Appeal to Standards Council

Item #125 - Section 715.3 of the 2021 Edition of the Uniform Plumbing Code (“UPC”)

Appellant: Sheila Joy
Executive Director
NASSCO, Inc.
2470 Longstone Lane, Suite M
Marriottsville, MD 21104
410-442-7473

Statement:

This appeal is being made to reverse the decision by the Plumbing Technical Committee (“**TC**”) at the Association Technical Meeting held September 24, 2019, to reject the recommendation made in the comment presented by Jason Walborn on behalf of NASSCO, Inc. and as designee for Joanne Carroll also representing NASSCO, Inc. on Proposal Item No. 125 to delete text without substitution in Section 715.3 as previously approved by the TC during the code development for the 2021 UPC.

Grounds for Appeal:

Throughout the 2021 UPC code development process, the TC has repeatedly rejected, without technical or safety justification, the proposal and comments on Section 715.3 Existing Sewers. If the deletion of text without substitution was made it would correct an internal conflict within the code, return the benefit to the public that was previously available to choose a replacement method for existing cast iron building sewers to address unsanitary conditions while lessening excavation and other construction hazards, and remove restrictions that were made during the 2018 and 2021 UPC development without technical or safety justification for such action.

Relief Requested:

Approve the proposed revision:

715.3 Existing Sewers. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216*, ASTM F2561, ASTM F2599, or ASTM F3240**. ~~Cast-iron soil pipes and fittings shall not be repaired or replaced by using this method aboveground or belowground.~~ ~~Replacement using cured-in-place pipe liners shall not be used on collapsed piping or when the existing piping is compromised.~~

**The italicized standards in the proposed revision were approved (Item #126) during the development process of the 2021 UPC. This appeal does not object to the inclusion of these standards as approved and shown above. Arguments included in this appeal are not affected by the addition of these standards as approved and shown above.*

Background:

The 2018 Edition of the Uniform Plumbing Code (the “**2018 UPC**”) amended Section 715.3 to ban the use of trenchless methodology, including cured-in-place pipe (“**CIPP**”), to repair or replace existing building sewer and building storm sewer pipe made of cast iron soil pipe, which was permitted in prior versions of the UPC. Throughout the development cycle of the 2021 Edition of the Uniform Plumbing Code (the “**2021 UPC**”) proposals and comments were rejected without legitimate substantiation. The following Substantiation and Detailed Argument sections detail the adoption process of the restrictive

{S0498810.1}

language and the resulting internal conflict and inconsistencies, as well as technical and scientific substantiation disproving the erroneous and misleading statements advanced in a desperate attempt to substantiate the retention of the prohibitive language in the 2021 UPC.

SUBSTANTIATION

Technical Merit: The language added to Section 715.3 during the standards development process resulting in the 2018 UPC and maintained throughout the 2021 UPC development process creates a ban on the use of any trenchless renewal method to repair or replace existing building sewer and building storm sewer pipes made of cast iron, and should be removed from the UPC for the following reasons:

1. There is no technical or scientific basis to support or substantiate the language added to Section 715.3 of the 2018 UPC. The only substantiation put forth is vague and ambiguous and even a cursory review of the support for the substantiation, reveals that the substantiation is illusory. Rather, studies show that CIPP provides a fully structural replacement pipe that complies with Section 102.4 of the UPC, meets requirements for internal and external loads, and can provide increased flow capacity over the existing pipe.
2. The language in Section 715.3 of the 2018 UPC and the 2021 UPC in development is internally inconsistent, causing IAMPO and therefore the American National Standards Institute ("**ANSI**") to have a standard that in one sentence approves the use of trenchless methodology and materials to replace pipe in accordance with ASTM F1216, which is the standard practice for CIPP, then in the next two sentences prohibits the use of CIPP to repair or replace both cast iron soil pipes and fittings as well as collapsed and compromised pipes. The referenced mandatory standard, ASTM F1216, specifically addresses the use of inversion and curing of resin-impregnated tube for the reconstruction of pipelines and conduits and provides design considerations for use with partially and fully deteriorated pipe. The language added to Section 715.3 of the 2018 UPC is directly inconsistent with the practices permitted by prior versions of the UPC; in addition, it is illogical to permit the replacement in one sentence and then prohibit the replacement in the next sentence. Further, prohibiting use of trenchless methodology on cast-iron soil pipes and fittings aboveground is inappropriate given that Section 312.3 of the UPC requires that building sewers and building storm sewers be buried and Section 715.3 only applies to existing building sewers and building storm sewers.
3. Adoption of the language in Section 715.3 of the 2018 UPC violated IAPMO's Regulations Governing Committee Projects (the "**Regulations**"). Further, the standard developed during the process that violated the Regulations created an unreasonable restraint on trade and could expose both IAPMO and the individuals involved in the standards development process to liability for violations of federal and state antitrust laws. Putting the antitrust matter and other violations aside, the manner in which the standards development process was transacted creates an appearance of impropriety and may cause ANSI and third parties to question the validity of all standards promulgated by IAPMO.

