Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

DENVER J. STUTLER, JR.
SECRETARY

May 25, 2006

Mr. Greg Williams
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 430
Proposed Specification: 4300000 – Pipe Culverts and Storm Sewers

Dear Mr. Williams:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Pipe Culverts and Storm Sewers.

This change was proposed by Linda Seigle of the State Drainage Office to resolve conflicts between Department documents and to provide clarification.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Signature on File

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/ft
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

PIPE CULVERTS
(REV ~~1-26-06~~5-12-06)

SECTION 430 (Pages 390 – 401) is deleted and the following substituted:

SECTION 430
PIPE CULVERTS ~~AND STORM SEWERS~~

430-1 Description.

Furnish and install drainage pipe and ~~mitered~~ end sections at the locations called for in the plans. Furnish and construct joints and connections to existing pipes, catch basins, inlets, manholes, walls, etc., as may be required to complete the work.

Construct structural plate pipe culverts or underdrains in accordance with Sections 435 and 440.

430-2 Materials.

430-2.1 Pipe: Meet the following requirements:

Concrete Pipe.....Section 449
Round Rubber Gaskets .....Section 942
Corrugated Steel Pipe and Pipe Arch.....Section 943
Corrugated Aluminum Pipe and Pipe Arch .....Section 945
~~Cast Iron Pipe.....Section 946~~
Corrugated Polyethylene Pipe.....Section 948
Polyvinyl Chloride (PVC) Pipe .....Section 948
~~Do not use bituminized fiber pipe.~~

430-2.2 Joint Materials: Use joint materials specified in 430-7 through 430-10 according to type of pipe and conditions of usage.

430-2.3 Mortar: Use mortar composed of one part portland cement and two parts of clean, sharp sand, to which mixture the Contractor may add hydrated lime in an amount not to exceed 15% of the cement content. Use mortar within 30 minutes after its preparation.

430-3 Type of Pipe to Be Used.

430-3.1 General: When the plans designate a type (or types) of pipe, use only the type (or choose from the types) designated. As an exception, when the plans designate reinforced concrete pipe as Class S, Class I, Class II, Class III and Class IV, the Contractor may use non-reinforced concrete pipe up to and including 36 inch ~~[900 mm]~~ in diameter or fiber reinforced concrete pipe up to and including 48 inch ~~[1,200 mm]~~ in diameter. Do not use fiber reinforced concrete pipe beneath the main travel lanes of interstate highways.

430-3.2 Side Drain: If the plans do not designate a type (or types) of pipe, the Contractor may use either a minimum Class I concrete pipe, corrugated steel pipe, corrugated aluminum pipe, corrugated polyethylene pipe or PVC pipe. If one of the metal types is chosen, use the minimum gage specified in Section 943 for steel pipe or Section 945 for aluminum pipe.

Non-reinforced concrete pipe or fiber-reinforced concrete pipe may also be substituted for concrete pipe in side drains, subject to the provisions of 430-3.1.

430-4 Laying Pipe.

430-4.1 General: Lay all pipe, true to the lines and grades given, with hubs upgrade and tongue end fully entered into the hub. When pipe with quadrant reinforcement or circular pipe with elliptical reinforcement is used, install the pipe in a position such that the manufacturer's marks designating "top" and "bottom" of the pipe are not more than five degrees from the vertical plane through the longitudinal axis of the pipe. Do not allow departure from and return to plan alignment and grade to exceed 1/16 inch per foot ~~[5 mm per meter]~~ of nominal pipe length, with a total of not more than 1 inch ~~[25 mm]~~ departure from theoretical line and grade. Take up and relay any pipe that is not in true alignment or which shows any settlement after laying at no additional expense to the Department.

Do not use concrete pipe with lift holes except round pipe which has a inside diameter in excess of 54 inches ~~[1,350 mm]~~ or any elliptical pipe.

Repair lift holes, if present, by use of a hand-placed, stiff, non-shrink, 1-to-1 mortar of cement and fine sand, after first washing out the hole with water. Completely fill the void created by the lift hole with mortar. Cover the repaired area with a 24 by 24 inches ~~[600 by 600 mm]~~ piece of filter fabric secured to the pipe. Use a ~~Class D~~ *Type D-3* filter fabric meeting the requirements shown on Design Standards, Index 199.

Secure the filter fabric to the pipe using a method that holds the fabric in place until the backfill is placed and compacted. Use a grout mixtures, mastics, or strapping devices to secure the fabric to the pipe.

When installing pipes in structures, construct inlet and outlet pipes of the same size and kind as the connecting pipe shown in the plans. Extend the pipes through the walls for a distance beyond the outside surface sufficient for the intended connections, and construct the concrete around them neatly to prevent leakage along their outer surface as shown on the Design Standards, Index 201. Keep the inlet and outlet pipes flush with the inside of the wall. Resilient connectors as specified in 942-3 may be used in lieu of a masonry seal.

Furnish and install a filter fabric jacket around all pipe joints and the joint between the pipe and the structure in accordance with Design Standards, Index Nos. 201 and 280. Use fabric meeting the physical requirements of Type *D*-3 specified on the Design Standards, Index 199. The fabric shall extend a minimum of 12 inches ~~[300 mm]~~ beyond each side of the joint or both edges of the coupling band, if a coupling band is used. The fabric shall have a minimum width of 24 inches ~~[600 mm]~~, and a length sufficient to provide a minimum overlap of 24 inches ~~[600 mm]~~. Secure the filter fabric jacket against the outside of the pipe by metal or plastic strapping or by other methods approved by the Engineer.

Meet the following minimum joint standards:

Pipe Application	Minimum Standard
Cross Drains	~~Soil~~*Water*-tight
Storm Drains	~~Soil~~*Water*-tight
Gutter Drain	Water-tight
Side Drains	Soil-tight

When rubber gaskets are to be installed in the pipe joint, the gasket shall be the sole element relied on to maintain a tight joint. Soil tight joints must be watertight to 2 psi ~~[13.8 kPa]~~. Water-tight joints must be water-tight to 5 psi ~~[34.5 kPa]~~ unless a higher pressure rating is required in the plans.

430-4.2 Trench Excavation: Excavate the trench for pipe culverts and storm sewers as specified in Section 125.

430-4.3 Foundation: Provide a suitable foundation, where the foundation material is of inadequate supporting value, as determined by the Engineer. Remove the unsuitable material and replace it with suitable material, as specified in 125-8. Where in the Engineer's opinion, the removal and replacement of unsuitable material is not practicable, he may direct alternates in the design of the pipe line, as required to provide adequate support. Minor changes in the grade or alignment will not be considered as an adequate basis for extra compensation.

Do not lay pipe on blocks or timbers, or on other unyielding material, except where the use of such devices is called for in the plans.

430-4.4 Backfilling: Backfill around the pipe as specified in 125-8 unless specific backfilling procedures are described in the Contract Documents.

430-4.5 Plugging Pipe: When existing pipe culverts are to be permanently placed out of service, fill them with flowable fill that is non-excavatable, contains a minimum 350 lbs/cy ~~[208 kg/cm]~~ of cementious material and meets the requirements of Section 121 and/or plug them with masonry plugs as shown in the plans. *Install masonry plugs~~,~~ that are a minimum of 8 inches ~~[200 mm]~~ in thickness, in accordance with Design Standards Index 280.*

When proposed or existing pipe culverts are to be temporarily placed out of service, plug them with prefabricated plugs as shown in the plans. *Install prefabricated plugs in accordance with the manufacturer's recommendations.* Do not fill, or construct masonry plugs in, any pipe culverts intended for current or future service.

~~**430-4.5.1 Plugging:** When the plans show that a pipe culvert is to be plugged, plug the pipe culvert with either a masonry plug or a prefabricated plug as shown in the plans.~~

~~Install masonry plugs, that are a minimum of 8 inches [200 mm] in thickness, in accordance with Design Standards Index 280. Install prefabricated plugs in accordance with the manufacturer's recommendations.~~

430-4.6 End Treatment: Place an end treatment at each cross drain, side drain, or storm sewer pipe end as shown in the plans. Refer to the Design Standards for types of end treatment details.

