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DIVISION 3
PIPE CULVERTS

SECTION 300
PIPE INSTALLATION

300-1 GENERAL

This section of the Standard Specifications, along with the standard drawings and the project plans, contains the requirements for the installation of various types of pipe. Additional requirements for the installation of structural plate pipe, pipe arch, and welded steel pipe are included at the end of Section 300 in this manual. Particular attention should be given to Standard Drawing Number 300 sheets 1 through 3. Sheet 1 provides details for the installation of flexible pipe. Flexible pipe includes HDPE, PVC and Corrugated Aluminum and Corrugated Steel pipe. Sheet 2 provides details for the installation of rigid pipe. Rigid pipe includes concrete and steel pipe. If a structural plate pipe or pipe arch is a part of the plans or is added by supplemental agreement, special details for their installation is required.

The location and size of pipe culverts is a design function of the Hydraulics Unit. The Engineer may make minor adjustments in the designed drainage system; however, if **major** changes are required, he should contact the State Hydraulics Engineer.

Examples of **major** changes are as follows:

1. The elimination of any cross drain
2. The addition of any cross drain
3. Any change in the size and gauge of pipe
4. Change in the inlet or outlet location if it is outside a natural course
5. Any change which would create a diversion of water
6. Extensive additions to outfall drainage ditches
7. Modifications to Type A basins
8. Any changes affecting permitted areas

Materials excavated for the installation of pipe, which are deemed suitable, shall be utilized in the construction of the project. While this material may not be suitable for pipe backfill above the required depth of select material, it may be useable as embankment if spread over a large shoulder or embankment area. Therefore, good engineering judgment must be exercised and all options explored before the Contractor is allowed to waste pipe excavation materials. Wasting of any unsuitable material is considered to be incidental to the pipe installation. Additional material, beyond that excavated during pipe installation, required for backfill up to the depth shown in the standard drawings, is incidental to price for pipe installation. When foundation conditioning material is required, payment will be made at the unit price for “foundation conditioning material, minor structures”.

300-2 MATERIALS

The type of pipe material received should be checked against the class or gauge pipe required by the plans. All select material used for foundation conditioning material must meet the requirements of Class V or VI. All select material used for bedding and backfill must meet the requirements of Class II or III depending on the type of pipe. The installation details for flexible

and rigid pipe are unique and should be consulted to ensure the proper type and amount of select material is used for each pipe system. Test and approve the select backfill material prior to use.

Corrugated Metal Culvert Pipe, Structural Plate Pipe and Arched Pipe

Corrugated metal culvert pipe is on the North Carolina Brand Registration Program. Only producers and suppliers who submit a yearly Brand Certification and Guarantee, and adhere to the requirements of the program as specified by the Materials & Tests Unit, can sell corrugated metal pipe to the Department. As part of the producers' final quality control check, they attach a sticker to 25% of the bundled pipe and to each large-diameter pipe shipped to a NCDOT project or Maintenance facility. The sticker will bear the name of the producer and the location of the plant where it was produced and will serve to notify the Technician that the pipe is from an approved source. However, it does not mean that it is NCDOT approved. **A Materials Technician from the Materials & Tests Unit should give final approval of the pipe before it is installed.**

Upon delivery of the pipe to the project, **the Engineer must notify the Materials & Tests Unit to request an inspection**. The project personnel will record the name of the Producer and the plant location on the Materials Received Report, along with the pipe dimensions and description. A copy of the Materials Received Report will be sent to the Records Section of the Materials & Tests Unit.

The Materials Technician will inspect the pipe and inform the Engineer of the results of the inspection. A test report will then be issued to the Engineer. A copy of this report will be submitted to the Records Section of the Materials & Tests Unit by the Materials Technician and one copy shall be maintained for the Technician's files.

Concrete Culvert Pipe

The Materials & Tests Unit performs all inspection and testing of concrete culvert pipe at the producer's site. Once the pipe has been tested and accepted, each piece will be stamped "NCDOT APPROVED", in addition to the plant name and location, the day the pipe was cast and the pipe ID number. A test report will be generated by the Technician and filed in the Records Section of the Materials & Tests Unit. Test reports will be kept on file for each producer. The "NCDOT APPROVED" stamp will ensure that the pipe has met the minimum strength and workmanship requirements for any particular lot of pipe. **Final acceptance of the pipe is the responsibility of project personnel.**

When concrete pipe is delivered to a project, the project personnel will verify that it is approved for use by ensuring that it is stamped "NCDOT APPROVED." A Materials Received Report will be completed. All information such as sizes, piece numbers, and name of manufacturer should be listed on the Materials Received Report. **The project personnel will inspect the pipe for any damage which may have occurred during shipment such as cracks, breaks, etc., and reject any pipe they find unacceptable.** A test report for the pipe will be sent to the Records Section of the Materials & Tests Unit, but will **not** be sent to the Engineer. If a need should ever arise, a copy of the report can be obtained from the Technician, who inspects the pipe at the plant before shipment, or from the Records Section.

