASTM F449.

Drain fill shall be placed in the drip drain trench in such a manner so as not to be contaminated with adjacent soil. Geotextile may be used to envelop the bottom and sides of the drain fill to accomplish this. Geotextile shall have properties equal to or exceeding the requirements of NRCS Design Note 24.

Outlets shall be located as shown on the drawings. Where downspouts empty directly onto the ground surface there shall be an elbow to direct the flow away from the building and splash blocks or other protection to prevent erosion. Downspouts shall not outlet into foundation drains.

4. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Subsurface Drain (Code 606)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the subsurface drain as outlined in the specification and the drawings.

2. MATERIALS

a. DRAINFILL AGGREGATE shall meet the requirements of Penn DOT, Publication 408, Section 703, fine and coarse aggregate. The size and gradation shall be as specified in the additional conditions of this specification or on the drawings.

Table 1 – Drain pipe requirements

Type	Specification
Clay drain tile, solid & perforated	ASTM-C-4
Clay pipe, perforated, standard and extra strength	ASTM-C-700
Clay pipe testing	ASTM-C-301
Concrete drain tile	ASTM-C-412
Concrete pipe for irrigation or drainage	ASTM-C-118
Concrete pipe or tile, determining physical properties of	ASTM-C-497
Concrete sewer, storm drain and culvert pipe	ASTM-C-14
Reinforced concrete culvert, storm drain and sewerpipe	ASTM-C-76
Perforated concrete pipe	ASTM-C-444
Portland cement	ASTM-C-150
Pipe, bituminized fiber & fitting	Federal Specification SS-P-1540
Styrene rubber (SR) plastic drain pipe & fitting	ASTM-D-2852
Polyvinyl chloride (PVC) sewer pipe & fitting	ASTM-D-2729
Polyvinyl chloride (PVC) pipe	ASTM-D-3034 type PSM
Corrugated polyethylene tubing & fitting (3-6 inch)	ASTM-F-405
Corrugated polyethylene tubing & fitting (8-24 inch)	ASTM-F-667
Pipe, corrugated (steel, polymer coated)	ASTM-A-762
Pipe, corrugated (steel, zinc coated)	ASTM-A-760

b. PIPE shall meet the requirements of Table 1, and as set forth in Section 9 and/or on the drawings. All pipes shall be clearly marked with the appropriate specification designation. If plastic pipe is stored on site for a length of time, it should be protected from sunlight. At the time of installation, it should be kept as cool as possible to minimize elongation of the pipe during installation.

c. GEOTEXTILE shall meet the requirements as outlined in PennDOT Publication 408, Section 735, Class 1, Subsurface Drainage.

3. SITE PREPARATION

All trees, brush, fences and rubbish shall be cleared within the area that the subsurface drain will be installed. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

4. INSPECTION AND MATERIAL HANDLING

Material for subsurface drains shall be carefully inspected before the drains are installed. If applicable, clay and concrete tile shall be checked for damage from freezing and thawing before it is installed. Bituminized fiber and plastic pipe and tubing shall be protected from hazard causing deformation or warping. Plastic pipe and tubing with physical imperfections shall not be installed. Any damaged section shall be removed and replaced. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

5. SAFETY

All positive "design" responses from the Pennsylvania One Call System are noted on the plans. It is the Contractor's or Landowner's responsibility to notify One Call of pending construction and to contact the affected utility for marking at the time of construction.

The Contractor must comply with OSHA requirements Part 1926, subpart P, for protection of workers entering trench.

6. INSTALLATION

Flexible conduits, such as plastic pipe or tubing and bituminized fiber pipe, shall be installed, according to the requirements in ASTM-F-449, "Standard Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control."

All subsurface drains shall be laid to line and grade and covered with approved blinding, envelope or filter material to a depth of not less than three inches over the top of the pipe. If an impervious sheet is used over the drain, at least three inches of blinding material must cover the sheet. No reversals in grade of the conduit shall be permitted.

If the conduit is to be laid in a rock trench or if rock is exposed at the bottom of the trench, the rock shall be removed below grade so that the trench can be backfilled, compacted and bedded. When completed, the tile conduit shall be not less than two inches from the rock.

Joints between drain tiles shall not exceed 1/8 inch except in sandy soils where the closest possible fit must be obtained and in organic soil where some of the more fibrous soil types make it desirable to slightly increase the space between tiles.

Earth backfill material shall be placed in the trench in a manner to ensure that the conduit does not become displaced and so that the filter and bedding material, after backfilling, meet the requirements of the plans and specifications.

If a filter is needed, no part of the conduit containing openings shall be left exposed. If a sand-gravel filter material is used, it shall be a gradation that is compatible with the base material in the trench. The trench shall be over excavated three inches and backfilled to grade with filter material. After the conduit is placed on the filter material, additional filter material shall be placed over the conduit to fill the trench to a depth of three inches over the conduit.

7. FITTING AND CONNECTIONS

All fitting and connections for pipe shall be made with manufacturer-supplied components made for the intended purpose.

8. CONDUIT PERFORATIONS

If perforations are specified, the water inlet area shall be at least 1inch/foot of the pipe length. The perforations shall be either circular or slots equally spaced around the circumference of the pipe in not less than three rows. Circular perforations shall not exceed 3/16 inch in diameter and slots shall not be more than 1/8 inch wide and 1 ¼ inch long for 3, 4 and 5 inch diameter pipe, or 1 ½ inch for 6 and 8 inch diameter pipe, or 1 ¾ inch for 10 and 12 inch diameter pipe. All slots and circular perforations shall be cleanly cut.

9. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Underground Outlet (Code 620)

1. SCOPE

The specification covers the fabrication, installation, and construction of underground outlets.

2. MATERIALS

The materials required for the underground outlet shall be as shown on the drawings or as otherwise required in Section 9.

a. DRAINFILL AGGREGATE shall meet the requirements of Penn DOT, Publication 408, Section 703, fine and coarse aggregate. The size and gradation shall be as specified in the additional conditions of this specification or on the drawings.

Table 1 – Drain pipe requirements

Type	Specification
Clay drain tile, solid	ASTM-C-4
Clay pipe, standard and extra strength	ASTM-C-700
Clay pipe testing	ASTM-C-301
Concrete drain tile	ASTM-C-412
Concrete pipe for irrigation or drainage	ASTM-C-118
Concrete pipe or tile, determining physical properties of	ASTM-C-497
Concrete sewer, storm drain and culvert pipe	ASTM-C-14
Reinforced concrete culvert, storm drain and sewer pipe	ASTM-C-76
Perforated concrete pipe	ASTM-C-444
Portland cement	ASTM-C-150
Pipe, bituminized fiber & fitting	Fed Spec SS-P-1540
Styrene rubber (SR) plastic drain pipe & fitting	ASTM-D-2852
Polyvinyl chloride (PVC), Sch'd. 40, 80, 120	ASTM-D-1785
Polyvinyl chloride (PVC) sewer pipe & fitting	ASTM-D-2729
Polyvinyl chloride (PVC) pipe	ASTM-D-3034 type PSM
Corrugated polyethylene tubing & fitting (3-6 inch)	ASTM-F-405
Corrugated polyethylene tubing & fitting (8-24 inch)	ASTM-F-667
Pipe, corrugated (steel, polymer coated)	ASTM-A-762
Pipe, corrugated (steel, zinc coated)	ASTM-A-760

b. PIPE shall meet the requirements of Table 1, and as set forth in Section 9 and/or on the drawings. All pipes shall be clearly marked with the appropriate specification designation. If plastic pipe is stored on site for a length of time, it should be protected from sunlight. At the time of installation, it should be kept as cool as possible to minimize elongation of the pipe during installation.

c. GEOTEXTILE shall meet the requirements as outlined in PennDOT Publication 408, Section 735, Class 1, Subsurface Drainage.

d. CONCRETE and related materials shall meet the requirements set forth in Construction Specification PA313S, Waste Storage Facility (Structure), and/or as set forth in Section 9.

All materials shall be carefully inspected prior to installation. Clay and concrete tile shall be checked for damage by freezing. Plastic pipe and tubing shall be protected from hazards causing deformation. Any damaged or imperfect pipe or tubing shall not be installed. Any pipe or tubing which is damaged during installation shall be removed and replaced.

3. SITE PREPERATION

All trees, brush, fences and rubbish shall be cleared within the area that the subsurface drain will be installed. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative.

4. INSPECTION AND MATERIAL HANDLING

Material for underground outlets shall be carefully inspected before the drains are installed. If applicable, clay and concrete tile shall be checked for damage from freezing and thawing before it is installed. Bituminized fiber and plastic pipe and tubing shall be protected from hazard causing deformation or warping.

Plastic pipe and tubing with physical imperfections shall not be installed. Any damaged section shall be removed and replaced. All material shall be satisfactory for its intended use and shall meet applicable specifications and requirements.

5. SAFETY

All positive "design" responses from the Pennsylvania One Call System are noted on the plans. It is the Contractor's or Landowner's responsibility to notify One Call of pending construction and to contact the affected utility for marking at the time of construction.

The Contractor must comply with OSHA requirements Part 1926, subpart P, for protection of workers entering trench.

6. EXCAVATION

Construction operations shall be done in such a manner that soil and water pollution are a minimum and all state and local erosion regulations are followed.

Unless otherwise specified, excavation for each underground outlet shall begin at the outlet end and progress upstream. The trench shall be excavated to the grades and cross sections shown on the drawings. The trench width above the conduit may increase as necessary for safe installation or for the convenience of the Contractor. Trench shields, shoring, or bracing are required whenever workers will be in a trench deeper than four feet, or as otherwise required be OSHA Regulations.

7. INSTALLATION

BEDDING. In stable soils, the conduit shall be firmly and uniformly bedded throughout its entire length as required on the drawings or Section 9. Where the underground outlet foundation is in unstable soils, the bedding shall be as shown on the drawings or as otherwise required by the Engineer. Where the conduit is to be laid in rock, or rock is exposed at the trench bottom, the rock shall be removed at least two inches below the invert grade to allow for compacted bedding under the conduit.

PLACEMENT. Debris inside of pipes and tubing shall be removed prior to installation. The conduit ends shall be protected during placement. Similarly, all appurtenances, including trash guards and animal guards, shall be protected during installation to avoid damage. All underground outlets shall be laid to line and grade, and immediately covered with an approved blinding, envelope, or the required depth of filter material. No reversals in grade of the conduit are permitted, no more than five percent stretch is allowed. Special precautions must be taken in hot weather to observe this stretch limit.

Flexible conduits, such as plastic pipe or tubing and bituminized fiber pipe, shall be installed, according to the requirements in ASTM-F-449, "Standard Recommended Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control."