As an exception to the above, when concrete mitered end sections are permitted, the Contractor may use reinforced concrete U-endwalls, if shop drawings are submitted to the Engineer for approval prior to use.

Provide end treatments for corrugated polyethylene pipe and PVC pipe as specified in Section 948, or as detailed in the plans.

430-4.7 Metal Pipe Protection: Apply a bituminous coating to the surface area of the pipe within and 12 inches ~~[300 mm]~~ beyond the concrete or mortar seal prior to sealing, to protect corrugated steel or aluminum pipe embedded in a concrete structure, such as an inlet, manhole, junction box, endwall, or concrete jacket.

Ensure that the surface preparation, application methods (dry film thickness and conditions during application), and equipment used are in accordance with the coating manufacturers' published specifications.

Obtain the Engineer's approval of the coating products used.

430-4.8 Final Pipe Inspection: Based on contract pavement type, upon completion of placement of concrete pavement or the placement of structural asphalt, but prior to placement of asphalt friction course, dewater installed pipe and provide the Engineer with a video recording schedule allowing for pipe videoing and reports to be completed and submitted to the Department and reviewed prior to continuation of pavement.

For pipe 48 inches ~~[1,200 mm]~~ or less in diameter, provide the Engineer a video DVD and report using low barrel distortion video equipment with laser profile technology, non-contact video micrometer and associated software that provides:

1. Actual recorded length and width measurements of all cracks within the pipe.
2. Actual recorded separation measurement of all pipe joints.
3. Pipe ovality report.
4. Deflection measurements and graphical diameter analysis report in terms of x and y axis.
5. Flat analysis report.
6. Representative diameter of pipe.
7. Pipe deformation measurements, leaks, debris, or other damage or defects.
8. Deviation in pipe line and grade, joint gaps, and joint misalignment.

Laser profiling and measurement technology must be certified by the company performing the work to be in compliance with the calibration criteria posted at: http://www.dot.state.fl.us/construction/ContractorIssues/Laser.htm .
Reports may be submitted in electronic media if approved by the Engineer.

For video recorded, laser profiled pipe that indicates deflection that appears to be in excess of that allowed by Specification, the Engineer may require further testing of the pipe. If directed by the Engineer, test pipe using a mandrel. The mandrel shall be pulled by hand and be approved by the Engineer prior to use. If use of a mandrel is selected as the means of further testing, the mandrel's diameter, length, and other requirements shall conform to 430-4.8.2. Remove, replace, and retest pipe failing to meet the specific deflection requirements for the type of pipe installed, at no cost to the Department. Should the deflection test prove that the pipe met specifications, the Department will bear the cost of the deflection testing.

The Engineer may waive this requirement for side drains and cross drains which are short enough to inspect from each end of the pipe.

430-4.8.1 Video Report: Provide a high quality DVD in a MPEG2 format video with a standard resolution of 720 x 480. Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe and rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition.

The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe. The video will include identification before each section of pipe filmed. The identification will include the project number, the structure number corresponding to the structure number on the set of plans for the project, size of pipe, the date and time, and indicate which pipe is being filmed if multiple pipes are connected to the structure. Notes should be taken during the video recording process. Provide the Engineer with copies of these notes along with the video.

Move the camera through the pipe at a speed not greater than 30 feet per minute ~~[10 meters per minute]~~. Mark the video with the distance down the pipe. The distance shall have an accuracy of one foot per 100 feet ~~[300 mm in 328 meters]~~. *Film the entire circumference at each joint.* Stop the camera and pan when necessary to document defects. ~~Film the entire circumference at each joint.~~

430-4.8.2 Mandrels: Use mandrels which are rigid, nonadjustable, odd-numbered legged (minimum 9 legs) having a length not less than its nominal diameter. The diameter at any point shall not be less than the allowed percent deflection of the certified actual mean diameter of the pipe being tested. The mandrel shall be fabricated of metal, fitted with pulling rings at each end, stamped or engraved on some segment other than a runner with the nominal pipe size and mandrel outside diameter.

430-5 Removing ~~and Relaying~~ Existing Pipe.

~~430-5.1 Removal:~~ If the plans indicate that existing pipe is to remain the property of the Department, collect and stack along the right-of-way all existing pipe or pipe arch so indicated in the plans to be removed, or that does not conform to the lines and grades of the proposed work and that is not to be re-laid, as directed by the Engineer. Take care to prevent damage to salvageable pipe during removal and stacking operations.

~~**430-5.2 Relaying:** Where so shown in the plans, collect and clean existing culvert pipe, then relay it in the same manner as specified for new culvert pipe. Where necessary, straighten existing metal pipe or pipe arch before it is relaid.~~

430-6 Placing Pipe Under Railroad.

430-6.1 General: Construct pipe culverts under railroad tracks in accordance with the requirements of the railroad company.

Perform all the shoring under the tracks, and sheeting and bracing of the trench, required by the railroad company or deemed necessary by the Engineer in order to ensure safe and uninterrupted movement of the railroad equipment, at no expense to the Department.

430-6.2 Requirements of the Railroad Company: Install pipe using methods required by the railroad company and shown in the Contract Documents.

When the general method of installation required by the railroad company is indicated in the plans, do not alter such method, or any other specific details of the installation which might be indicated in the plans, without receiving approval or direction from the railroad, followed by written approval from the Engineer.

430-6.3 Notification to Railroad Company: Notify the railroad company and the Engineer at least ten days prior to the date on which pipe is to be placed under the railroad tracks.

430-6.4 Placing Pipe by Jacking: Obtain the Engineer's and the railroad company's approval of the details of the jacking method to be used, when placing pipe through the railroad embankment, before the work is started.

430-6.5 Use of Tunnel Liner: When the railroad company requires that a tunnel liner be used for placing the pipe in lieu of the jacking method, the Department will pay for the tunnel liner material separately in cases where the Contract Documents do not require the use of a tunnel liner. For these cases the Department will reimburse the Contractor for the actual cost of the liner, delivered at the site. The Department will base such cost on a liner having the minimum gage acceptable to the railroad.

430-7 Specific Requirements for Concrete Pipe.

430-7.1 Sealing Joints: Seal the pipe joints with round rubber or profile gaskets meeting the requirements of Section 449. Ensure that the gasket and the surface of the pipe joint, including the gasket recess, are clean and free from grit, dirt and other foreign matter, at the time the joints are made. In order to facilitate closure of the joint, application of a vegetable soap lubricant immediately before closing of the joint will be permitted. Prelubricated gaskets may be used in lieu of a vegetable soap lubricant when the lubricating material is certified to be inert with respect to the rubber material.

430-7.2 Laying Requirements for Concrete Pipe with Rubber Gasket Joints: Do not allow the gap between sections of pipe to exceed 5/8 inch for pipe diameters of 12 inches through 18 inches ~~[16 mm for pipe diameters of 300 through 450 mm]~~, 7/8 inch for pipe diameters of 24 through 66 inches ~~[25 mm for pipe diameters of 600 mm through 1.7 m]~~, and 1 inch for pipe diameters 72 inches and larger ~~[25 mm for pipe diameters 1.8 m and larger]~~. Where minor imperfections in the manufacture of the pipe create an apparent gap in excess of the tabulated gap, the Engineer will accept the joint provided that the imperfection does not exceed 1/3 the circumference of the pipe, and the rubber gasket is 1/4 inch ~~[6 mm]~~ or more past the pipe joint entrance taper. Where concrete pipes are outside of these tolerances, replace them at no expense to the Department. Do not apply mortar, joint compound, or other filler to the gap which would restrict the flexibility of the joint.

430-7.3 Field Joints for Elliptical Concrete Pipe: Use either a preformed plastic gasket material or an approved rubber gasket to make a field joint.