The amendment of Section 715.3 of the 2021 UPC is of an emergency nature and requires prompt action for the following reasons:

1. The language proposed in this Appeal will correct a circumstance that resulted in the adoption of language without adequate technical (safety) justification for the action.
2. The language proposed/approved by the TC for Section 715.3 of the 2021 UPC contains an internal conflict and is internally inconsistent.

3. The language proposed/approved by the TC for Section 715.3 of the 2021 UPC bans a benefit that was previously available to the public to choose a replacement method for *existing cast iron building sewers* to address unsanitary conditions while lessening excavation and other construction hazards.
4. The language in Section 715.3 of the 2018 UPC was adopted in violation of IAPMO's rules and regulations.

DETAILED ARGUMENT

Development/Adoption of the Challenged Language

The objectionable language in Section 715.3 was proposed and adopted during the triennial redevelopment process for the 2018 UPC. Two proposals to amend the language in Section 715.3 were submitted to the TC during that process, Item # 204 and Item # 205 in the 2016 Report on Proposals. Item # 204 was submitted by Bill LeVan, a Member of the TC and a representative of the Cast Iron Soil Pipe Institute ("**CISPI**"), a Manufacturer interest classification/category. Item # 205 was submitted by John A. Parizek of the Minnesota Department of Labor and Industry, representing the Minnesota Plumbing Board.

Item # 204 proposed the following change:

> **715.3 Existing Sewers.** Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216. <u>Cast iron soil pipes and fittings shall not be repaired or replaced by using this method aboveground or belowground.</u>

Mr. LeVan provided the following substantiation for the proposed change:

> The ASTM and CISPI standards for cast iron soil pipes and fittings prohibit the repair of the cast iron soil pipes and fittings by any means. ASTM F1216 allows for repair of partially deteriorated piping and would conflict with the manufacturer's instructions and the product standards.

Item # 205 requested the following revision:

> **715.3 Existing Sewers**. Replacement of existing building sewer and building storm sewers using <u>cured-in-place pipe lining</u> trenchless methodology and materials shall be installed in accordance with ASTM F1216. <u>Replacement using cured-in-place pipe liners shall not be used on collapsed piping or when the existing piping is compromised to a point where the installation of the liners will not eliminate hazardous or insanitary conditions.</u>

The TC amended the Proposal submitted by Mr. Parizek and adopted the following language that includes the language proposed by Mr. LeVan:

> **715.3 Existing Sewers**. Replacement of existing building sewer and building storm sewers using ~~cured-in-place pipe lining~~ trenchless methodology and materials shall be installed in accordance with ASTM F1216. <u>Cast iron soil pipes and fittings shall not be repaired or replaced by using this method aboveground or belowground.</u> Replacement using cured-in-place pipe liners shall not be used on collapsed piping or when the existing piping is compromised ~~to a point where the installation of the liners will not eliminate hazardous or insanitary conditions~~.

The Committee Statement regarding the amendment to Item # 205 perpetuated the incorrect bases cited for substantiating the change proposed by Item # 204 and suffers from the same deficiencies, discussed in the next section. The Committee Statement provides:

> The modification adds language that cast iron soil pipe and fittings shall not be repaired or replaced by this method. ASTM F1216 allows for repair of partially deteriorated piping and would conflict with the manufacturer's instructions and the product standards.

Thereafter, the language adopted by the TC was approved and published in the 2018 UPC:

> **715.3 Existing Sewers.** Replacement of existing building sewer and building storm

> sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216. Cast-iron soil pipes and fittings shall not be repaired or replaced by using this method aboveground or belowground. Replacement using cured-in-place pipe liners shall not be used on collapsed piping or when the existing piping is compromised.

