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ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

**SUBJECT: Corrugated Steel Pipe-Type 1R
Corrugated Aluminum Pipe-Type 1R**

Subject Code: 727-1-603

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Code: EI 93-011

Date: 5/13/93

Supersedes: EI 90-34

APPROVED:



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PURPOSE. The primary purpose of this Engineering Instruction is to incorporate Corrugated Aluminum and Steel Type 1R pipes into the Standard Specifications. These pipes were previously referred to in Department publications, including the superseded EI, as spiral rib steel and aluminum pipe. The primary purpose is accomplished by:

- A. Issuing proposal inserts which modify existing standard specification sections 203, 603 and 707 to accommodate Type 1R corrugated steel and aluminum pipe and provide specifications and pay items including those needed to backfill aluminum pipes. The new proposal inserts also incorporate information from existing proposal inserts, thus replace them.
- B. Issuing a Design Data Sheet for Corrugated Steel and Aluminum Type 1R Pipe. This is to be incorporated into the existing Highway Design Manual.

The secondary purpose is to bring the nomenclature used in the Standard Specifications into closer conformance with that used nationally as reflected in the AASHTO Part 1 Specifications (ie. the maroon looseleaf notebooks.) The proposal insert note entitled "Polymer Coated Pipe" arises out of this effort.

TRANSMITTED MATERIALS. The following materials are transmitted:

11" x 17" materials;

DESIGN CRITERIA FOR TYPE 1R CORRUGATED STEEL AND ALUMINUM PIPE-HS 20 LOADING. This gives maximum and minimum fill heights and durabilities (life expectancies) for the various gauges and types of metals. It will be incorporated into Chapter 8 of the Highway Design Manual when that chapter is next updated.

8.5" x 11" materials (proposal insert notes);

Select Granular Fill for Aluminum Pipe. This modifies the Standard Specifications for item 203.07 so that only appropriate granular material will be used for aluminum pipe, including the new type 1R corrugated pipe. Appropriate material for type 1R aluminum pipe will all pass a two-inch sieve and for aluminum pipes or steel pipes coated with aluminum, regardless of type, should be free of cement and cement products.

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	2 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Polymer Coated Steel Pipe. This note modifies §602 of the Standard Specifications to reflect the changes made to §707-02 Corrugated Steel Pipe.

Culverts and Storm Drains. This note modifies Section 603 of the Standard Specifications to incorporate type 1R corrugated metal pipes, to establish joint tolerance, and to require the contractor to provide equipment to measure pipe metal and coating thicknesses.

Corrugated Steel Pipe. This is a rewrite of §707-02 to bring the nomenclature and structure of our materials sections and those of the AASHTO Standard Specifications into closer conformance.

Galvanized Steel End Sections. This is a rewrite of §707-10 and requires the contractor to provide thickness measuring equipment.

707-11 Aluminum End Sections. This is a new subsection and was created by removing the specifications for aluminum end sections from §707-13. This is being done so that the materials section for steel corrugated pipes and aluminum corrugated pipes would be similar in their construction. It also adds the requirement that the contractor provide thickness measuring equipment.

707-13 Corrugated Aluminum Pipe. This is a rewrite of §707-13. It removes end sections from that subsection and rewrites it to be consistent with the national materials specifications as given in AASHTO.

BACKGROUND. Both aluminum and steel type 1R corrugated pipes have been used in department projects. The use of type 1R steel pipe was suspended however due to the cracking that occurred at the ends while rerolling the ends of the pipe. It was for this reason that EI 90-34 issued specifications for type 1R corrugated aluminum pipe but prohibited the use of type 1R corrugated steel pipe. The prohibition of the use type 1R corrugated steel pipe has created limitations in type 1R pipe selection due to the lesser allowable fill heights.