430-7.3.1 Plastic Gasket: Meet the following requirements when field joints are made from preformed plastic gasket material:

430-7.3.1.1 General: Install field joints in accordance with the manufacturer's instructions and the following:

430-7.3.1.2 Material: Meet the requirements of 942-2.

430-7.3.1.3 Joint Design: Ensure that the pipe manufacturer furnishes the Engineer with details regarding configuration of the joint and the amount of gasket material required to ~~effect~~*affect* a satisfactory seal. Do not brush or wipe joint

surfaces which are to be in contact with the gasket material with a cement slurry. Fill minor voids with cement slurry.

430-7.3.1.4 Primer: Apply a primer of the type recommended by the manufacturer of the gasket material to all joint surfaces which are to be in contact with the gasket material, prior to application of the gasket material. Thoroughly clean and dry the surface to be primed.

430-7.3.1.5 Application of Gasket: Apply gasket material to form a continuous gasket around the entire circumference of the leading edge of the tongue and the groove joint, in accordance with the detail shown on the Design Standards, Index No. 280. Do not remove the paper wrapper on the exterior surface of the gasket material until immediately prior to joining of sections. Apply plastic gasket material only to surfaces which are dry. When the atmospheric temperature is below 60ºF ~~[15ºC]~~, either store plastic joint seal gaskets in an area above 70ºF ~~[20ºC]~~, or artificially warm the gaskets to 70ºF ~~[20ºC]~~ in a manner satisfactory to the Engineer.

430-7.3.1.6 Installation of Pipe: Remove and reposition or replace any displaced or contaminated gasket as directed by the Engineer. Install the pipe in a dry trench. Carefully shape the bottom of the trench to minimize the need for realignment of sections of pipe after they are placed in the trench. Hold to a minimum any realignment of a joint after the gaskets come into contact. Prior to joining the pipes, fill the entire joint with gasket material and ensure that when the pipes are joined there is evidence of squeeze-out of gasket material for the entire internal and external circumference of the joint. Trim excess material on the interior of the pipe to provide a smooth interior surface. If a joint is defective, remove the leading section of pipe and reseal the joint.

430-7.3.2 Rubber Gasket: Meet the following requirements when field joints are made with profile rubber gaskets:

430-7.3.2.1 General: Install field joints in accordance with the manufacturer's instructions and the following:

430-7.3.2.2 Material: Meet the requirements of 942-4.

430-7.3.2.3 Joint Design: Ensure that the pipe manufacturer furnishes the Engineer with details regarding configuration of the joint and gasket required to effect a satisfactory seal. Do not apply mortar, joint compound, or other filler which would restrict the flexibility of the gasket joint.

430-7.4 Requirements for Concrete Radius Pipe:

430-7.4.1 Design: Construct concrete radius pipe in segments not longer than 4 feet ~~[1.2 m]~~ (along the pipe centerline), except where another length is called for in the Contract Documents. Join each segment using round rubber gaskets. Ensure that the pipe manufacturer submits details of the proposed joint, segment length and shape for approval by the Engineer, prior to manufacture.

430-7.4.2 Pre-Assembly: Ensure that the manufacturer pre-assembles the entire radius section in his yard, in the presence of the Engineer, to ensure a proper fit for all parts. At the option of the manufacturer, the Contractor may assemble the pipe without gaskets. Consecutively number the joints on both the interior and exterior surfaces of each joint, and make match marks showing proper position of joints. Install the pipe at the project site in the same order as pre-assembly.

430-8 Specific Requirements for Corrugated Metal Pipe.

430-8.1 Field Joints:

430-8.1.1 General: Make a field joint with locking bands, as specified in Article 9 of AASHTO M 36 and AASHTO M 196M for aluminum pipe. For aluminum pipe, fabricate bands from the same alloy as the culvert sheeting.

When existing pipe to be extended is helically fabricated, make a field joint between the existing pipe and the new pipe using one of the following methods:

(1) Cut the new pipe to remove one of the re-rolled annular end sections required in Sections 943 or 945, or fabricate the pipe so that the re-rolled annular section is fabricated only on one end. Use either a spiral (helical) band with a gasket or a flat band with gaskets as required by 430-8.1.2 (2) to join the pipe sections.

(2) The Contractor may construct a concrete jacket as shown on the Design Standards, Index No. 280, provided that the minimum cover required by the Design Standards, Index No. 205 can be obtained.

430-8.1.2 Side Drain, Cross Drain, Storm Sewer, and Gutter Drains: Where corrugated metal pipe is used as side drain, cross drain, storm sewer, or gutter drain, use a rubber or neoprene gasket of a design shown to provide a joint as specified in 430-4.

Use a gasket of one of the following dimensions:

(1) For annular joints with 1/2 inch ~~[13 mm]~~ depth corrugation: either a single gasket a minimum of 7 inches by 3/8 inch ~~[175 by 9.5 mm]~~ or two gaskets a minimum of 3 1/2 inches by 3/8 inch ~~[90 by 9.5 mm]~~; and for annular joints with 1 inch ~~[25 mm]~~ depth corrugations: either a single gasket a minimum of 7 inches by 7/8 inch ~~[175 by 25 mm]~~ or two gaskets a minimum of 3 1/2 inches by 7/8 inch ~~[90 by 25 mm]~~.

(2) For helical joints with 1/2 inch ~~[13 mm]~~ depth corrugation: either a single gasket a minimum of 5 inches by 1 inch ~~[125 by 25 mm]~~ or two gaskets a minimum of 3 1/2 inches by 1 inch ~~[90 by 25 mm]~~; and for helical joints with 1 inch ~~[25 mm]~~ depth corrugations: either a single gasket a minimum of 5 inches by 1 1/2 inches ~~[125 by 40 mm]~~ or two gaskets a minimum of 3 1/2 inches by 1 1/2 inches ~~[90 by 40 mm]~~.

(3) Such other gasket designs as may be approved by the Engineer.

If, in lieu of a single gasket spanning the joint, two gaskets are used, place these individual gaskets approximately 2 inches ~~[50 mm]~~ from each pipe end at the joint. When two gaskets are used, seal the overlapping area on the coupling band between the gaskets consistent with the joint performance specified. The Contractor may tuck a strip of preformed gasket material over the bottom lip of the band for this purpose. Use coupling bands that provide a minimum circumferential overlap of 3 inches ~~[75 mm]~~. As the end connections on the coupling band are tightened, ensure that there is no local bending of the band or the connection. Use precurved coupling bands on pipe diameters of 24 inches ~~[600 mm]~~ or less.

Use flat gaskets meeting the requirements of ASTM D 1056, designation 2C2 or 2B3. In placing flat gaskets on pipe prior to placing the coupling band, do not stretch the gasket more than 15% of its original circumference. Use circular

gaskets meeting the requirements of ASTM C 361~~ [ASTM C 361M]~~. Do not stretch the circular gasket more than 20% of its original circumference in placing the gasket on pipe. Use preformed plastic gasket material meeting the composition requirements of 942-2.2.

Apply an approved vegetable soap lubricant, as specified for concrete pipe in 430-7.1.1.

430-8.1.3 Alternate Joint: In lieu of the above-specified combination of locking bands and flat gaskets, the Contractor may make field joints for these pipe installations by the following combinations:

(a) Use the metal bands as specified in Article 9 of AASHTO M 36M that are at least 10 1/2 inches ~~[265 mm]~~ wide and consist of a flat central section with a corrugated section near each end, designed to match the annular corrugation in the pipe with which they are to be used. Connect the bands in a manner approved by the Engineer, with a suitable fastening device such as the use of two galvanized 1/2 inch ~~[M12]~~ diameter bolts through a galvanized bar and galvanized strap, suitably welded to the band. Use a strap that is the same gage as the band.