300-3 UNLOADING AND HANDLING

This article of the Specifications requires that the Contractor exercise reasonable care in the handling of pipe and places the responsibility for the decision of rejection or repair of damaged sections on the Engineer. Repair may be permitted when damage will not impair the function or life expectancy of the pipe. If a question arises regarding repair or rejection of damaged pipe, the Section Materials Specialist may be consulted. The Contractor may elect to use undamaged rejected portions of pipe for partial sections.

When the pipe is being handled in the field it is imperative that approved lifting techniques be used. As stated in this section of the specifications only a lifting device which uniformly distributes the weight of the pipe along its axis or circumference will be allowed. The only alternative to these methods will be where the contractor is utilizing a supplier-approved device.

Concrete pipe delivered for use shall be stamped NCDOT approved. All pipes should also be field inspected by project personnel to ensure that there has been no delivery or job site damage. **The final approval/rejection of pipe material should be made at the project level with assistance from the Materials & Tests Unit.**

300-4 PREPARATION OF PIPE FOUNDATION

All pipe foundations are to be constructed in accordance with Roadway Standard Drawing Number 300, Sheet 1 or Sheet 2. All pipes require pipe bedding to distribute loads around the circumference of the pipe and to reduce point loading. The bedding should not be compacted prior to pipe installation. The line and grade of the bed should be checked from an offset string line, batter boards, or laser. When lasers are used to establish line and grade, the Technician should verify that the instrument is properly set up and functioning by checking the laser established line and grade against an independent line and grade stake set by the survey party.

A properly constructed foundation is a necessity inasmuch as a pipe culvert performs both a hydraulic and structural function. Distortion of the foundation under load may result in pipe failure and ultimately embankment failure. Appropriate care should be taken in the inspection of foundation construction. The Technician should carefully observe the foundation as it is being uncovered such that the Contractor may be advised as to any undercutting that may be required while the excavation is being made. On shallow trenches, an inspection of the proposed line should be made before the Contractor begins excavation and a decision made at that time as to any undercutting required, grade revisions, or revised location of the line. The decision to undercut, revise grade, or relocate the alignment should be made by the Engineer.

No pipe culvert shall rest on rock foundations and undercut will be performed. The depth of undercut may be varied along the length of the line as the embankment height varies along the line.

No pipe culvert shall rest on foundations that cannot be reasonably expected to support the anticipated dead and live loads. In areas of unsuitable material, undercut and provide geotextile and foundation conditioning material in accordance with Standard Number 300. Sheet 1 or 2. Ideally, undercut should be performed to a depth which is capable of supporting the load or capable of bridging over the unsuitable material. Foundation conditioning material will consist of Select Material Cl. V or Cl. VI fully encapsulated in engineering fabric.

The pipe foundation should be maintained in a dry condition. Water standing or flowing in the foundation should be ditched to a sump or pumped out. If seepage is a major problem, it may be necessary to construct subsurface drainage adjacent to the foundation as seepage after construction may undermine the foundation. It is the responsibility of the Contractor to divert

existing drainage necessary to install the required pipelines. The Engineer should insure that any temporary diversion is adequate and will not cause siltation or property damage, especially in the case of heavy rainfall. **No direct payment is made for diverting and/or dewatering the site as this is considered incidental to the cost of placing pipe. Earth material is not acceptable for damming a stream during pipe installation.**

Where pipes are founded on compressible material, camber should be placed in the grade of the pipe to compensate for the settlement. The amount of camber to be used depends on the load imposed on the foundation material and the compressibility of the material. Since these factors vary, judgment is required in selecting the amount of camber to be used. In an effort to provide some guidance in the selection of values for camber, a chart of these values is included at the end of this section with the Technician's Check List. Unless more precise information is available through consultation with the Geotechnical Unit, the values taken from the chart may be used. Typical situations that would require Geotech consultation include high fill over weak, compressible soils. The Technician should thoroughly familiarize himself with the stakes and marks in laying off the pipeline.

300-5 INVERT ELEVATIONS

The proposed pipe invert elevations shown on the drainage summary sheets are for bidding purposes only and may not be appropriate for construction layout. It is the responsibility of the surveyor (DOT or Contractor) to stake out drainage system inverts according to actual field conditions. When Contractor surveying is utilized, it is the Contractor's responsibility to submit the drainage layout, based on actual field surveys, to the Resident Engineer for approval prior to beginning work. Prior to beginning work on any pipe installation, the Engineer should have already reviewed the planned installation layout, provided by the surveyor, for invert elevations and pipe length. If the Engineer observes that pipe work has begun and no drainage layout has been submitted, the Engineer should request and review the layout.