The pipe manufacturers have since resolved the manufacturing problem with type 1R corrugated steel pipe and we are once again allowing its use on projects. Design data for type 1R corrugated pipe is located on the new design data sheet titled "DESIGN CRITERIA FOR TYPE 1R CORRUGATED STEEL AND ALUMINUM PIPE, HS-20 LOADING". As indicated on the design data sheet, the pipe uses ¾" X ¾" square edged ribs projecting outward at 7-½" spacing. The interior of the pipe has a hydraulic smoothness equivalent to that of concrete pipe. For design purposes, a Mannings "n" value of 0.013 should be used for both steel and aluminum type 1R pipe.

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	3 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Type 1R pipe is available in round steel or aluminum but pipe-arches are not manufactured. Steel pipe is available metallurgically coated with a zinc coating (galvanized), zinc/aluminum coating (galvalume), or with an aluminum coating. The metallic coating is the contractor's option thus there are no separate pay items because of these coatings. The aluminum coating is more resistant to abrasion and corrosion and, if the contractor chooses an aluminum coating, a reduction in pipe thickness of one gauge size may be allowed. This is further explained in the new proposal insert titled "Culverts and Storm Drains". Type 1R steel pipe is also available with a paved invert and there are separate pay items for type 1R steel pipe with a paved invert.

Select granular fill required for both aluminum and steel spiral rib pipe will be paid for under existing item 203.07 - Select Granular Fill. Select granular fill for aluminum type 1R pipe is restricted to a maximum particle size of two inches as specified in the revised §203-2.02C Select Granular Fill and Select Structural Fill and in a revision to §603-3.03 of the proposal insert entitled "Culverts and Storm Drains".

Questions regarding the information contained in this instruction should be directed to John Haviland of the Design Quality Assurance Bureau at (518) 457-7283. Questions regarding the material or construction of the actual pipes should be addressed to Bill Cuerdon at (518) 457-5956.

Specification Status

The following existing special pay items will be replaced with standard pay items and therefore will be disapproved for use beginning with the letting of 9/9/93 :

Item No.	Item	Pay Unit
17203.0715	Backfill for Spiral Rib Aluminum Pipe	Cubic Yard
91603.2116 thru 91603.2162	Spiral Rib Steel Pipe XX Inch Dia., XX Gauge	Linear Foot
91603.9614 thru 91603.9662	Spiral Rib Aluminum Pipe XX Inch Dia., XX Gauge	Linear Foot.

The following standard pay items replace the above disapproved items and should be used beginning with the letting of 9/9/93 :

Corrugated Steel Pipe-Type 1R Items

Item No.	Item	Pay Unit
603.5601	Corrugated Steel Pipe-Type 1R 18 Inch Diameter, 16 Gauge	Linear Foot
603.5602	Corrugated Steel Pipe-Type 1R 18 Inch Diameter, 14 Gauge	Linear Foot
603.5603	Corrugated Steel Pipe-Type 1R 21 Inch Diameter, 16 Gauge	Linear Foot