Where helically corrugated pipe is to be jointed by this alternate combination, ensure that at least the last two corrugations of each pipe section are annular, and designed such that the band will engage each pipe end with the next-to-outside annular corrugation.

(b) For these bands, use a rubber gasket with a circular cross-section of the "O-ring" type conforming to ASTM C 361~~ [ASTM C 361M]~~. Use gaskets having the following cross-sectional diameter for the given size of pipe:

Non-SI Units	
Pipe Size	Gasket Diameter
12 inches through 36 inches (with 1/2 inch depth corrugations)	13/16 inch
42 inches through 96 inches (with 1/2 inch depth corrugations)	7/8 inch
36 inches through 120 inches (with 1 inch depth corrugations)	1 3/8 inches

~~SI Units~~	
~~Pipe Size~~	~~Gasket Diameter~~
~~300 through 900 mm (with 13 mm depth corrugations)~~	~~20 mm~~
~~1,000 through 2,400 mm (with 13 mm depth corrugations)~~	~~22 mm~~
~~900 through 3,000 mm (with 25 mm depth corrugations)~~	~~35 mm~~

Use preformed gasket material to seal the overlapping area on the coupling band between gaskets.

(c) Use channel band couplers in helical pipe with ends which have been reformed and flanged specifically to receive these bands. Use channel band couplers that are of a two piece design, are fabricated from galvanized steel stock conforming to AASHTO M 36, have 2 by 2 by 3/16 inch ~~[51 by 51 by 4.8 mm]~~ angles fastened to the band ends to allow for proper tightening, and meet the following:

Non SI Units	
Band Thickness	Pipe Wall Thickness
0.079 inch	0.109 inch or lighter
0.109 inch	0.138 inch or heavier
3/4 inch wide	0.109 inch or lighter
1 inch wide	0.138 inch or heavier

~~SI Units~~	
~~Band Thickness~~	~~Pipe Wall Thickness~~
~~2.01 mm~~	~~2.77 mm or lighter~~
~~2.77 mm~~	~~3.51 mm or heavier~~
~~19 mm~~	~~2.77 mm or lighter~~
~~25 mm~~	~~3.51 mm or heavier~~

Furnish two 1/2 inch ~~[M12]~~ diameter connection bolts with each band, that conform to ASTM A 307, Grade A and are electroplated in accordance with ASTM B 633.

Use a gasket with the joint that is a hydrocarbon blend of butyl rubber meeting the chemical composition and physical properties of 942-2.2. Use a 3/8 by 3/4 inch ~~[9.5 by 19 mm]~~ gasket for pipe fabricated from 0.109 inch ~~[2.77 mm]~~ or lighter material and a 3/8 by 1 inch ~~[9.5 by 25 mm]~~ gasket for pipe fabricated from 0.138 inch ~~[3.51 mm]~~ and heavier material.

The Contractor may use a flange band coupler without the gasket for all applications other than side drain, cross drain, storm sewer and gutter drain.

Do not use the flange band coupler to join dissimilar types of pipe.

The Contractor may join reformed flanged helical pipe to existing annular or reformed pipe having annular ends. On non-gasketed installations, use either an annular band or an alternate joint described in 430-8.1.3. On gasketed installations, use an annular band, minimum of five corrugations in width, in conjunction with two O-ring gaskets as specified in 430-8.1.3. Use mastic material to seal the area of band overlap.

The minimum joint performance standards specified in 430-4.1 apply.

430-8.2 Laying and Shape Requirements for Corrugated Metal Pipe: Install pipe using either a trench or open ditch procedure.

Check pipe shape regularly during backfilling to verify acceptability of the construction method used. Pipe deflected 5% or more of the certified actual mean diameter of the pipe at final inspection shall be replaced at no cost to the Department. Deflection measurements are taken at the point of smallest diameter on the corrugations.

~~Upon completion of the project, and just prior to acceptance by the Department, clean the inside of all corrugated metal pipe and inspect it for breaks, corrosion or other damage to the coating or to the pipe itself, and make necessary repairs.~~

~~**430-9 Joints for Cast Iron Pipe.**~~

~~Meet the requirements of 430-7.1.2 for mortaring and wetting inside the joints, as specified for concrete side drain pipe without rubber gaskets.~~

430-*9*~~10~~ Specific Requirements for Corrugated Polyethylene Pipe and Polyvinyl Chloride (PVC) Pipe.

430-*9*~~10~~.1 Field Joints: Use gasketed joints to seal side drain, cross drain and storm drain. Use gaskets meeting the requirements of Section 449. Ensure that the pipe manufacturer provides a joint design approved by the Engineer before use.

430-*9*~~10~~.2 Installation Requirements Including Trenching, Foundation and Backfilling Operations: Check structure shape regularly during backfilling to verify acceptability of the construction method used.

Pipe deflected 5% or more of the certified actual mean diameter of the pipe at final inspection shall be replaced at no cost to the Department.

***430-10 Desilting Pipe or Concrete Box Culvert*.**

Desilt pipe culvert and concrete box culvert as designated in the plans.

430-11 Method of Measurement.

430-11.1 New Pipe: The quantities of storm drain pipe, storm drain trench, cross drain pipe, side drain pipe and gutter drain pipe to be paid for will be plan quantity, in place and accepted. The plan quantity will be determined from the inside wall of the structure as shown on the plans, along the centerline of the pipe.

~~**430-11.2 Relaid Pipe:** The quantity to be paid for (including relaid pipe arch) will be the length of pipe, measured in place after relaying, completed and accepted.~~

430-11.*2*~~3~~ Mitered End Section: The quantity to be paid for will be the number completed and accepted.

430-12 Basis of Payment.

430-12.1 General: Prices and payments will be full compensation for all work specified in this Section, including all excavation except the volume included in the items for the grading work on the project, and except for other items specified for separate payment in Section 125; all backfilling material and compaction; disposal of surplus material; and all clearing and grubbing outside of the required limits of clearing and grubbing as shown in the plans.

~~**430-12.2 Relaid Pipe:** Price and payment will be full compensation for all work, including hauling the pipe to the new location as necessary, any cleaning necessary and, for metal pipe, any straightening, etc., which might be required.~~

430-12.*2*~~3~~ Removing Existing Pipe: When existing pipe is removed and replaced with new pipe approximately at the same location~~, and clearing and grubbing is not designated to be paid for in the particular area~~, the cost of excavating and removing the old pipe and of its disposal will be included in the Contract unit price for ~~the new pipe in place~~*clearing and grubbing*.

430-12.*3*~~4~~ Site Restoration: The cost of restoring the site, as specified in 125-11, that is disturbed, solely for the purpose of constructing pipe culvert, will be included in the Contract unit price for the pipe culvert, unless designated specifically to be paid for under other items.

430-12.*4*~~5~~ Plugging Pipes: ~~The cost of plugging pipes, where so shown in the plans, will be included in the Contract unit price for the pipe culvert.~~ *The cost of temporarily plugging a pipe culvert, either proposed or existing, will be incidental to the contract unit price for new pipe culvert.*

The cost of filling and/or plugging an existing pipe culvert that is to be permanently placed out of service will be paid for at the contract unit price for filling and plugging pipe, per cubic yard ~~(cubic meter)~~. Price and payment will be full compensation for flowable fill, masonry, concrete, mortar, and all labor and materials necessary to complete the work.

When the project includes no quantities for new pipe culverts, and temporary plugs are required for existing pipe culverts, the cost will be considered as extra work, in accordance with 4-3.5.