Earth backfill material shall be placed in the trench in a manner to ensure that the conduit does not become displaced and so that the filter and bedding material, after backfilling, meet the requirements of the plans and specifications.

8. BACKFILL

Initial backfill shall be of selected material that is free of rocks or other sharp-edged material that could damage the pipe. Earth backfill shall be placed in the trench in such a manner that the conduit is not displaced, and that the filter and bedding materials are not contaminated or displaced. Unless otherwise specified, where the underground outlet is laid under roads or at other designated locations, the backfill shall be placed in successive layers of not more than six inches, and each lift compacted before the subsequent layer. Backfill shall extend above the adjacent ground to allow for settlement, and be well rounded over the trench.

Work areas shall be restored to their pre- construction condition or as otherwise required in the plans or Section 9.

9. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

Practice Specification
Structure for Water Control (Code 587)

1. SCOPE

The work shall consist of furnishing materials and installing all components of the structure for water control, as outlined in this specification and to the dimensions and grades shown on the drawings.

2. MATERIALS

Unless otherwise set forth in Section 6, the following materials are to be used:

a. Earth fill material used around conduits and structures shall be obtained from the project area, or other approved sources and thoroughly compacted.

b. Pipe type, pipe sizes, fittings and other necessary pipe material shall be as specified on the drawings or as defined in Section 6 of this specification, when applicable.

c. ROCK shall be durable and obtained from sources listed in Penn DOT Bulletin 14 or as otherwise approved by the designer. Size and gradation, where required, shall be as specified in Section 6 or as shown on the drawings. The nominal size of a rock is that dimension (middle) which passes through a square opening with the same size dimension; i.e. it is not the greatest dimension. The rock shall be free from soil and trash. Rocks shall be angular or subangular in shape. However, the least dimension of any individual rock shall be not less than one-third the greatest dimension.

d. GEOSYNTHETICS shall meet the requirements set forth in Section 6 and/or on the drawings. In addition, geotextile shall meet the requirements of Penn DOT Specifications, Section 635, for the appropriate class defined in Section 212. Certification from the manufacturer shall be provided by the Contractor that the geosynthetics meets these requirements.

e. AGGREGATE for bedding, drain fill, and concrete shall be durable and obtained from sources listed in Penn DOT Bulletin 14. The gradation shall be as set forth in Section 6 or on the drawings.

f. PORTLAND CEMENT shall be Type I, with air-entrainment agent, or Type IA, unless otherwise required in Section 6. All cement shall conform to ASTM-C150.

g. MASONRY shall meet the requirements of ASTM-C90 & C270.

h. PRECAST concrete units shall meet the requirements of ACI-525 & 533, unless otherwise specified in Section 6.

i. LUMBER shall be the dimensions and species specified in Section 6 or shown on the drawings. Wood shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. Pressure treated wood products shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 6. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, "Wood Used on Farms, Pressure Treatment", except that only non-CCA preservatives, suitable for use in aquatic habitats, can be used. Each piece shall bear the AWPA stamp of quality. In the absence of grade and treatment stamps, the Contractor or material supplier shall provide written certification that the wood meets the designated quality criteria.

j. Other required materials shall be as shown in the drawings or as defined in Section 6 of this specification.

3. SITE ACCESS AND CLEARING

All trees, roots and boulders and other obstructions shall be removed, as necessary. Tree and brush removal shall be done in such a manner to prevent damage to other property, and to minimize erosion. Unless otherwise specified in Section 6, all cleared materials, including trash, shall be removed from the site or burned. Burning shall comply with all state and local applicable regulations.

Unless otherwise set forth in Section 6, sufficient topsoil shall be stockpiled and re- spread over disturbed areas to establish a vegetative cover.

4. STRUCTURAL INSTALLATION

Structures shall be installed as shown on the drawings and as set forth in Section 6. Construction operations will be carried out in such a manner as to minimize erosion and sedimentation.

Provisions must be made to prevent piping and settlement where underground conduits are used from a structure. Backfill shall be placed in successive layers of not more than six inches, and each lift compacted before the subsequent layer.

Commercially manufactured structures, including but not limited to gabions, precast units, pipe, fence, etc., shall be installed as required by the manufacturer for flowing water applications.

5. VEGETATION

All exposed earth surfaces shall be protected by a vegetative cover as soon, after installation of the structure, as practical. Vegetation, if required, shall be established at the locations shown on the drawings and/or staked in the field, and as set forth herein, in Section 6, and/or as shown on the drawings.

6. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE:

USDA

United States Department of Agriculture

Fact Sheet #9

January 2016

Agriculture Construction Safety

Compliance with safety regulations on agricultural projects is required by OSHA and by all construction insurance/ liability companies. The contractor is to maintain a safe working environment for themselves, their employees, subcontractors, and others who must have access to the site. Detailed knowledge and implementation of safety regulations is their responsibility. Those with more than ten employees must have written safety procedures and document implementation.

Imminent danger situations (hazards that could cause death or serious physical harm) require immediate action, including work stoppage. When NRCS and/or partner personnel observe or become aware of an imminent danger on the work site they will alert the contractor and landowner. They will also advise the landowner that funding and/or technical assistance will be withdrawn if the situation is not corrected. Work may continue after the imminent danger is resolved.

Effective January 1, 2015, all employers must report work-related fatalities, hospitalizations, amputations, and losses of an eye. They can contact the 24-hour OSHA hotline at 1-800-321-OSHA (6742) or their regional OSHA office. See OSHA standards 29 CFR 1904.39 for more information.