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	4 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Item No.	Item	Pay Unit
603.5604	Corrugated Steel Pipe-Type 1R 21 Inch Diameter, 14 Gauge	Linear Foot
603.5605	Corrugated Steel Pipe-Type 1R 21 Inch Diameter, 12 Gauge	Linear Foot
603.5606	Corrugated Steel Pipe-Type 1R 24 Inch Diameter, 16 Gauge	Linear Foot
603.5607	Corrugated Steel Pipe-Type 1R 24 Inch Diameter, 14 Gauge	Linear Foot
603.5608	Corrugated Steel Pipe-Type 1R 24 Inch Diameter, 12 Gauge	Linear Foot
603.5609	Corrugated Steel Pipe-Type 1R 30 Inch Diameter, 16 Gauge	Linear Foot
603.5610	Corrugated Steel Pipe-Type 1R 30 Inch Diameter, 14 Gauge	Linear Foot
603.5611	Corrugated Steel Pipe-Type 1R 30 Inch Diameter, 12 Gauge	Linear Foot
603.5612	Corrugated Steel Pipe-Type 1R 36 Inch Diameter, 16 Gauge	Linear Foot
603.5613	Corrugated Steel Pipe-Type 1R 36 Inch Diameter, 14 Gauge	Linear Foot
603.5614	Corrugated Steel Pipe-Type 1R 36 Inch Diameter, 12 Gauge	Linear Foot
603.5615	Corrugated Steel Pipe-Type 1R 42 Inch Diameter, 16 Gauge	Linear Foot
603.5616	Corrugated Steel Pipe-Type 1R 42 Inch Diameter, 14 Gauge	Linear Foot
603.5617	Corrugated Steel Pipe-Type 1R 42 Inch Diameter, 12 Gauge	Linear Foot
603.5618	Corrugated Steel Pipe-Type 1R 48 Inch Diameter, 16 Gauge	Linear Foot
603.5619	Corrugated Steel Pipe-Type 1R 48 Inch Diameter, 14 Gauge	Linear Foot
603.5620	Corrugated Steel Pipe-Type 1R 48 Inch Diameter, 12 Gauge	Linear Foot
603.5621	Corrugated Steel Pipe-Type 1R 54 Inch Diameter, 16 Gauge	Linear Foot
603.5622	Corrugated Steel Pipe-Type 1R 54 Inch Diameter, 14 Gauge	Linear Foot
603.5623	Corrugated Steel Pipe-Type 1R 54 Inch Diameter, 12 Gauge	Linear Foot
603.5624	Corrugated Steel Pipe-Type 1R 60 Inch Diameter, 16 Gauge	Linear Foot
603.5625	Corrugated Steel Pipe-Type 1R 60 Inch Diameter, 14 Gauge	Linear Foot
603.5626	Corrugated Steel Pipe-Type 1R 60 Inch Diameter, 12 Gauge	Linear Foot
603.5627	Corrugated Steel Pipe-Type 1R 60 Inch Diameter, 10 Gauge	Linear Foot
603.5628	Corrugated Steel Pipe-Type 1R 66 Inch Diameter, 14 Gauge	Linear Foot
603.5629	Corrugated Steel Pipe-Type 1R 66 Inch Diameter, 12 Gauge	Linear Foot
603.5630	Corrugated Steel Pipe-Type 1R 66 Inch Diameter, 10 Gauge	Linear Foot
603.5631	Corrugated Steel Pipe-Type 1R 72 Inch Diameter, 14 Gauge	Linear Foot
603.5632	Corrugated Steel Pipe-Type 1R 72 Inch Diameter, 12 Gauge	Linear Foot
603.5633	Corrugated Steel Pipe-Type 1R 72 Inch Diameter, 10 Gauge	Linear Foot
603.5634	Corrugated Steel Pipe-Type 1R 78 Inch Diameter, 14 Gauge	Linear Foot
603.5635	Corrugated Steel Pipe-Type 1R 78 Inch Diameter, 12 Gauge	Linear Foot
603.5636	Corrugated Steel Pipe-Type 1R 78 Inch Diameter, 10 Gauge	Linear Foot
603.5637	Corrugated Steel Pipe-Type 1R 84 Inch Diameter, 12 Gauge	Linear Foot
603.5638	Corrugated Steel Pipe-Type 1R 84 Inch Diameter, 10 Gauge	Linear Foot
603.5639	Corrugated Steel Pipe-Type 1R 90 Inch Diameter, 12 Gauge	Linear Foot
603.5640	Corrugated Steel Pipe-Type 1R 90 Inch Diameter, 10 Gauge	Linear Foot

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	5 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Item No.	Item	Pay Unit
603.5641	Corrugated Steel Pipe-Type 1R 96 Inch Diameter, 12 Gauge	Linear Foot
603.5642	Corrugated Steel Pipe-Type 1R 96 Inch Diameter, 10 Gauge	Linear Foot
603.5643	Corrugated Steel Pipe-Type 1R 102 Inch Diameter, 12 Gauge	Linear Foot
603.5644	Corrugated Steel Pipe-Type 1R 102 Inch Diameter, 10 Gauge	Linear Foot