***430-12.5 Desilting Pipe:** Desilting Pipe will be paid for at the contract unit price per foot ~~(meter)~~ for each pipe desilted. Price and payment will be full compensation for furnishing all equipment, tools and labor, disposal of silt and debris, and all incidentals necessary for satisfactorily performing the work.*

***430-12.6 Desilting Concrete Box Culverts:** Price and payment will be full compensation for all work required.*

430-12.*7*~~6~~ Flared End Sections: *Price and payment will be full compensation for all work and materials required.* ~~The cost of temporarily plugging a pipe culvert, either proposed or existing, will be incidental to the Contract unit price for new pipe culvert.~~

~~The cost of filling and/or plugging an existing pipe culvert that is to be permanently placed out of service will be paid for at the contract unit price for filling and plugging pipe, per cubic yard [cubic meter]. Price and payment will be full compensation for flowable fill, masonry, concrete, mortar, and all labor and materials necessary to complete the work.~~

~~When the project includes no quantities for new pipe culverts, and temporary plugs are required for existing pipe culverts, the cost will be considered as extra work, in accordance with 4-3.5.~~

430-12.*8*~~7~~ Mitered End Sections: Price and payment will be full compensation for all pipe, grates when required, fasteners, reinforcing, connectors, anchors, concrete, sealants, jackets and coupling bands, and all work required.

430-12.*9*~~8~~ Railroad Requirements: Where pipe culvert is constructed under railroad tracks, the Contract unit price for the pipe culvert will include the costs of any jacking operations and the operation of placing the pipe by use of a tunnel liner, (except as specified for unanticipated tunnel liner, in 430-6.5, where reimbursement is to be made for such unanticipated liner), and all other work necessary to meet the requirements of the railroad company, excluding the costs of watchman or flagman services provided by the railroad company, except as provided below.

The Department will reimburse the Contractor for the actual costs of any trestle bridge work which is performed by the railroad's forces, as billed to him by the railroad, less the value of any salvage materials derived there from, whether such salvage materials are retained by the railroad company or by the Contractor. When the work of shoring and bracing is to be performed by the railroad, such fact will be stipulated in the Contract Documents and the Contractor will be required to pay to the railroad the amount of such costs, which amount will be reimbursed to him by the Department. The Contract unit price for the pipe culvert shall include the costs of all other work of shoring and bracing.

430-12.*10*~~9~~ Payment Items: Payment will be made under:

Item No. 430- 17- Pipe Culvert Optional Material - per foot.

~~Item No. 2430- 17- Pipe Culvert Optional Material - per meter.~~
Item No. 430- 94- Desilting Pipe – per foot
~~*Item No. 2430- 94- Desilting Pipe – per meter*~~
Item No. 430- 96- Polyvinyl Chloride Pipe - per foot.
~~Item No. 2430- 96- Polyvinyl Chloride Pipe - per meter.~~
Item No. 430- 98- Mitered End Section - each.
~~Item No. 2430- 98- Mitered End Section - each.~~
~~Item No. 430-150- Cast Iron Pipe Culvert - per foot.~~
~~Item No. 2430-150- Cast Iron Pipe Culvert - per meter.~~
~~Item No. 430-190- Relay Existing Pipe - per foot.~~
~~Item No. 2430-190- Relay Existing Pipe - per meter.~~
Item No. 430-200- Flared End Sections - each.
~~Item No. 2430-200- Flared End Sections - each.~~
Item No. 430-610- U-Endwall ~~With Grate -~~ each.
Item No. 2430-610- U-Endwall ~~With Grate -~~ each.
Item No. 430-830- Filling and Plugging Pipe – cubic yard.
~~Item No. 2430-830- Filling and Plugging Pipe – cubic meter.~~
Item No. 430-950- Desilting Concrete Box Culvert – per cubic yard.
~~*Item No. 2430-950- Desilting Concrete Box Culvert - per cubic meter.*~~

PIPE CULVERTS
(REV 5-12-06)

SECTION 430 (Pages 390 – 401) is deleted and the following substituted:

SECTION 430
PIPE CULVERTS

430-1 Description.

Furnish and install drainage pipe and end sections at the locations called for in the plans. Furnish and construct joints and connections to existing pipes, catch basins, inlets, manholes, walls, etc., as may be required to complete the work.

Construct structural plate pipe culverts or underdrains in accordance with Sections 435 and 440.

430-2 Materials.

430-2.1 Pipe: Meet the following requirements:

Concrete Pipe.....Section 449
Round Rubber Gaskets .....Section 942
Corrugated Steel Pipe and Pipe Arch.....Section 943
Corrugated Aluminum Pipe and Pipe Arch .....Section 945
Corrugated Polyethylene Pipe.....Section 948
Polyvinyl Chloride (PVC) Pipe .....Section 948

430-2.2 Joint Materials: Use joint materials specified in 430-7 through 430-10 according to type of pipe and conditions of usage.

430-2.3 Mortar: Use mortar composed of one part portland cement and two parts of clean, sharp sand, to which mixture the Contractor may add hydrated lime in an amount not to exceed 15% of the cement content. Use mortar within 30 minutes after its preparation.

430-3 Type of Pipe to Be Used.

430-3.1 General: When the plans designate a type (or types) of pipe, use only the type (or choose from the types) designated. As an exception, when the plans designate reinforced concrete pipe as Class S, Class I, Class II, Class III and Class IV, the Contractor may use non-reinforced concrete pipe up to and including 36 inch in diameter or fiber reinforced concrete pipe up to and including 48 inch in diameter. Do not use fiber reinforced concrete pipe beneath the main travel lanes of interstate highways.

430-3.2 Side Drain: If the plans do not designate a type (or types) of pipe, the Contractor may use either a minimum Class I concrete pipe, corrugated steel pipe, corrugated aluminum pipe, corrugated polyethylene pipe or PVC pipe. If one of the metal types is chosen, use the minimum gage specified in Section 943 for steel pipe or Section 945 for aluminum pipe.

Non-reinforced concrete pipe or fiber-reinforced concrete pipe may also be substituted for concrete pipe in side drains, subject to the provisions of 430-3.1.

430-4 Laying Pipe.

430-4.1 General: Lay all pipe, true to the lines and grades given, with hubs upgrade and tongue end fully entered into the hub. When pipe with quadrant reinforcement or circular pipe with elliptical reinforcement is used, install the pipe in a position such that the manufacturer's marks designating "top" and "bottom" of the pipe are not more than five degrees from the vertical plane through the longitudinal axis of the pipe. Do not allow departure from and return to plan alignment and grade to exceed 1/16 inch per foot of nominal pipe length, with a total of not more than 1 inch departure from theoretical line and grade. Take up and relay any pipe that is not in true alignment or which shows any settlement after laying at no additional expense to the Department.

Do not use concrete pipe with lift holes except round pipe which has a inside diameter in excess of 54 inches or any elliptical pipe.

Repair lift holes, if present, by use of a hand-placed, stiff, non-shrink, 1-to-1 mortar of cement and fine sand, after first washing out the hole with water. Completely fill the void created by the lift hole with mortar. Cover the repaired area with a 24 by 24 inches piece of filter fabric secured to the pipe. Use a Type D-3 filter fabric meeting the requirements shown on Design Standards, Index 199.

Secure the filter fabric to the pipe using a method that holds the fabric in place until the backfill is placed and compacted. Use a grout mixtures, mastics, or strapping devices to secure the fabric to the pipe.

When installing pipes in structures, construct inlet and outlet pipes of the same size and kind as the connecting pipe shown in the plans. Extend the pipes through the walls for a distance beyond the outside surface sufficient for the intended connections, and construct the concrete around them neatly to prevent leakage along their outer surface as shown on the Design Standards, Index 201. Keep the inlet and outlet pipes flush with the inside of the wall. Resilient connectors as specified in 942-3 may be used in lieu of a masonry seal.

Furnish and install a filter fabric jacket around all pipe joints and the joint between the pipe and the structure in accordance with Design Standards, Index Nos. 201 and 280. Use fabric meeting the physical requirements of Type D-3 specified on the Design Standards, Index 199. The fabric shall extend a minimum of 12 inches beyond each side of the joint or both edges of the coupling band, if a coupling band is used. The fabric shall have a minimum width of 24 inches, and a length sufficient to provide a minimum overlap of 24 inches. Secure the filter fabric jacket against the outside of the pipe by metal or plastic strapping or by other methods approved by the Engineer.