Soil Cave-In Protection

- Applies to all excavation over five feet in depth.
- OSHA has regulations set forth in Standards 29 CFR 1926 -Subpart P.
- Options include: sloping, shoring, or working from a safe distance.
- See "Fact Sheet" – SOIL CAVE IN – A FATAL SLIP for general information.

Fall Protection

- This applies to all areas where an individual could fall six feet or more.
- OSHA regulations in 29 CFR Parts 1910 for General Industry and 1926 for the Construction Industry apply to agricultural construction.
- OSHA 29 CFR 1926 subpart L deals with scaffolds and 29 CFR 1926 Subpart M deals with overall fall protection, including but not limited to cast-in-place concrete work, leading edge work, pre-cast concrete erection, tying reinforcement steel, truss installation, and roof construction.
- Options include: warning line system, safety monitors, mechanical equipment, controlled access area, covers, safety nets, scaffolding, guardrail system, and personal fall arrest.
- Selected method(s) shall be implemented at the start of construction.

Underground and Overhead Utility Protection

- Contractor is required to do their own utility check via PA-ONE Call system (811).
- Landowner and/or contractor shall contact any overhead utilities and prepare a procedure to avoid contact and/or schedule work with utility oversight.
- Landowner is to mark and locate any known private buried utilities within the work area.

NOTE: Critical safety measures may be highlighted in the Project Drawings and Specifications.

Batch ticket supplement worksheet

(Information here summarizes portions of the Construction Specifications relating to concrete design mix and batch tickets. Work and materials are subject to all other related information within the Specs.)

Concrete supplied without the supporting information listed below will not be certified by NRCS and is subject to non-payment without additional contractor/supplier certification and/or testing.

Design Mix:

- 28-day compressive strength at least 4,000 PSI
- 5-6% air entrainment
- 3-5 inch slump without superplasticizers
- Slump no greater than 7.5" with superplasticizers
    - If superplasticizer will be added the initial slump shall be 2-4 inches
- A copy of the plant's 4,000 PSI design mix should be given to the inspector in advance, or provided with the first load of concrete delivered to the site.

Batch tickets must show the following:

- 4,000 PSI air entrained mix
- Yards of concrete on truck
- Any admixtures added at the plant. All admixtures must meet the material requirements in the Const. Spec.
- Time out from batch plant
- Water that can be added on site and be within design mix
    - Concrete with water added above allowable limits or missing information will not be certified
- It is the duty of the contractor to provide this information to the batch plant to insure a complete batch ticket is provided with each truck
- Any admixtures which the contractor will add on-site and are not listed on the batch ticket must be approved 24 hours prior to concrete placement

This information was reviewed and understood by the contractor, contract holder and NRCS representative at the preconstruction meeting.

_____ Contractor	
_____ Contract holder	_____ NRCS representative

****PLAN MUST BE APPROVED 24 HOURS IN ADVANCE OF CONCRETE PLACEMENT****

COLD WEATHER CONCRETE PLAN FOR: _____

COLD WEATHER CONCRETING DEFINITION:

When the air temperature has fallen to, or is expected to fall below, 40°F (4°C) during the protection period. The protection period is defined as the amount of time recommended to prevent concrete from being adversely affected by exposure to cold weather during construction. Refer to Table 7.2 in the Cold Weather Concreting Inspection Guide.

Concrete shall not be placed when the forecasted low temperatures are below 40°F or anytime between December 1 to March 15 for liquid waste storage structures unless an NRCS approved Cold Weather Concrete Plan meeting ACI 306R-16 has been submitted and approved by the NRCS Engineer.

CONCRETE HEAVY USE AREA OR STACKING AREA PLAN: ☐

LIQUID WASTE STORAGE STRUCTURE COLD WEATHER CONCRETE PLAN: ☐

(Provide detailed plan on separate page if not included on this page)

COLD WEATHER CONCRETING REQUIREMENTS

- Concrete shall not be placed on frozen or frosted ground
- *Cover subgrade overnight with plastic and /or concrete blankets*
- *Concrete CANNOT be placed when air temperature is below 32°F*
- *All necessary equipment and materials shall be onsite before concrete placement begins.*
- *Document the high/low temperatures for the protection period (see next page)*
- *If predicted low air temperature is above 30° F: Concrete temperature will be 60°F at time of mixing, 55°F at placement.*
- *If predicted low air temperature is within 0-30° F: Concrete temperature will be 65°F at time of mixing, 55° F at placement.*
- *Minimum 500 lb. cement per CY of concrete - no fly ash or slag shall be used to substitute for cement*

OPTIONAL "ACCELERATED SET" CONCRETE METHOD USED TO REDUCE PROTECTION PERIOD

(TO BE LISTED ON CONCRETE DESIGN MIX & CONCRETE BATCH TICKET):

Type III Cement-high early strength concrete

Accelerating admixture -must conform to ASTM-C494, Type C or E (non-corrosive/non chloride)

Other: _____

The length of protection period depends on the type and amount of cement used and whether an accelerated set concrete or normal set concrete is used: For no load exposed service condition see below For other conditions refer to table 7.2*

Concrete temperature must be maintained at 55°F & maintain air temperature to 40°F for:

- ☐ 3 days for Normal-set concrete Type I or II *
- ☐ 2 days accelerated-set concrete cement w/ chemical accelerator (type III/high early strength) *
- ☐ Other, refer to Table 7.2 for Service Condition and required protection period** _____

Floor/Pad

Concrete temp will be maintained with the use of:

Forecasted lows 32°-40°F

- ☐ concrete blankets (minimum R-8 Value)
- ☐ 6 mil plastic with 8" of straw
- ☐ other: _____

☐ **Forecasted lows less than 32°F**
cover with concrete blankets and heat to maintain air temperature above 40°F for the protection period. Provide details.