The Language added to Section 715.3 Lacked both Technical and Scientific Bases

The Proposal submitted by Mr. LeVan, acting on behalf of CISPI, provided no technical or scientific support or justification for the proposed language. Instead, Mr. LeVan's substantiation for Item # 204 claims that unidentified ASTM and CISPI standards "prohibit the repair of cast iron soil pipes and fittings by any means" and that ASTM F1216 would "conflict with the manufacturer's instructions and the product standards."

Mr. LeVan's substantiation fails to provide any analysis or explanation of the alleged prohibition or conflict or even identify the standards and instructions he is relying upon; his substantiation simply states that the prohibition and conflict exist. In light of the lack of specificity in Item # 204, we assume Mr. LeVan's substantiation referred to ASTM and CISPI referenced standards incorporated into the UPC and not ASTM and CISPI standards not otherwise part of the UPC. The ASTM and CISPI standards that are incorporated into the UPC and relate to cast iron soil pipes and fittings are ASTM A74, ASTM A888, and CISPI 301 (collectively, the "**Referenced Standards**"). ASTM A74 contains the following statement: "Pipe and fittings shall not be patched, filled, or welded to correct cosmetic or material defects that occur during the course of manufacturing." ASTM A888 and CISPI 301 contain the following statement: "Pipe and fittings shall not be patched, filled, or welded by the manufacturer to repair cosmetic or material defects that occur during the course of manufacturing." The prohibitions in the Referenced Standards apply only to cosmetic and material defects that occur during the course of manufacturing, while Section 715.3 specifically addresses the repair and replacement of existing sewer pipes. Existing cast iron soil pipe could suffer from many defects that require repair that are unrelated to the manufacturing process, such as corrosion, deterioration, and damage. Expanding a prohibition on correcting manufacturing defects prior to the installation of cast iron pipes and fittings to a prohibition covering any defect in existing pipes and fittings is a major step that should only be taken if complete and accurate information is provided and there are technical, scientific, or safety reasons justifying the need for such prohibition. In this instance, no such rationale or justification was provided. The only substantiation provided in Item # 204 was a vague and ambiguous statement, which upon even a cursory review of the Referenced Standards, clearly reveals that the substantiation is erroneous.

Despite the technical and scientific deficiencies of Mr. LeVan's proposal, the TC accepted Item # 204 as submitted. Furthermore, the TC amended Item # 205 and provided a Committee Statement that failed to provide any legitimate technical or scientific rationale for its decision. Instead, the TC provided a vague and misleading statement that perpetuated the inaccuracies contained in the substantiation for Item # 204.

Contrary to the actions of the TC, technical support exists for the effective repair of cast iron soil pipes through the use of CIPP. CIPP is a proven rehabilitation method that has been used for over four decades and its effectiveness for use with rehabilitating pipe, including cast iron pipe, has been substantiated by numerous independent studies, including studies commissioned by the United States Environmental Protection Agency. When CIPP is installed in accordance with ASTM F1216, as required by Section 715.3, it replaces the existing pipe by forming a new pipe within the existing pipe. CIPP does not merely cover-up imperfections or defects, CIPP replaces deteriorated or compromised pipe with a fully structural pipe capable of meeting the internal and external load requirements applicable to the original pipe. An illustration of CIPP is attached to this Appeal as <u>Attachment 1</u>. In addition, CIPP is not only effective, it can be more economical, safer, and less intrusive than open trench methods of pipe repair or replacement. Because it can be more economical and less intrusive, it reduces the burden on consumers to repair or replace pipes, especially when access is difficult or disruptive, increasing the probability that consumers repair pipes before serious sanitary or environmental damage occurs.

During the development process of the 2021 UPC, the TC's Committee Statement and Explanation of Affirmative Vote included in the 2019 UPC Report on Comments in support of the Committee Statement states that the use of CIPP would "violate the ASTM dimensional standards" and would "violate the ASTM A888 and ASTM A74 dimensional standards". This "dimensional standards argument" was not advanced prior to the issuance of the 2019 UPC Report on Comments and was utilized to reject comments which were intended to correct the language included in Section 715.3 of the 2018 UPC before the identical language is included in the 2021 Edition of the UPC. Once again, the TC failed to explain its decision, rather provided a vague statement that the use of CIPP would violate ASTM dimensional standards without any additional explanation.