Meet the following minimum joint standards:

Pipe Application	Minimum Standard
Cross Drains	Water-tight
Storm Drains	Water-tight
Gutter Drain	Water-tight
Side Drains	Soil-tight

When rubber gaskets are to be installed in the pipe joint, the gasket shall be the sole element relied on to maintain a tight joint. Soil tight joints must be watertight

to 2 psi. Water-tight joints must be water-tight to 5 psi unless a higher pressure rating is required in the plans.

430-4.2 Trench Excavation: Excavate the trench for pipe culverts and storm sewers as specified in Section 125.

430-4.3 Foundation: Provide a suitable foundation, where the foundation material is of inadequate supporting value, as determined by the Engineer. Remove the unsuitable material and replace it with suitable material, as specified in 125-8. Where in the Engineer's opinion, the removal and replacement of unsuitable material is not practicable, he may direct alternates in the design of the pipe line, as required to provide adequate support. Minor changes in the grade or alignment will not be considered as an adequate basis for extra compensation.

Do not lay pipe on blocks or timbers, or on other unyielding material, except where the use of such devices is called for in the plans.

430-4.4 Backfilling: Backfill around the pipe as specified in 125-8 unless specific backfilling procedures are described in the Contract Documents.

430-4.5 Plugging Pipe: When existing pipe culverts are to be permanently placed out of service, fill them with flowable fill that is non-excavatable, contains a minimum 350 lbs/cy of cementious material and meets the requirements of Section 121 and/or plug them with masonry plugs as shown in the plans. Install masonry plugs that are a minimum of 8 inches in thickness, in accordance with Design Standards Index 280.

When proposed or existing pipe culverts are to be temporarily placed out of service, plug them with prefabricated plugs as shown in the plans. Install prefabricated plugs in accordance with the manufacturer's recommendations. Do not fill, or construct masonry plugs in, any pipe culverts intended for current or future service.

430-4.6 End Treatment: Place an end treatment at each cross drain, side drain, or storm sewer pipe end as shown in the plans. Refer to the Design Standards for types of end treatment details.

As an exception to the above, when concrete mitered end sections are permitted, the Contractor may use reinforced concrete U-endwalls, if shop drawings are submitted to the Engineer for approval prior to use.

Provide end treatments for corrugated polyethylene pipe and PVC pipe as specified in Section 948, or as detailed in the plans.

430-4.7 Metal Pipe Protection: Apply a bituminous coating to the surface area of the pipe within and 12 inches beyond the concrete or mortar seal prior to sealing, to protect corrugated steel or aluminum pipe embedded in a concrete structure, such as an inlet, manhole, junction box, endwall, or concrete jacket.

Ensure that the surface preparation, application methods (dry film thickness and conditions during application), and equipment used are in accordance with the coating manufacturers' published specifications.

Obtain the Engineer's approval of the coating products used.

430-4.8 Final Pipe Inspection: Based on contract pavement type, upon completion of placement of concrete pavement or the placement of structural asphalt, but prior to placement of asphalt friction course, dewater installed pipe and provide the Engineer with a video recording schedule allowing for pipe videoing and reports to be completed and submitted to the Department and reviewed prior to continuation of pavement.

For pipe 48 inches or less in diameter, provide the Engineer a video DVD and report using low barrel distortion video equipment with laser profile technology, non-contact video micrometer and associated software that provides:

1. Actual recorded length and width measurements of all cracks within the pipe.
2. Actual recorded separation measurement of all pipe joints.
3. Pipe ovality report.
4. Deflection measurements and graphical diameter analysis report in terms of x and y axis.
5. Flat analysis report.
6. Representative diameter of pipe.
7. Pipe deformation measurements, leaks, debris, or other damage or defects.
8. Deviation in pipe line and grade, joint gaps, and joint misalignment.

Laser profiling and measurement technology must be certified by the company performing the work to be in compliance with the calibration criteria posted at: http://www.dot.state.fl.us/construction/ContractorIssues/Laser.htm .
Reports may be submitted in electronic media if approved by the Engineer.

For video recorded, laser profiled pipe that indicates deflection that appears to be in excess of that allowed by Specification, the Engineer may require further testing of the pipe. If directed by the Engineer, test pipe using a mandrel. The mandrel shall be pulled by hand and be approved by the Engineer prior to use. If use of a mandrel is selected as the means of further testing, the mandrel's diameter, length, and other requirements shall conform to 430-4.8.2. Remove, replace, and retest pipe failing to meet the specific deflection requirements for the type of pipe installed, at no cost to the Department. Should the deflection test prove that the pipe met specifications, the Department will bear the cost of the deflection testing.

The Engineer may waive this requirement for side drains and cross drains which are short enough to inspect from each end of the pipe.

430-4.8.1 Video Report: Provide a high quality DVD in a MPEG2 format video with a standard resolution of 720 x 480. Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe and rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition.

The video image shall be clear, focused, and relatively free from roll, static, or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe. The video will include identification before each section of pipe filmed. The identification will include the project number, the structure number corresponding to the structure number on the set of plans for the project, size of pipe, the date and time, and indicate which pipe is being filmed if multiple pipes are connected to the structure. Notes should be taken during the video recording process. Provide the Engineer with copies of these notes along with the video.

Move the camera through the pipe at a speed not greater than 30 feet per minute. Mark the video with the distance down the pipe. The distance shall have an accuracy of one foot per 100 feet. Film the entire circumference at each joint. Stop the camera and pan when necessary to document defects.

430-4.8.2 Mandrels: Use mandrels which are rigid, nonadjustable, odd-numbered legged (minimum 9 legs) having a length not less than its nominal diameter. The diameter at any point shall not be less than the allowed percent deflection of the certified actual mean diameter of the pipe being tested. The mandrel shall be fabricated of metal, fitted with pulling rings at each end, stamped or engraved on some segment other than a runner with the nominal pipe size and mandrel outside diameter.

430-5 Removing Existing Pipe.

If the plans indicate that existing pipe is to remain the property of the Department, collect and stack along the right-of-way all existing pipe or pipe arch so indicated in the plans to be removed, or that does not conform to the lines and grades of the proposed work and that is not to be re-laid, as directed by the Engineer. Take care to prevent damage to salvageable pipe during removal and stacking operations.

430-6 Placing Pipe Under Railroad.

430-6.1 General: Construct pipe culverts under railroad tracks in accordance with the requirements of the railroad company.

Perform all the shoring under the tracks, and sheeting and bracing of the trench, required by the railroad company or deemed necessary by the Engineer in order to ensure safe and uninterrupted movement of the railroad equipment, at no expense to the Department.

430-6.2 Requirements of the Railroad Company: Install pipe using methods required by the railroad company and shown in the Contract Documents.

When the general method of installation required by the railroad company is indicated in the plans, do not alter such method, or any other specific details of the installation which might be indicated in the plans, without receiving approval or direction from the railroad, followed by written approval from the Engineer.

430-6.3 Notification to Railroad Company: Notify the railroad company and the Engineer at least ten days prior to the date on which pipe is to be placed under the railroad tracks.

430-6.4 Placing Pipe by Jacking: Obtain the Engineer's and the railroad company's approval of the details of the jacking method to be used, when placing pipe through the railroad embankment, before the work is started.

430-6.5 Use of Tunnel Liner: When the railroad company requires that a tunnel liner be used for placing the pipe in lieu of the jacking method, the Department will pay for the tunnel liner material separately in cases where the Contract Documents do not require the use of a tunnel liner. For these cases the Department will reimburse the Contractor for the actual cost of the liner, delivered at the site. The Department will base such cost on a liner having the minimum gage acceptable to the railroad.

430-7 Specific Requirements for Concrete Pipe.