The pay adjustment formula for changes in pipe invert elevations should be uniformly applied to all drainage systems where inverts are contained in the plans. A new line item should be created in HiCAMS to provide compensation.

300-6 LAYING PIPE

When laying pipe in areas covered by environmental permits, the pipe will be installed to allow the passage of low stream flows. This should allow the continued movement of fish and other aquatic life as well as to prevent head-cutting (upstream erosion) of the streambed. Consult the permit for details. Generally, for all pipes greater than 48 inches in diameter, the bottom of the pipe will be buried at least one foot below the bed of the stream unless such burial would be impractical and the Corps of Engineers has waived this requirement. For pipe 48 inches in diameter or smaller, the bottom of the pipe must be buried below the bed of the stream to a depth equal to or greater than 20 percent of the diameter of the pipe. For example, a 36 inch pipe should be buried a minimum of: 36 inches x 20% = 7.2 inches. Placement of the pipe and temporary erosion control measures shall not be conducted in a manner that may result in the disequilibrium of wetlands, streambeds, or stream banks adjacent to, upstream, or downstream of the pipe. To allow the continued movement of bed load and aquatic organisms, existing stream channel widths and depths will be maintained at the inlets and outlets of the pipe. Riprap armoring of streams at inlets and outlets shall be minimized above ordinary high water elevation in favor of bioengineering techniques such as bank sloping, erosion control matting and revegetation with deep rooted woody plants.

(A) RIGID PIPE (RCP, Welded Steel)

Where possible, lay pipe beginning at the downstream end of the line. On skewed lines, which are to be field cut to fit headwalls or drainage structures, care must be taken to ensure that the first joint of pipe is placed so that a cut across the full diameter of the pipe may be made. The bell or groove end shall point upstream. When a bell and spigot type of pipe is used, the bedding must be excavated to a sufficient depth and width to accommodate the bell such that the entire length of joint is resting snugly in the bedding.

Before the joining of pipe sections is begun, the Technician should assure himself that the Contractor has the specified jointing agent. The Specifications require the use of flexible plastic joint material for concrete culvert pipe. For pipe 42" in diameter and greater, the joint shall be wrapped in geotextile that will extend at least 12" on each side of the joint prior to backfill. The requirement for the use of any other joint material will be given in the Project Special Provisions. The Technician should determine that the joint material is on the approved products list at the M & T website. The joint material should be placed midway on the tongue of the pipe and homed using techniques that do not damage either pipe. Too much force in homing can damage the tongue or bell and too little force can fail to properly seal the pipe.

The Technician shall assure himself that the pipe has been laid to proper line and grade and the lift hole filled with grout or other approved method, prior to giving his permission to backfill the pipe.

A pipe density should be run at the springline of each cross line pipe and again at the top of the backfill. Pay particular attention to compaction efforts where pipelines enter drainage structures to ensure density is obtained under the last joint of pipe.

(B) FLEXIBLE PIPE (HDPE, PVC, Corrugated Metal, Corrugated Aluminum)

Prior to laying metal pipe, the Technician shall assure himself that the Materials & Tests Unit has approved the pipe and bands. The Materials Specialist performs this inspection on the site after the pipe has been delivered to the project.

The procedure for laying flexible pipe is virtually the same as for rigid pipe although the backfill requirements are different (See Std. Drawing 300 Sht. 1 of 3). When HDPE is used, install it starting on the downstream end with the circumferential laps pointing downstream and with the longitudinal laps at the side or quarter points. Flexible pipe joints should be cleaned prior to joining. When corrugated bands are used to connect pipe, the band is first slipped into position over the end of the pipe section in place with the band left open to receive the next section. The adjoining section is brought to within about 1 inch of the first section with the corrugations of the band matching the corrugations of the pipe. The corrugations must be kept free of dirt and gravel so that the corrugations fit snugly and are properly sealed. As the bolts are tightening the band, it should be tapped with a hammer or mallet to take up the slack. Torqueing of the bolts alone will not produce a tight joint on large diameter pipe. All pipe 60" or larger shall be match marked at the plant for proper installation on the project. Check the plans to determine if gaskets or rod and lug coupling bands are required.

Special attention should be given in placement so that the proper ends and matches are made to ensure best fit.