Wall/Curb

Concrete temp will be maintained with the use of:

Forecasted lows 17°-40°F

- ☐ concrete blankets (minimum R-8 Value)
- ☐ Other: _____

☐ **Forecasted lows less than 17°F**
Cover with concrete blankets and heat to maintain air temperature above 40°F for the protection period. Provide details.

Failure to adhere to this cold weather concreting plan could result in loss of project certification

Contractor signature _____ Date _____ NRCS Approval _____ Date _____

JMH V.1.0 10.02.20

Cold Weather Concrete Protection Period Recording Tables

Project :____

Maintain air temperature above 40°F for the protection period to maintain concrete temperature at 55°F (min).

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Placement Description:_______________________________

Date of Placement:__________________________________

Outside Air Temperature during placement:___________ °F

Concrete Temp. during placement:______°F

# of Days Protection required: ___

Notes:______________________________________

Date	#Day of Protection Period	Daily Outside HIGH Air Temp °F	Daily Outside LOW Air Temp °F	Concrete surface HIGH Air Temp °F	Concrete Surface LOW Air Temp °F
	1				
	2				
	3				
	4				
	5				
	6				

1 day= a 24 hour period

Successful
HOT WEATHER CONCRETING

HOT WEATHER can lead to many problems in mixing, placing, and curing of concrete that can have an adverse affect on its properties and service life. This guide has been developed by Master Builders, Inc. to assist the entire construction team (owners, specifiers, contractors, and ready mixed concrete producers) in the design, manufacture, delivery, placement and curing of quality concrete in HOT WEATHER.

ACI Committee 305 defines hot weather as any combination of high ambient temperature, high concrete temperature, low relative humidity, wind velocity and solar radiation. The effects of high temperature, solar radiation and low relative humidity on concrete may be more pronounced with increases in wind velocity (see Figure 1), and can lead to rapid evaporation of moisture, which is the primary cause of plastic shrinkage cracks in concrete.

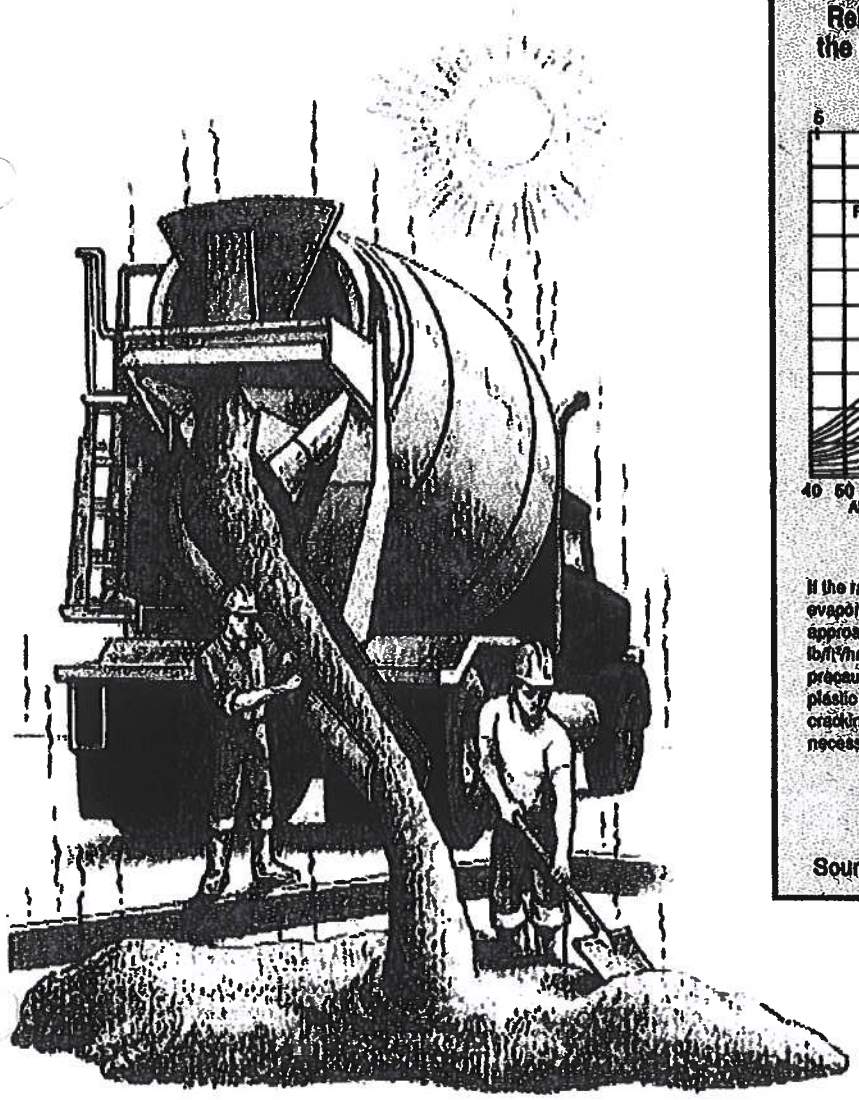
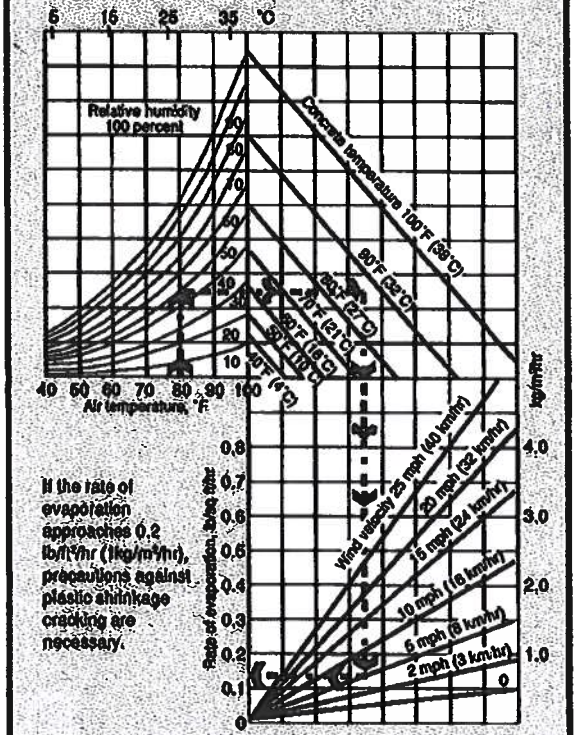