430-7.1 Sealing Joints: Seal the pipe joints with round rubber or profile gaskets meeting the requirements of Section 449. Ensure that the gasket and the surface of the

pipe joint, including the gasket recess, are clean and free from grit, dirt and other foreign matter, at the time the joints are made. In order to facilitate closure of the joint, application of a vegetable soap lubricant immediately before closing of the joint will be permitted. Prelubricated gaskets may be used in lieu of a vegetable soap lubricant when the lubricating material is certified to be inert with respect to the rubber material.

430-7.2 Laying Requirements for Concrete Pipe with Rubber Gasket Joints: Do not allow the gap between sections of pipe to exceed 5/8 inch for pipe diameters of 12 inches through 18 inches, 7/8 inch for pipe diameters of 24 through 66 inches, and 1 inch for pipe diameters 72 inches and larger. Where minor imperfections in the manufacture of the pipe create an apparent gap in excess of the tabulated gap, the Engineer will accept the joint provided that the imperfection does not exceed 1/3 the circumference of the pipe, and the rubber gasket is 1/4 inch or more past the pipe joint entrance taper. Where concrete pipes are outside of these tolerances, replace them at no expense to the Department. Do not apply mortar, joint compound, or other filler to the gap which would restrict the flexibility of the joint.

430-7.3 Field Joints for Elliptical Concrete Pipe: Use either a preformed plastic gasket material or an approved rubber gasket to make a field joint.

430-7.3.1 Plastic Gasket: Meet the following requirements when field joints are made from preformed plastic gasket material:

430-7.3.1.1 General: Install field joints in accordance with the manufacturer's instructions and the following:

430-7.3.1.2 Material: Meet the requirements of 942-2.

430-7.3.1.3 Joint Design: Ensure that the pipe manufacturer furnishes the Engineer with details regarding configuration of the joint and the amount of gasket material required to affect a satisfactory seal. Do not brush or wipe joint surfaces which are to be in contact with the gasket material with a cement slurry. Fill minor voids with cement slurry.

430-7.3.1.4 Primer: Apply a primer of the type recommended by the manufacturer of the gasket material to all joint surfaces which are to be in contact with the gasket material, prior to application of the gasket material. Thoroughly clean and dry the surface to be primed.

430-7.3.1.5 Application of Gasket: Apply gasket material to form a continuous gasket around the entire circumference of the leading edge of the tongue and the groove joint, in accordance with the detail shown on the Design Standards, Index No. 280. Do not remove the paper wrapper on the exterior surface of the gasket material until immediately prior to joining of sections. Apply plastic gasket material only to surfaces which are dry. When the atmospheric temperature is below 60ºF, either store plastic joint seal gaskets in an area above 70ºF, or artificially warm the gaskets to 70ºF in a manner satisfactory to the Engineer.

430-7.3.1.6 Installation of Pipe: Remove and reposition or replace any displaced or contaminated gasket as directed by the Engineer. Install the pipe in a dry trench. Carefully shape the bottom of the trench to minimize the need for realignment of sections of pipe after they are placed in the trench. Hold to a minimum any realignment of a joint after the gaskets come into contact. Prior to joining the pipes, fill the entire joint with gasket material and ensure that when the pipes are joined there is evidence of squeeze-out of gasket material for the entire internal and external

circumference of the joint. Trim excess material on the interior of the pipe to provide a smooth interior surface. If a joint is defective, remove the leading section of pipe and reseal the joint.

430-7.3.2 Rubber Gasket: Meet the following requirements when field joints are made with profile rubber gaskets:

430-7.3.2.1 General: Install field joints in accordance with the manufacturer's instructions and the following:

430-7.3.2.2 Material: Meet the requirements of 942-4.

430-7.3.2.3 Joint Design: Ensure that the pipe manufacturer furnishes the Engineer with details regarding configuration of the joint and gasket required to effect a satisfactory seal. Do not apply mortar, joint compound, or other filler which would restrict the flexibility of the gasket joint.

430-7.4 Requirements for Concrete Radius Pipe:

430-7.4.1 Design: Construct concrete radius pipe in segments not longer than 4 feet (along the pipe centerline), except where another length is called for in the Contract Documents. Join each segment using round rubber gaskets. Ensure that the pipe manufacturer submits details of the proposed joint, segment length and shape for approval by the Engineer, prior to manufacture.

430-7.4.2 Pre-Assembly: Ensure that the manufacturer pre-assembles the entire radius section in his yard, in the presence of the Engineer, to ensure a proper fit for all parts. At the option of the manufacturer, the Contractor may assemble the pipe without gaskets. Consecutively number the joints on both the interior and exterior surfaces of each joint, and make match marks showing proper position of joints. Install the pipe at the project site in the same order as pre-assembly.

430-8 Specific Requirements for Corrugated Metal Pipe.

430-8.1 Field Joints:

430-8.1.1 General: Make a field joint with locking bands, as specified in Article 9 of AASHTO M 36 and AASHTO M 196M for aluminum pipe. For aluminum pipe, fabricate bands from the same alloy as the culvert sheeting.

When existing pipe to be extended is helically fabricated, make a field joint between the existing pipe and the new pipe using one of the following methods:

(1) Cut the new pipe to remove one of the re-rolled annular end sections required in Sections 943 or 945, or fabricate the pipe so that the re-rolled annular section is fabricated only on one end. Use either a spiral (helical) band with a gasket or a flat band with gaskets as required by 430-8.1.2 (2) to join the pipe sections.

(2) The Contractor may construct a concrete jacket as shown on the Design Standards, Index No. 280, provided that the minimum cover required by the Design Standards, Index No. 205 can be obtained.

430-8.1.2 Side Drain, Cross Drain, Storm Sewer, and Gutter Drains: Where corrugated metal pipe is used as side drain, cross drain, storm sewer, or gutter drain, use a rubber or neoprene gasket of a design shown to provide a joint as specified in 430-4.

Use a gasket of one of the following dimensions:

(1) For annular joints with 1/2 inch depth corrugation: either a single gasket a minimum of 7 inches by 3/8 inch or two gaskets a minimum of

3 1/2 inches by 3/8 inch; and for annular joints with 1 inch depth corrugations: either a single gasket a minimum of 7 inches by 7/8 inch or two gaskets a minimum of 3 1/2 inches by 7/8 inch.

(2) For helical joints with 1/2 inch depth corrugation: either a single gasket a minimum of 5 inches by 1 inch or two gaskets a minimum of 3 1/2 inches by 1 inch; and for helical joints with 1 inchdepth corrugations: either a single gasket a minimum of 5 inches by 1 1/2 inches or two gaskets a minimum of 3 1/2 inches by 1 1/2 inches.

(3) Such other gasket designs as may be approved by the Engineer.

If, in lieu of a single gasket spanning the joint, two gaskets are used, place these individual gaskets approximately 2 inches from each pipe end at the joint. When two gaskets are used, seal the overlapping area on the coupling band between the gaskets consistent with the joint performance specified. The Contractor may tuck a strip of preformed gasket material over the bottom lip of the band for this purpose. Use coupling bands that provide a minimum circumferential overlap of 3 inches. As the end connections on the coupling band are tightened, ensure that there is no local bending of the band or the connection. Use precurved coupling bands on pipe diameters of 24 inches or less.

Use flat gaskets meeting the requirements of ASTM D 1056, designation 2C2 or 2B3. In placing flat gaskets on pipe prior to placing the coupling band, do not stretch the gasket more than 15% of its original circumference. Use circular gaskets meeting the requirements of ASTM C 361. Do not stretch the circular gasket more than 20% of its original circumference in placing the gasket on pipe. Use preformed plastic gasket material meeting the composition requirements of 942-2.2.

Apply an approved vegetable soap lubricant, as specified for concrete pipe in 430-7.1.1.