Corrugated Steel Pipe-Type 1R - Paved Invert Items

Item No.	Item	Pay Unit
603.5701	Corrugated Steel Pipe-Type 1R Paved Invert 18 Inch Diameter, 16 Gauge	Linear Foot
603.5702	Corrugated Steel Pipe-Type 1R Paved Invert 18 Inch Diameter, 14 Gauge	Linear Foot
603.5703	Corrugated Steel Pipe-Type 1R Paved Invert 21 Inch Diameter, 16 Gauge	Linear Foot
603.5704	Corrugated Steel Pipe-Type 1R Paved Invert 21 Inch Diameter, 14 Gauge	Linear Foot
603.5705	Corrugated Steel Pipe-Type 1R Paved Invert 21 Inch Diameter, 12 Gauge	Linear Foot
603.5706	Corrugated Steel Pipe-Type 1R Paved Invert 24 Inch Diameter, 16 Gauge	Linear Foot
603.5707	Corrugated Steel Pipe-Type 1R Paved Invert 24 Inch Diameter, 14 Gauge	Linear Foot
603.5708	Corrugated Steel Pipe-Type 1R Paved Invert 24 Inch Diameter, 12 Gauge	Linear Foot
603.5709	Corrugated Steel Pipe-Type 1R Paved Invert 30 Inch Diameter, 16 Gauge	Linear Foot
603.5710	Corrugated Steel Pipe-Type 1R Paved Invert 30 Inch Diameter, 14 Gauge	Linear Foot
603.5711	Corrugated Steel Pipe-Type 1R Paved Invert 30 Inch Diameter, 12 Gauge	Linear Foot
603.5712	Corrugated Steel Pipe-Type 1R Paved Invert 36 Inch Diameter, 16 Gauge	Linear Foot
603.5713	Corrugated Steel Pipe-Type 1R Paved Invert 36 Inch Diameter, 14 Gauge	Linear Foot
603.5714	Corrugated Steel Pipe-Type 1R Paved Invert 36 Inch Diameter, 12 Gauge	Linear Foot
603.5715	Corrugated Steel Pipe-Type 1R Paved Invert 42 Inch Diameter, 16 Gauge	Linear Foot

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	6 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Item No.	Item	Pay Unit
603.5716	Corrugated Steel Pipe-Type 1R Paved Invert 42 Inch Diameter, 14 Gauge	Linear Foot
603.5717	Corrugated Steel Pipe-Type 1R Paved Invert 42 Inch Diameter, 12 Gauge	Linear Foot
603.5718	Corrugated Steel Pipe-Type 1R Paved Invert 48 Inch Diameter, 16 Gauge	Linear Foot
603.5719	Corrugated Steel Pipe-Type 1R Paved Invert 48 Inch Diameter, 14 Gauge	Linear Foot
603.5720	Corrugated Steel Pipe-Type 1R Paved Invert 48 Inch Diameter, 12 Gauge	Linear Foot
603.5721	Corrugated Steel Pipe-Type 1R Paved Invert 54 Inch Diameter, 16 Gauge	Linear Foot
603.5722	Corrugated Steel Pipe-Type 1R Paved Invert 54 Inch Diameter, 14 Gauge	Linear Foot
603.5723	Corrugated Steel Pipe-Type 1R Paved Invert 54 Inch Diameter, 12 Gauge	Linear Foot
603.5724	Corrugated Steel Pipe-Type 1R Paved Invert 60 Inch Diameter, 16 Gauge	Linear Foot
603.5725	Corrugated Steel Pipe-Type 1R Paved Invert 60 Inch Diameter, 14 Gauge	Linear Foot
603.5726	Corrugated Steel Pipe-Type 1R Paved Invert 60 Inch Diameter, 12 Gauge	Linear Foot
603.5727	Corrugated Steel Pipe-Type 1R Paved Invert 60 Inch Diameter, 10 Gauge	Linear Foot
603.5728	Corrugated Steel Pipe-Type 1R Paved Invert 66 Inch Diameter, 14 Gauge	Linear Foot
603.5729	Corrugated Steel Pipe-Type 1R Paved Invert 66 Inch Diameter, 12 Gauge	Linear Foot
603.5730	Corrugated Steel Pipe-Type 1R Paved Invert 66 Inch Diameter, 10 Gauge	Linear Foot
603.5731	Corrugated Steel Pipe-Type 1R Paved Invert 72 Inch Diameter, 14 Gauge	Linear Foot
603.5732	Corrugated Steel Pipe-Type 1R Paved Invert 72 Inch Diameter, 12 Gauge	Linear Foot
603.5733	Corrugated Steel Pipe-Type 1R Paved Invert 72 Inch Diameter, 10 Gauge	Linear Foot
603.5734	Corrugated Steel Pipe-Type 1R Paved Invert 78 Inch Diameter, 14 Gauge	Linear Foot
603.5735	Corrugated Steel Pipe-Type 1R Paved Invert 78 Inch Diameter, 12 Gauge	Linear Foot