300-7 BEDDING and BACKFILLING

Determine which type, flexible or rigid, of pipe system that is in use. Consult the appropriate standard drawing, Roadway Standard Drawing 300 Sheet 1 or Sheet 2 for the depths and types of

backfill material required. All pipe systems require the use of Select Granular Material Cl. III or Cl. II Type 1 for bedding material. The bedding thickness is the inside diameter divided by 6 but never less than 6". The bedding should be loosely placed so that the pipe will self bed within the material. Once the pipe is laid, the bedding material that is not under the pipe can be compacted. Pipe backfill should continue with select material up to the springline (middle) of the pipe. The type of select material varies depending on the type of pipe. Take care to fully compact the backfill in the haunch zone so that the full circumference of the pipe is supported. The type of backfill required above the springline varies based on the type of pipe utilized. When local material is permitted by the standard drawing, the Engineer must still ensure the local material is suitable for backfill.

Samples of the material proposed for use as select backfill shall be submitted to the Materials & Tests Unit for approval prior to use on the project. Special care should be taken to ensure that the samples submitted are representative of the material proposed for use. Reference should be made to Section l0l6 for the material requirements for the various classifications of select backfill material.

Regardless of the type of backfill, the backfill material will be spread uniformly on each side of the pipe and compacted. No subsequent layers shall be placed until the preceding layer has been satisfactorily compacted. The lifts of backfill shall be kept approximately equal in height on each side of the pipe to prevent distortion of alignment and pipe cross section by the compactive effort.

Periodic density tests shall be made on pipe backfill to verify the Contractor's method of compaction is giving satisfactory results. It is recommended that a density be obtained at the springline and the top of backfill for each crossline pipe. A subsequent embankment or subgrade density should also be run in this area but recorded as an embankment or subgrade density.

The Specifications do not place any restrictions on the equipment that may be used for compacting backfill. The Contractor should use equipment appropriate to obtain adequate density results.

If the Technician has reasonable grounds to believe that the pipe backfill has been improperly placed or compacted, he has the authority to direct the Contractor to remove the backfill, replace, and recompact it. "Reasonable Grounds" may be the result of probing with a sounding rod or density test. If this action is taken, the guidelines set forth in Article 105-11 of this Manual shall apply. As the backfill material is being removed, if there is any dispute with the Contractor as to whether or not the backfill is satisfactory, density tests shall be run to either verify or refute the contention.

No heavy equipment shall be allowed to operate over any pipe culvert until the backfill is completed to **at least** 3 feet above the top of the pipe. When 3-feet of cover is ramped up over a pipe line, box, or arch culvert in order to allow hauling with heavy equipment, the ramp approach should be of sufficient length to avoid impact loads on the pipe or culvert. This depth may be increased if, in the opinion of the Engineer, the Contractor's equipment would cause damage to the completed pipe culvert. In any event, however, it is the Contractor's responsibility to conduct his operations in such a manner as not to cause damage to any completed structure. Where possible, project personnel shall periodically inspect completed pipe culverts for possible damage caused by live loads developed from the Contractor's operations. If there is suspicion that damage has occurred to a pipe, the Materials and Tests Unit can provide a camera for viewing the inside walls.

Ensure that pipe is installed in accordance with permit conditions, erosion control plans and roadway plans. Where required by the plans, installation of Rip Rap at pipe inlets and/or outlets should be installed in conjunction with the pipe installation.

300-8 INSPECTION AND MAINTENANCE

The Engineer should perform random video and mandrel inspection of completed pipelines prior to final acceptance. A percentage of crosslines should be included in the inspection. This testing should occur after the completion of embankments but prior to base and paving when possible. Guidelines for repair/replacement of pipe include:

- For cracks ≤ 0.01" – if a single crack or sporadic cracks of this nature, no repair or remediation is required. If there are multiple cracks of this size in a small area, repair may be necessary.

- For cracks > 0.01" but ≤ 0.10" – for cracks of this size, check the vertical offset of the crack. For vertical offsets ≤ 0.2", provide a site specific repair for the crack. For vertical offsets > 0.2", replace the pipe.

- For cracks > 0.2" – replace the pipe.

* For the following counties, site specific repairs may be necessary that fall outside the provided ranges to prevent corrosion in the pipe's reinforcement: Beaufort, Bertie, Bladen Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Currituck, Dare, Gates, Hertford, Hyde, Jones, Martin, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington. Other areas throughout the state may require repairs if the pipe is determined to be installed in a corrosive environment (hot rock, very high soil ph levels, very low soil ph levels, etc)

Joints

- For joints that are Soil Tight – If the joint gap is greater than the manufacturer's requirements, repair per manufacturer's recommendations. If not able to repair, replace as needed. If the joint gap is greater than manufacturer's recommendations, replace as needed.

Slabbing or Spalling

- For pipe with slabbing that does not have exposed reinforcement, repair the pipe.
- For pipe with slabbing that has exposed reinforcement, replace the pipe.
- For pipe with spalling that does not have exposed reinforcement, evaluate if a repair is necessary.
- For pipe with spalling that has exposed reinforcement, evaluate if repair will be appropriate. If not, replace the pipe.