430-8.1.3 Alternate Joint: In lieu of the above-specified combination of locking bands and flat gaskets, the Contractor may make field joints for these pipe installations by the following combinations:

(a) Use the metal bands as specified in Article 9 of AASHTO M 36M that are at least 10 1/2 inches wide and consist of a flat central section with a corrugated section near each end, designed to match the annular corrugation in the pipe with which they are to be used. Connect the bands in a manner approved by the Engineer, with a suitable fastening device such as the use of two galvanized 1/2 inch diameter bolts through a galvanized bar and galvanized strap, suitably welded to the band. Use a strap that is the same gage as the band.

Where helically corrugated pipe is to be jointed by this alternate combination, ensure that at least the last two corrugations of each pipe section are annular, and designed such that the band will engage each pipe end with the next-to-outside annular corrugation.

(b) For these bands, use a rubber gasket with a circular cross-section of the “O-ring” type conforming to ASTM C 361. Use gaskets having the following cross-sectional diameter for the given size of pipe:

Non-SI Units	
Pipe Size	Gasket Diameter
12 inches through 36 inches (with 1/2 inch depth corrugations)	13/16 inch
42 inches through 96 inches (with 1/2 inch depth corrugations)	7/8 inch
36 inches through 120 inches (with 1 inch depth corrugations)	1 3/8 inches

Use preformed gasket material to seal the overlapping area on the coupling band between gaskets.

(c) Use channel band couplers in helical pipe with ends which have been reformed and flanged specifically to receive these bands. Use channel band couplers that are of a two piece design, are fabricated from galvanized steel stock conforming to AASHTO M 36, have 2 by 2 by 3/16 inch angles fastened to the band ends to allow for proper tightening, and meet the following:

Non SI Units	
Band Thickness	Pipe Wall Thickness
0.079 inch	0.109 inch or lighter
0.109 inch	0.138 inch or heavier
3/4 inch wide	0.109 inch or lighter
1 inch wide	0.138 inch or heavier

Furnish two 1/2 inch diameter connection bolts with each band, that conform to ASTM A 307, Grade A and are electroplated in accordance with ASTM B 633.

Use a gasket with the joint that is a hydrocarbon blend of butyl rubber meeting the chemical composition and physical properties of 942-2.2. Use a 3/8 by 3/4 inch gasket for pipe fabricated from 0.109 inch or lighter material and a 3/8 by 1 inch gasket for pipe fabricated from 0.138 inch and heavier material.

The Contractor may use a flange band coupler without the gasket for all applications other than side drain, cross drain, storm sewer and gutter drain.

Do not use the flange band coupler to join dissimilar types of pipe.

The Contractor may join reformed flanged helical pipe to existing annular or reformed pipe having annular ends. On non-gasketed installations, use either an annular band or an alternate joint described in 430-8.1.3. On gasketed installations, use an annular band, minimum of five corrugations in width, in conjunction with two O-ring gaskets as specified in 430-8.1.3. Use mastic material to seal the area of band overlap.

The minimum joint performance standards specified in 430-4.1 apply.

430-8.2 Laying and Shape Requirements for Corrugated Metal Pipe: Install pipe using either a trench or open ditch procedure.

Check pipe shape regularly during backfilling to verify acceptability of the construction method used. Pipe deflected 5% or more of the certified actual mean diameter of the pipe at final inspection shall be replaced at no cost to the Department. Deflection measurements are taken at the point of smallest diameter on the corrugations.

430-9 Specific Requirements for Corrugated Polyethylene Pipe and Polyvinyl Chloride (PVC) Pipe.

430-9.1 Field Joints: Use gasketed joints to seal side drain, cross drain and storm drain. Use gaskets meeting the requirements of Section 449. Ensure that the pipe manufacturer provides a joint design approved by the Engineer before use.

430-9.2 Installation Requirements Including Trenching, Foundation and Backfilling Operations: Check structure shape regularly during backfilling to verify acceptability of the construction method used.

Pipe deflected 5% or more of the certified actual mean diameter of the pipe at final inspection shall be replaced at no cost to the Department.

430-10 Desilting Pipe or Concrete Box Culvert.

Desilt pipe culvert and concrete box culvert as designated in the plans.

430-11 Method of Measurement.

430-11.1 New Pipe: The quantities of storm drain pipe, storm drain trench, cross drain pipe, side drain pipe and gutter drain pipe to be paid for will be plan quantity, in place and accepted. The plan quantity will be determined from the inside wall of the structure as shown on the plans, along the centerline of the pipe.

430-11.2 Mitered End Section: The quantity to be paid for will be the number completed and accepted.

430-12 Basis of Payment.

430-12.1 General: Prices and payments will be full compensation for all work specified in this Section, including all excavation except the volume included in the items for the grading work on the project, and except for other items specified for separate payment in Section 125; all backfilling material and compaction; disposal of surplus material; and all clearing and grubbing outside of the required limits of clearing and grubbing as shown in the plans.

430-12.2 Removing Existing Pipe: When existing pipe is removed and replaced with new pipe approximately at the same location, the cost of excavating and removing the old pipe and of its disposal will be included in the Contract unit price for clearing and grubbing.

430-12.3 Site Restoration: The cost of restoring the site, as specified in 125-11, that is disturbed, solely for the purpose of constructing pipe culvert, will be included in the Contract unit price for the pipe culvert, unless designated specifically to be paid for under other items.

430-12.4 Plugging Pipes: The cost of temporarily plugging a pipe culvert, either proposed or existing, will be incidental to the contract unit price for new pipe culvert.

The cost of filling and/or plugging an existing pipe culvert that is to be permanently placed out of service will be paid for at the contract unit price for filling and plugging pipe, per cubic yard. Price and payment will be full compensation for flowable fill, masonry, concrete, mortar, and all labor and materials necessary to complete the work.

When the project includes no quantities for new pipe culverts, and temporary plugs are required for existing pipe culverts, the cost will be considered as extra work, in accordance with 4-3.5.

430-12.5 Desilting Pipe: Desilting Pipe will be paid for at the contract unit price per footfor each pipe desilted. Price and payment will be full compensation for furnishing all equipment, tools and labor, disposal of silt and debris, and all incidentals necessary for satisfactorily performing the work.

430-12.6 Desilting Concrete Box Culverts: Price and payment will be full compensation for all work required.

430-12.7 Flared End Sections: Price and payment will be full compensation for all work and materials required.

430-12.8 Mitered End Sections: Price and payment will be full compensation for all pipe, grates when required, fasteners, reinforcing, connectors, anchors, concrete, sealants, jackets and coupling bands, and all work required.

430-12.9 Railroad Requirements: Where pipe culvert is constructed under railroad tracks, the Contract unit price for the pipe culvert will include the costs of any jacking operations and the operation of placing the pipe by use of a tunnel liner, (except as specified for unanticipated tunnel liner, in 430-6.5, where reimbursement is to be made for such unanticipated liner), and all other work necessary to meet the requirements of the railroad company, excluding the costs of watchman or flagman services provided by the railroad company, except as provided below.

The Department will reimburse the Contractor for the actual costs of any trestle bridge work which is performed by the railroad's forces, as billed to him by the railroad, less the value of any salvage materials derived there from, whether such salvage materials are retained by the railroad company or by the Contractor. When the work of shoring and bracing is to be performed by the railroad, such fact will be stipulated in the Contract Documents and the Contractor will be required to pay to the railroad the amount of such costs, which amount will be reimbursed to him by the Department. The Contract unit price for the pipe culvert shall include the costs of all other work of shoring and bracing.

430-12.10 Payment Items: Payment will be made under:

Item No.	430- 17-	Pipe Culvert Optional Material - per foot.
Item No.	430- 94-	Desilting Pipe – per foot
Item No.	430- 96-	Polyvinyl Chloride Pipe - per foot.
Item No.	430- 98-	Mitered End Section - each.
Item No.	430-200-	Flared End Sections - each.
Item No.	430-610-	U-Endwall - each.
Item No. 2	430-610-	U-Endwall - each.
Item No.	430-830-	Filling and Plugging Pipe – cubic yard.
Item No.	430-950-	Desilting Concrete Box Culvert – per cubic yard.