Figure 1
Effect of Concrete and Air Temperatures, Relative Humidity and Wind Velocity on the Rate of Surface Moisture Evaporation from Concrete



Source: ACI 305R-91, "Hot Weather Concreting"

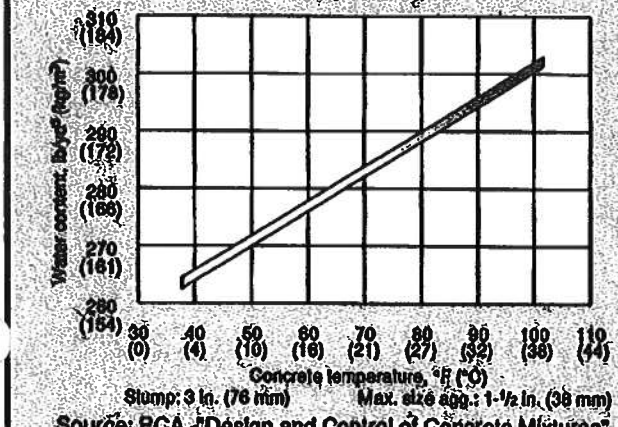
degussa.
Construction Chemicals

Potential Problems

The potential problems of hot weather can occur at any time of the year in warm tropical or arid climates and generally occur during the summer season in other climates. Problems associated with freshly-mixed concrete placed during hot weather conditions include increased:

- **water demand (see Figure 2)**
- **rate of slump loss**
- **tendency for retempering**
- **rate of setting (see Table 1)**
- **difficulty in handling, placing, compacting and finishing**
- **occurrence of plastic shrinkage cracking**
- **amount of air-entraining admixture to entrain air**
- **need for early curing**

Figure 2
Effect of Concrete Mix Temperature on Water Requirement



Source: PCA, "Design and Control of Concrete Mixtures"

Table 1
Setting Time of Concrete at Various Temperatures

Temperature		Approximate Setting Time
100 °F	(38 °C)	1-2/3 hours
90 °F	(32 °C)	2-2/3 hours
80 °F	(27 °C)	4 hours
70 °F	(21 °C)	6 hours
60 °F	(16 °C)	8 hours
50 °F	(10 °C)	10-2/3 hours
40 °F	(4 °C)	14-2/3 hours

In hardened concrete, hot weather can increase:

- **drying shrinkage and differential thermal cracking**
- **permeability**

and decrease:

- **compressive and flexural strength**
- **durability**
- **watertightness**
- **uniformity of surface appearance**

ACI 305-91 report on, "Hot Weather Concreting", states that "concrete can be produced in hot weather without maximum limits on placing temperatures and will perform satisfactorily if proper precautions are observed in proportioning, production, delivery, placing and curing. As part of these precautions, an effort should be made to keep concrete temperature as low as practical."

Concrete Temperature Control

Concrete temperature at the time of mixing is influenced by temperature, specific heat and quantity of its ingredients. The approximate temperature of concrete can be calculated from the following equation:

$$T = \frac{0.22(TaWa + TcWc) + TwWw + TwaWwa}{0.22(Wa + Wc) + Ww + Wwa}$$

where T = temperature of freshly-mixed concrete
Ta,Tc,Tw,Twa = temperature of aggregates, cement, added mixing water and free water on aggregates, respectively.

Wa,Wc,Ww,Wwa = weight of aggregates, cement, added mixing water, and free water on aggregates, respectively.