Maintenance

The maintenance portion of this provision of the Specifications requires constant monitoring by project personnel. All of the inlet and outlet channels of the pipe culverts should be periodically inspected to determine that they are properly functioning. Channels and pipe culverts that become clogged with debris and silt must be promptly cleaned out. This is necessary in order to prevent water from being impounded on private property and to properly

drain the roadway. All inspections and subsequent instructions given to the Contractor shall be documented in the project diary.

Erosion control plans should be coordinated with the pipe installation to provide effective control of erosion and sediment loss.

300-9 MEASUREMENT AND PAYMENT

Foundation Conditioning

Using Local Material:

Undercut Excavation will be measured in its original position by the average end method and paid for at double the contract unit price for Unclassified Excavation as provided in Article 225-7 or 104-7 if there is not a contract price for Unclassified Excavation. If local material is used for foundation conditioning (ie. there was Cl. V or Cl. VI material excavated on the project or from a project borrow pit), then payment for the foundation conditioning material will be made in accordance with Section 225-7 or 230-5.

Using other than Local Material:

When **Class V or VI material is hauled to the project** for foundation conditioning, **no payment will be provided for Undercut Excavation for it is incidental to Foundation Conditioning Material. Care should be taken to avoid over-excavating the width of the trench and increasing the amount of Foundation Conditioning material needed.**

Foundation Conditioning Geotextile

Measure and pay for foundation conditioning geotextile by the square yard. The measurement is based on the length of the pipe installed times twice the theoretical width. There is no measurement for any fabric overlap nor the vertical dimension of the fabric.

Bedding and Backfilling – Select Material

There is no measurement for select material for bedding and backfilling. This is considered incidental to the pipe. If unclassified excavation or borrow excavation meets the requirements for the required type of select material, no deduction from unclassified or borrow excavation to account for this use, will be made.

TECHNICIAN'S CHECKLIST
SECTION 300
PIPE INSTALLATION

1. Study the Specifications, plans, permits, erosion control phasing and Special Provisions.
2. Determine the type of pipe, flexible or rigid, and review that standard drawing.
3. Does pipe staking appear to be correct? Is the staked pipe length as long as shown in the plans. If not, contact the Engineer.
4. Did the permits require the culvert to be buried?
5. Observe pipe sections after delivery to the site. Record any joint or section rejected and reason for the same. Ensure that concrete pipe has been stamped with the Department's Seal of Approval. For flexible pipe, see that the pipe, fittings, and other accessories have been provided by a supplier having met the requirements of the Department's Brand Certification Program and listed on the Department's preapproved list. Ensure the flexible pipe has been inspected by the Materials and Tests Unit. If unloading or handling is careless, notify Contractor's supervisory personnel. Mark any rejected pieces of pipe. Ensure pipe is handled on the project using an approved device.
6. Verify the class of pipe and installation method against the drainage summary sheet within the plans and ensure the minimum/maximum fill heights will be obtained as listed in Roadway Standard Drawing 300 Sheet 3 of 3.
7. See that Department Policy & Procedures for Excavation, Trenching, and Shoring are being strictly followed. Notify the Engineer if an unsafe condition exists, stop work if imminent danger exists.
8. Monitor the Contractor's control of the pipe grade, including pipe camber.
9. If unsuitable material or rock is encountered, undercut and use Select Material Cl. V or VI fully encapsulated in geotextile.
10. If local material is used to backfill undercut areas, measure undercut and record in Pay Record Book as pipe foundation undercut.
11. If other than local material is used,, pay for the material but not the undercut excavation..
12. Temporary water diversion is the responsibility of the Contractor. See that this is adequate to prevent foundation damage and erosion problems.
13. See that shaped bedding is properly constructed.
14. Ensure that pipe is laid, joints properly connected, and protected in accordance with Specification requirements. Check line and grade before starting and periodically thereafter.
15. Plug lifting holes with either concrete or grout mixture or other approved method.
16. Ensure that backfill is placed in layers of 6 inches or less, unless otherwise authorized, with both sides brought up at the same time. See that heavy equipment is not operated over any pipe until it has been backfilled with a minimum of 3 feet of cover.
17. Run density tests to verify that the methods of compaction are satisfactory. If results are not satisfactory, require the Contractor to change methods and obtain required density. Record on the density form that it is in a pipe backfill.
18. Backfill to be shaped to drain when work is suspended or completed.
19. Test select backfill material to be sure it meets the appropriate requirements prior to use.
20. Perform periodic inspections of completed drainage facilities to assure they are maintained in accordance with Specifications. See that all damage is repaired prior to placement of base and pavement.
21. Ensure that all necessary erosion control devices have been properly installed. If silt basins are constructed at ends of pipe, see that these are cleaned out as needed. Monitor all devices to ensure they are functioning properly and that they are receiving proper maintenance.