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	7 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

Item No.	Item	Pay Unit
603.5736	Corrugated Steel Pipe-Type 1R Paved Invert 78 Inch Diameter, 10 Gauge	Linear Foot
603.5737	Corrugated Steel Pipe-Type 1R Paved Invert 84 Inch Diameter, 12 Gauge	Linear Foot
603.5738	Corrugated Steel Pipe-Type 1R Paved Invert 84 Inch Diameter, 10 Gauge	Linear Foot
603.5739	Corrugated Steel Pipe-Type 1R Paved Invert 90 Inch Diameter, 12 Gauge	Linear Foot
603.5740	Corrugated Steel Pipe-Type 1R Paved Invert 90 Inch Diameter, 10 Gauge	Linear Foot
603.5741	Corrugated Steel Pipe-Type 1R Paved Invert 96 Inch Diameter, 12 Gauge	Linear Foot
603.5742	Corrugated Steel Pipe-Type 1R Paved Invert 96 Inch Diameter, 10 Gauge	Linear Foot
603.5743	Corrugated Steel Pipe-Type 1R Paved Invert 102 In. Diameter, 12 Gauge	Linear Foot
603.5744	Corrugated Steel Pipe-Type 1R Paved Invert 102 In. Diameter, 10 Gauge	Linear Foot

Corrugated Aluminum Pipe-Type 1R

Item No.	Item	Pay Unit
603.5801	Corrugated Aluminum Pipe- Type 1R, 18 Inch Diameter, 16 Gauge	Linear Foot
603.5802	Corrugated Aluminum Pipe-Type 1R, 18 Inch Diameter, 14 Gauge	Linear Foot
603.5803	Corrugated Aluminum Pipe-Type 1R, 21 Inch Diameter, 16 Gauge	Linear Foot
603.5804	Corrugated Aluminum Pipe-Type 1R, 21 Inch Diameter, 14 Gauge	Linear Foot
603.5805	Corrugated Aluminum Pipe-Type 1R, 21 Inch Diameter, 12 Gauge	Linear Foot
603.5806	Corrugated Aluminum Pipe-Type 1R, 24 Inch Diameter, 16 Gauge	Linear Foot

Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R

Item No.	Item	Pay Unit
603.5807	Corrugated Aluminum Pipe-Type 1R, 24 Inch Diameter, 14 Gauge	Linear Foot
603.5808	Corrugated Aluminum Pipe-Type 1R, 24 Inch Diameter, 12 Gauge	Linear Foot
603.5809	Corrugated Aluminum Pipe-Type 1R, 30 Inch Diameter, 16 Gauge	Linear Foot
603.5810	Corrugated Aluminum Pipe-Type 1R, 30 Inch Diameter, 14 Gauge	Linear Foot
603.5811	Corrugated Aluminum Pipe-Type 1R, 30 Inch Diameter, 12 Gauge	Linear Foot
603.5812	Corrugated Aluminum Pipe-Type 1R, 36 Inch Diameter, 16 Gauge	Linear Foot
603.5813	Corrugated Aluminum Pipe-Type 1R, 36 Inch Diameter, 14 Gauge	Linear Foot
603.5814	Corrugated Aluminum Pipe-Type 1R, 36 Inch Diameter, 12 Gauge	Linear Foot
603.5815	Corrugated Aluminum Pipe-Type 1R, 36 Inch Diameter, 10 Gauge	Linear Foot
603.5816	Corrugated Aluminum Pipe-Type 1R, 42 Inch Diameter, 16 Gauge	Linear Foot
603.5817	Corrugated Aluminum Pipe-Type 1R, 42 Inch Diameter, 14 Gauge	Linear Foot
603.5818	Corrugated Aluminum Pipe-Type 1R, 42 Inch Diameter, 12 Gauge	Linear Foot
603.5819	Corrugated Aluminum Pipe-Type 1R, 42 Inch Diameter, 10 Gauge	Linear Foot
603.5820	Corrugated Aluminum Pipe-Type 1R, 48 Inch Diameter, 14 Gauge	Linear Foot
603.5821	Corrugated Aluminum Pipe-Type 1R, 48 Inch Diameter, 12 Gauge	Linear Foot
603.5822	Corrugated Aluminum Pipe-Type 1R, 48 Inch Diameter, 10 Gauge	Linear Foot
603.5823	Corrugated Aluminum Pipe-Type 1R, 54 Inch Diameter, 14 Gauge	Linear Foot
603.5824	Corrugated Aluminum Pipe-Type 1R, 54 Inch Diameter, 12 Gauge	Linear Foot
603.5825	Corrugated Aluminum Pipe-Type 1R, 54 Inch Diameter, 10 Gauge	Linear Foot
603.5826	Corrugated Aluminum Pipe-Type 1R, 60 Inch Diameter, 12 Gauge	Linear Foot

Manual	ENGINEERING INSTRUCTION	Code	EI 93-011	Date	5-13-93	Page	9 of 9
Subject: Corrugated Steel Pipe-Type 1R Corrugated Aluminum Pipe-Type 1R							

603.5827	Corrugated Aluminum Pipe-Type 1R, 60 Inch Diameter, 10 Gauge	Linear Foot
603.5828	Corrugated Aluminum Pipe-Type 1R, 66 Inch Diameter, 10 Gauge	Linear Foot
603.5829	Corrugated Aluminum Pipe-Type 1R, 72 Inch Diameter, 10 Gauge	Linear Foot

Select Granular Fill for Aluminum Pipe

Make the following changes to the Standard Specifications of January 2, 1990.

Page 2-10

Under §203-2.02 C. *Select Granular Fill and Select Structural Fill*, delete the subsection and *replace* it with the following:

"§203-2.02 C. *Select Granular Fill and Select Structural Fill*. Materials furnished under these items shall be suitable and conform to the following requirements:

1. Gradation. Except when used as backfill material for aluminum pipe with Type IR' corrugations (Spiral Rib Pipe), the material shall have the following gradation:

Sieve Size	Percent Passing by Weight
4 inch	100
No. 40	0 to 70
No. 200	0 to 15

When used as backfill for Corrugated Aluminum Pipe, Type 1R (Spiral Rib Pipe) 100% of the material shall also pass the two inch sieve.

2. Soundness. The materials shall be substantially free of shale and soft, poor durability particles. Where the State elects to test for this requirement, a material with Magnesium Sulfate Soundness Loss exceeding 30% will be rejected.

3. Composition. When used as backfill for aluminum pipe, the material shall be free of portland cement or portland cement concrete."