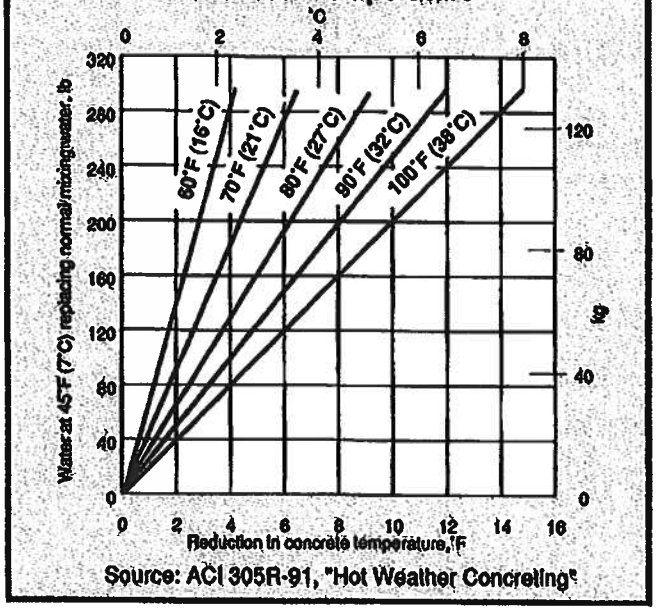
The temperature of concrete can be reduced 1 °F (0.5 °C) by reducing:

- **cement temperature by 8 °F (4 °C)**
- **water temperature by 4 °F (2 °C) (see Figure 3)**
- **aggregate temperature by 2 °F (1 °C)**

Of all concrete-making materials, water is the easiest to cool, and using ice as part of the mixing water will help reduce the concrete temperature. The amount of ice used must be included as part of the mix water and should not exceed the established water-cementitious materials ratio. The following measures will further help to control concrete temperature at the time of batching or during the hydration process:

- **sprinkling and spraying of aggregates**
- **shade storage of aggregates**
- **use of liquid nitrogen**
- **use of fly ash/slag cement**
- **use of set controlling admixtures (POZZOLITH®, POLYHEED®, RHEOBUILD®, DELVO® Stabilizer, DELVO® ESC)**
- **use of an evaporation reducer (CONFILM®)**

Figure 3
Effect of Cooled Mixing Water on Concrete Temperature



Source: ACI 305R-91, "Hot Weather Concreting"

The use of slower setting cements may improve the handling characteristics of concrete in hot weather. A 10 °F (5 °C) to 15 °F (8 °C) temperature rise per 100 lb (45 kg) of cement occurs from cement hydration. The temperature increase from cement hydration is directly proportional to its cement content.

Fly ash, other pozzolans and ground granulated blast-furnace slag are used as partial replacements for portland cement and impart a slower rate of setting and strength development to concrete, both of which are desirable in hot weather concreting.

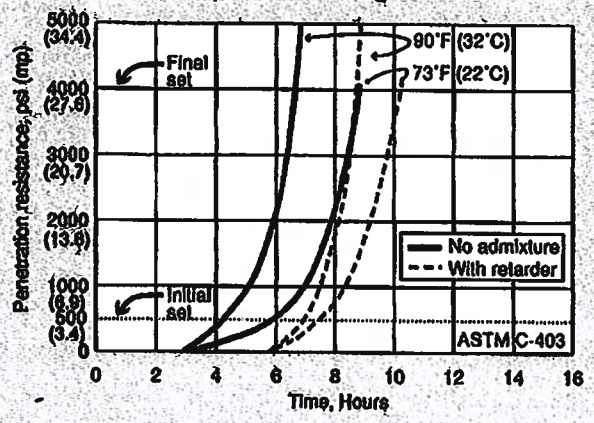
The requirements to achieve good results in hot weather concrete placing and curing are no different than those for other seasons. Concrete should be placed where it will remain and in shallow layers to allow adequate vibration; use sunscreens, shades, wind breaks, cure and protect from moisture loss; place at times to escape the heat of day.

Chemical Admixtures

Chemical admixtures conforming to ASTM C 494 Types B, Retarding; D, Water-reducing and retarding and G, High-range water-reducing and retarding, are beneficial for concrete placed during hot weather. Benefits obtained from these admixtures include:

- **lower water demand - minimum 5%**
- **improved workability during placing**
- **slower rate of setting time (see Figure 4)**
- **lower rate of heat evolution**
- **increased compressive strength**

Figure 4
Effect of Concrete Temperature and Retarder on Setting Time



Source: PCA, "Design and Control of Concrete Mixtures"

In addition, Type G admixtures also provide a minimum of 12% water reduction and extended slump retention of rheoplastic concrete - slump > 7 in. (175 mm).

Master Builders, Inc. offers a complete family of retarding admixtures that conform to ASTM C 494 requirements.

Typical performance data is as follows:

Table 2
Typical Performance Data
Concrete & Ambient Temperature 90 °F (32 °C)
70 °F (21 °C)**

Product	ASTM C 494 Designation	Dosage fl oz/cwt (mL/100 kg)	Setting Time Retardation vs. Plain Concrete (h:min)
POZZOLITH 100 XR Conventional water-reducing and retarding admixture	B & D	2 (130) 5 (330)	+2:30 +8:55
POLYHEED RI Mid-range water-reducing and retarding admixture	B & D	6 (390) 12 (780)	+1:38 +4:49
RHEOBUILD 716 I High-range water-reducing and retarding admixture	B & G	11 (720) 13 (850)	+1:00** +3:20**
DELVO Stabilizer Hydration control admixture (Liquid)	B & D	2 (130) 6 (390)	+0:45 +2:00
DELVO ESC Hydration control admixture (Dry Formulation)	B & D	4 (260)* (1/4 puck)	+2:15**

*1 DELVO ESC PUCK = 16 fl oz (470 mL) of Liquid DELVO Stabilizer

Your Master Builders sales representative will help you select the formulation that best serves your needs.