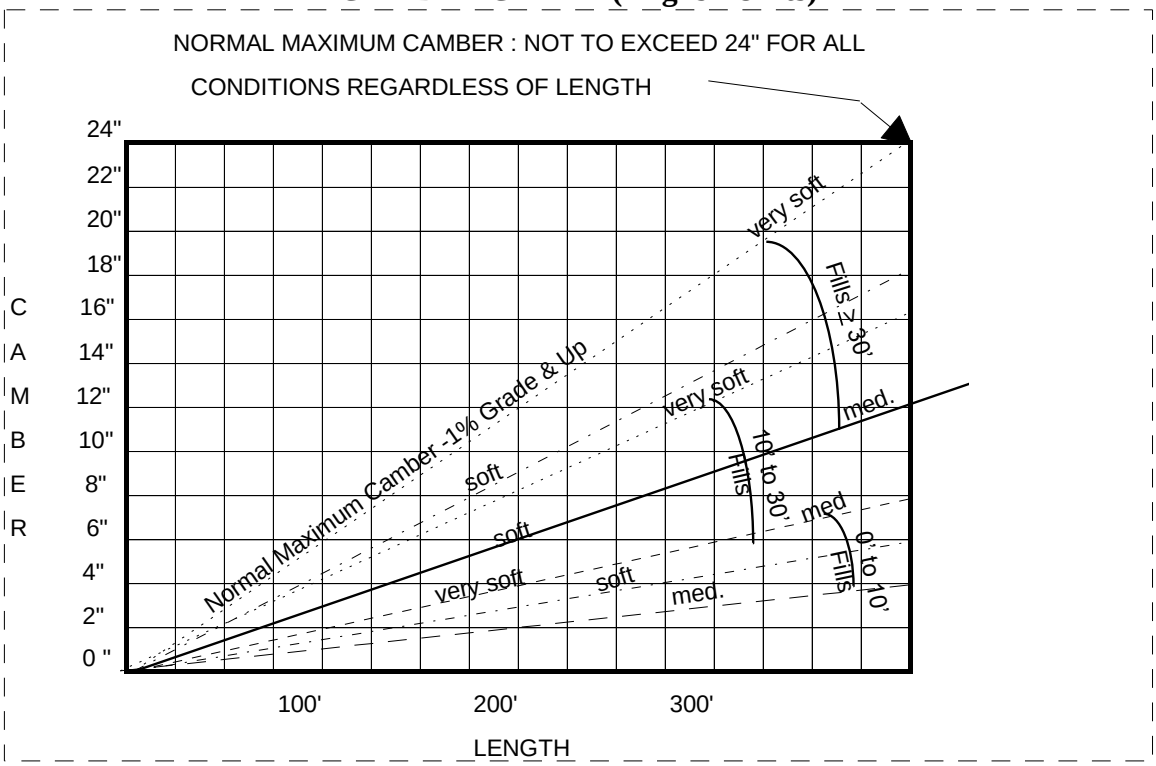
22. If pipe is structural plate, notify the Engineer before any phase of construction is begun.
23. Record conversations, observations, spot checks made, and work done, including material used, in the diary.
24. Keep pay records as required.

CAMBER FOR PIPE AND BOX CULVERTS

Where pipes or box culverts are founded on compressible material, camber should be placed in the grade to compensate for the settlement. The amount of camber to be used depends on the load imposed on the foundation material and the compressibility of the material. Since these factors vary, judgment is required in selecting the amount of camber to be used. In an effort to provide some guidance in the selection of values for camber, the chart below has been prepared. Unless more precise information is available, the values taken from the chart may be used.

Do not exceed maximum camber, 1/2 the available fall, or L/200 x % grade, for any box or pipe culvert.

CAMBER CHART (English Units)



Sample Use of Chart (English Units):

1. Example : Assume 250' culvert on 1.55 grade under 25' fill with soft material
   Max. Camber = 250/200 x 1.5 = 1.875' = 22 ½". By Chart Camber - 7 ½". Use 8".
2. Example: Assume 250’ culvert on 0.4% grade under 25’ fill with soft material
   Max. Camber = 250/200 x 0.4 = 0.500’ = 6”. By Chart Camber = 7 ½”. Use 6”.

- Note - Metal pipe culverts, fittings, and other accessories covered by this section shall be furnished by a supplier who has met the requirements of the Department’s Brand Certification Program for metal culvert pipes and is listed on the Department's preapproved list for suppliers of metal culvert pipe. The preapproved list can be found on HiCAMS Vendor. The pipe must be accompanied by the Manufacturer’s Bill of Lading. Quality Control Stickers should identify 25% of each shipment. Material meeting the above requirements may be used upon receipt. Testing will be performed by the Materials & Tests Unit.