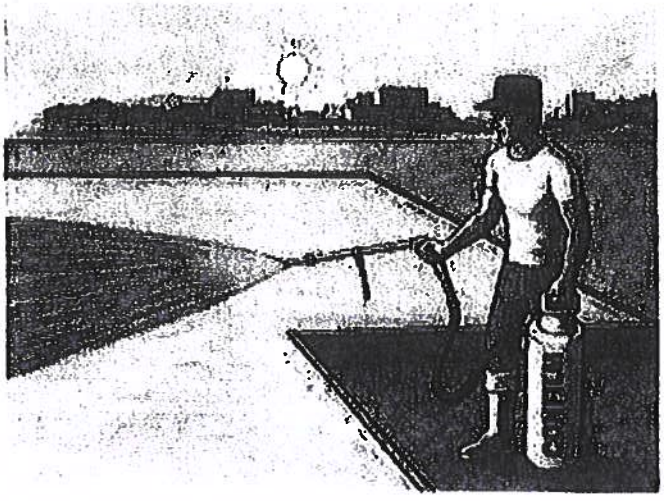
Miscellaneous Products

Polypropylene synthetic fibers (Fibermesh®) reduce the formation of plastic settlement and shrinkage cracks. In addition, these fibers:

- **reinforce against plastic shrinkage crack formation**
- **hold cracks together**
- **reinforce against abrasion**
- **are compatible with all surface treatments**

The use of an evaporation reducer (CONFILM) will enhance the quality of the concrete. This monomolecular film:

- **reduces surface moisture evaporation**
- **reduces crusting, plastic shrinkage cracks**
- **increases amount of surface handled per finisher**
- **reduces overall finishing costs**
- **Is NOT a finishing aid**
- **Is NOT a curing compound for concrete**



Fact Sheet

SOIL CAVE IN-A FATAL SLIP

United States Department of Agriculture

Natural Resources Conservation Service

Cause of Cave Ins

Cave ins in pits and ditches cause the death of construction workers every year. Most deaths have occurred in trenches dug for utility lines. However, soil slippage can occur anywhere soil is excavated. Landslides in clay soils kill more people each year than those in sandy soils.

Most workers are careful around sand because they know it moves easily. However, many believe a thick, tough clay soil will not slip. Yet, most clay soils shrink and crack open when dry and swell when wet. This shrinkage and swelling cause slick areas to develop beneath the surface.

Some clay soils contain water-tight layers called fragipans. Water accumulating on the impervious layer lubricates the soil, increasing the probability of slippage. When a ditch or pit is dug in a soil with a fragipan or in a soil with a high shrink-swell potential, the soil will often slip, resulting in a dangerous cave in. This becomes even more likely WHEN THE SOIL IS WET.

Prevention

Occupational Safety and Health Administration (OSHA) regulations require protective action on all worker-occupied excavations unless the cut is made in stable rock, or the cut is less than five feet deep and there is no potential for a cave in to occur. Protection can be accomplished with sloping and benching, support systems, or shield systems which conform to OSHA regulations.

Sloping the sides of the excavation is the simplest protection against a cave in. If soil properties in the excavation are unknown, the excavation slopes should be no steeper than 1-1/2 horizontal to 1 vertical. If the soil can be classified as a Type A or Type B material according to the OSHA classification system (see back side), you can use a steeper slope, as shown in Figures 1 through 5.

Consult OSHA regulations when more than one soil type is exposed in an excavated slope, or when benched slopes are used. The regulations also provide details on support and shield requirements. Complete requirements are found in OSHA's safety and health standards (29 CFR 1926, Subpart P).

Soils Information

Soil survey publications are available for most counties. This information is useful to engineers, builders, contractors and others interested in construction hazards. The publication identifies soils with fragipans and high shrink-swell potential. Other potential construction problems, such as water table, bedrock and corrosiveness, are also contained in the reports as well as information on engineering properties of soils.

Copies of soil survey reports and other soils information are available from the local office of the USDA, Natural Resources Conservation Service, or write Soils, USDA, Natural Resources Conservation Service, Suite 340, One Credit Union Place, Harrisburg, PA 17110-2993.

OSHA Soils Classification for Excavated Slopes

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or
(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
(iii) The soil has been previously disturbed; or
(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater; or
(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or
(ii) Granular, cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam; or
(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil; or
(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
(v) Dry rock that is not stable; or
(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V, but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
(ii) Granular soils including gravel, sand, and loamy sand; or
(iii) Submerged soil or soil from which water is freely seeping; or
(iv) Submerged rock that is not stable; or
(v) Material in a sloped, layered system where the layers dip into the excavation ona slope of four 4H:1V or steeper.

MAXIMUM ALLOWABLE SLOPES

Figure 1. Type A Soil
Simple Slope, General

Figure 2. Type A Soil
Simple Slope, Short Term

Figure 3. Type A Soil
Unsupported, Vertically Sided Lower Portion, Maximum 8 Feet in Depth

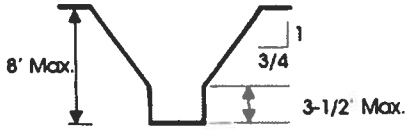


Figure 4. Type A Soil
Unsupported, Vertically Sided Lower Portion, Maximum 12 Feet

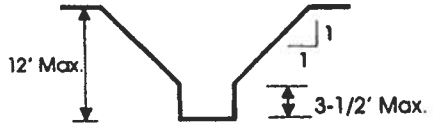


Figure 5. Type B Soil
Simple Slope

Figure 6. Type C Soil
Simple Slope