SECTION 305
DRAINAGE PIPE

305-1 DESCRIPTION

Unless otherwise shown in the plans, flexible or rigid pipe may be used.

305-2 MATERIALS

The types of acceptable materials are listed here and referenced to Section 1032. Note that Corrugated Steel is not permitted in the listed counties. Only pipes with a smooth interior may be used in storm drain systems.

305-4 CONSTRUCTION METHODS

Only one type of pipe may be used between drainage structures.

305-5 MEASUREMENT AND PAYMENT

Measure pipe by counting the number of joints and multiplying by the length of the joint. Measure partial joints along the longest length to the nearest 0.1ft. Pay for pipe by the linear foot.

Measure and pay for pipe end sections, tees, elbows and eccentric reducers per each as the actual number that have been included in the work.

Select bedding and backfill is incidental to the installation.

TECHNICIAN'S CHECKLIST
SECTION 305
DRAINAGE PIPE

See section 300 for the Technician's Checklist.

SECTION 310
PIPE CULVERTS

310-1 DESCRIPTION

This section describes the method of measurement and payment for pipe and pipe products. Where the pay item is Pipe Culverts, the drainage summary will list the various types of pipe materials s that may be used.

310-2 MATERIALS

The types of acceptable materials are listed here and referenced to Section 1032. Note that Corrugated Steel is not permitted in the listed counties.

310-4 SIDE DRAIN PIPE

Side drain pipe is defined here. The minimum cover for side drain pipe is only one foot.

310-5 PIPE END SECTIONS

Both metal and concrete end sections will work with various pipe types. Ensure the proper width is utilized.

310-6 MEASUREMENT AND PAYMENT

Measure pipe by counting the number of joints and multiplying by the length of the joint. Measure partial joints along the longest length to the nearest 0.1ft. Pay for pipe by the linear foot.

Measure and pay for pipe end sections, tees, elbows and eccentric reducers per each as the actual number that have been included in the work.

Select bedding and backfill is incidental to the installation.

TECHNICIAN'S CHECKLIST
SECTION 310
PIPE CULVERTS

See section 300 for the Technician's Checklist.

SECTION 330
WELDED STEEL PIPE

330-2 MATERIALS

Only a supplier that has met the requirements of the Department's Brand Certification Program and listed on the Department's preapproved list shall supply pipe, fittings, and other accessories to the project.

330-3 PIPE INSTALLATION

Install the pipe by trenchless construction, true to line and grade and in a manner such that settlement does not occur. Fill all voids around the pipe. Installations that become damaged or have to be abandoned will be replaced by the Contractor at no cost to the Department as directed by the Engineer.

Conduct a pre-construction meeting in the presence of the Engineer at least 48 hours prior to the beginning of the pipe installation. The meeting shall consist of but not limited to:

A. Reviewing all installation methods to install the pipe true to the line and grade given,
B. Methods to insure there is no settlement of the pipe or of the completed roadway section,
C. Methods for filling any potential voids around the pipe.

330-4 MEASUREMENT AND PAYMENT

Welded Steel Pipe in Soil will be measured and paid for in the actual number of linear feet of pipe measured along the flow line to the nearest foot, which has been installed in soil.

Welded Steel Pipe Not in Soil must be confirmed as "not in soil" prior to work proceeding. If the Engineer is not notified prior to work proceeding, payment will be made at the "in soil" contract unit price.

TECHNICIAN'S CHECKLIST
SECTION 330
WELDED STEEL PIPE

1. Have the subsurface conditions been investigated?
2. Is the proposed equipment adequate for the work?
3. Has the pre-installation meeting been held?
4. Is the welder certified with NCDOT?
5. Is the boring pit shored or sloped in accordance with OSHA requirements?
6. Is the Contractor aware of the need to request DOT approval prior to boring "not in soil"?

SECTION 340
PIPE REMOVAL

340-1 DESCRIPTION

Remove and dispose of pipe, end sections and elbows as indicated in the plans or as directed by the Engineer.

Where the existing pipe is not in conflict with planned work, the Contractor may leave the pipe in place and fill with flowable fill.

340-3 CONSTRUCTION METHODS

When an existing pipe is encountered that is not shown in the plans, do not remove the pipe without prior approval of the Engineer.

340-4 MEASUREMENT AND PAYMENT

If a planned pipe falls in an existing pipe trench then there is no additional compensation for pipe removal. Pipe trench is defined in the Standard Drawings.

SECTION 350
PIPE CLEANOUT

350-1 DESCRIPTION

Removing silt and cleaning existing pipelines may become necessary to establish proper drainage.

350-3 MEASUREMENT AND PAYMENT

Measure and pay for each existing pipe cleaned except where the existing pipe required cleaning due to Contractor's negligence.

REINFORCED CONCRETE PIPE DESIGN

DESCRIPTION

When pipe is installed where the required fill height is greater 40 feet and less than or equal to 80 feet, the Contractor will provide the design for a reinforced concrete pipe system. The designer must be a NC Professional Engineer. The Engineer should consider which pipe on the project plans are near 40 feet of fill so that when reviewing the drainage design provided **by the** Contract surveyor, the RE will be able to ensure the 40 feet threshold is not crossed without using this provision.

MEASUREMENT AND PAYMENT

The design, manufacture and installation will be paid for at the linear foot price for R.C. Pipe Culvert (Contractor Design).

TECHNICIAN'S CHECKLIST
REINFORCED CONCRETE PIPE DESIGN

1. Check fill heights to determine if they meet the >40' and < 80' fill height that invokes this provision.
2. Ensure you have a copy of the PE stamped design in hand prior to beginning work.
3. See Section 300 checklist above.

CORRUGATED STEEL AND ALUMINUM ALLOY STRUCTURAL PLATE PIPE AND PIPE ARCH

DESCRIPTION

The project special provisions and any information shown on the project plans cover the requirements for the installation of structural plate pipe and pipe arch.

MATERIALS

This pipe, fittings, and all other accessories covered by this section shall be furnished by a supplier who has met the requirements of the Department's Brand Certification program for metal culvert pipes and is listed on the Department's preapproved list for suppliers of metal culvert pipe.

Ensure design drawings have been submitted and approved for all structural plate elbows, wyes and tees.

CONSTRUCTION METHODS

(A) EXCAVATION, FOUNDATION PREPARATION, AND BACKFILLING

The special provisions, plans and/or Contractor design will contain the construction details. Particular care should be given in the inspection of the foundation to make certain that all seepage into the foundation conditioning will properly drain. If seepage is a problem, subsurface drainage is recommended.

Camber may be placed in the pipe foundation as outlined previously in this section. Care must be exercised, however, to make certain that the amount of camber is not set so high as to cause the bolt holes to improperly align.

The Engineer is required to inspect the various stages of construction of this type of pipe regardless of fill height over pipe. The Engineer should inspect the following stages of construction:

1. When the excavation has been made or the embankment prepared to the approximate flow line of the pipe.
2. When the pipe has been assembled and plates, bolts, and spelter coating have been inspected and approved by the Engineer.
3. When the project has been completed and is ready for final inspection.

(B) ERECTION

The Materials and Tests Unit must check the pipe coating to verify conformance with the Standard Specifications.

Structural plate pipe is always erected and installed in accordance with the fabricator's instructions. These instructions and shop drawings should be maintained on the project at all times when work is being performed.

Generally, the following erection procedures represent good practice, but these are not intended to supersede any specific erection instructions given by the fabricator.

The entire structure is normally shipped complete, including plates, bolts, nuts, and erection instructions. Bolt heads are color coded to indicate various lengths. The plates are stamped to indicate their relative position in the structure.

The structure shall be assembled in the order prescribed in the instructions. It is good practice to initially assemble the structure with a few untightened bolts near the center of circumferential and longitudinal seams of each plate. Inserting the remaining bolts and tightening by hand follows. It is also good practice to work from the center of the seam to the corners. Corner bolts should not be inserted until others have been tightened.

It is easier to align the bolt holes when the bolts are loose. When utilizing a drift pin, care must be exercised to see that over drifting causing an enlargement of the holes does not occur. This has been determined to contribute to pipe failures in the past. Enlargement of holes may be grounds for rejection of plates.

The torque wrench used to check nut tightness must be properly calibrated and approved by the Engineer. It is extremely important to check bolt torque both before and after completion of the embankment. It should be remembered that a good fit of the plates is better than high torque.

(C) WORKMANSHIP

There are event which can result in rejection of the work. Prior to the Engineer rejecting any work under these causes, consultation should be made.

MEASUREMENT AND PAYMENT

Measurement and payment will be as detailed in the special provision.

TECHNICIAN'S CHECKLIST
CORRUGATED STEEL AND ALUMINUM ALLOY
STRUCTURAL PLATE PIPE AND PIPE ARCH

In addition to the items listed under the Technician's Checklist in Section 300, the Technician shall also:

1. Become familiar with the erection plans and make certain that the Contractor follows that plan.
2. See that the supplier that has met the requirements of the Department’s Brand Certification Program and is listed on the Department’s preapproved list is providing the pipe, fittings, and other accessories.
3. See that the torque wrench utilized has been properly calibrated and approved by the Engineer.
4. During and after erection, check the spelter coating, nut tightness, horizontal and vertical alignment, and fit of plates. Damaged areas should be coated with brushed- type zinc-rich paint.
5. Should spiraling occur, this condition should be corrected during installation.