Furthermore, the assertion that utilizing CIPP to rehabilitate cast iron soil pipes violates the ASTM dimensional standards is incorrect. There are no required dimensional standards prescribed by either the UPC or the Referenced Standards for pipe rehabilitated by CIPP. In fact, existing cast iron pipes often fail to meet the dimensional standards of new cast iron pipe due to deterioration and corrosion. In addition, aged cast iron building sewers and building storm sewers can be subject to deterioration and corrosion with sedimentation and encrustation that negatively impact its hydraulic capacity. Replacement of existing cast iron pipe with CIPP is shown to improve flow capacity and inhibit internal corrosion. *See* "Determining Rehabilitated Sewer Flow Capacity" (attached to this Appeal as Attachment 2). Pipe replaced with CIPP, even despite a reduced interior diameter, can result in equal or greater flow capacity than the existing cast iron pipe based on industry accepted gravity flow rate equations and friction factors. Moreover, pipes which require rehabilitation have generally lost wall thickness during the cleaning and preparation process. Following CIPP installation, the internal surface of the pipe is improved, which positively improves hydraulics, alleviating concern that the flow capacity of the pipe could be insufficient and ensuring the operational capabilities of the CIPP replacement pipe meet Drainage Fixture Unit requirements of the original cast iron pipe.

The restrictions contained in Section 715.3 were further discussed during the Association Technical Meeting on September 24, 2019, for the development of the 2021 UPC. During the meeting an argument was raised that there is no need to revise the language of Section 715.3 because CIPP can be approved as an Alternative Material under Section 301.3. Whether or not CIPP is able to be approved as an Alternate Material under Section 301.3 is immaterial because it does not change the fact that the current standard was promulgated by the TC without any technical or scientific merit and in violation of the Regulations. Attempts to have CIPP approved to replace cast iron pipe under as an alternative material are negated due to the ban in Section 715.3 given that Section 102.1 of the UPC requires that "where this code, applicable standards or the manufacturer's installation instructions conflict, the more stringent provisions shall prevail". Obviously, a complete ban, such as the ban on CIPP in Section 715.3, is the most stringent provision.

The continued opposition to attempts to correct the language of Section 715.3 and the continued advancement of additional unsubstantiated and meritless arguments to rationalize the use of the prohibitive language in Section 715.3 are astounding. Each additional argument is a desperate attempt to save language which should never have been adopted. The proposed language in this Appeal corrects the erroneous language in Section 715.3 of the 2021 UPC; and provides for a standard that is based on technical and scientific justification, rather than on mere assertions of a TC Member or others.

Section 715.3 contains Internal Inconsistencies

The language in Section 715.3 contains internal inconsistencies which are readily evident when each sentence of the Section is examined. The first sentence provides: "Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216." ASTM F1216, a Referenced Mandatory Standard in the UPC since the 2015 Edition, titled "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube", authorizes use of CIPP to replace building sewer and building storm sewers upon compliance with ASTM F1216. ASTM F1216 is the Standard Practice which outlines the industry standard for design and application of CIPP for the rehabilitation of both partially and fully deteriorated pipe. ASTM F1216 states that this method of pipe reconstruction "can be used in a variety of gravity and pressure applications such as sanitary sewers [and] storm sewers" and notably does not limit its application based on the material of the existing pipe.

The second sentence of Section 715.3 of the UPC provides: "Cast-iron soil pipes and fittings shall not be repaired or replaced by using this method aboveground or belowground." Thus, this sentence prohibits the exact method of repair which was authorized in the first sentence of Section 715.3. Furthermore, this sentence prohibits the use of this method "aboveground". "Aboveground" cast iron building sewer and building storm sewer pipes are already prohibited by Section 312.3 of the UPC, which requires that building sewers be buried. Therefore, there is no legitimate rationale for the inclusion of "aboveground" in Section 715.3, which only applies to building sewers and building storm sewers. The prohibition on trenchless methodology to repair or replace "aboveground" cast iron pipes may be a manipulative attempt to affect sections of the UPC that deal with aboveground piping by including superfluous language in Section 715.3.

The third sentence of Section 715.3 of the UPC provides: "Replacement using cured-in-place pipe liners shall not be used on collapsed piping or when the existing piping is compromised." This language bans the use of one type of trenchless methodology, CIPP, on collapsed or compromised piping, the exact type of rehabilitation method covered by ASTM F1216, the referenced standard incorporated into Section 715.3 by the first sentence. In fact, ASTM F1216 expressly contemplates scenarios when CIPP will be utilized to repair pipes which have been crushed or collapsed. ASTM F1216 classifies crushed and collapsed pipes as "obstructions". ASTM F1216 permits the removal of obstructions by "conventional sewer cleaning equipment" or a "point repair excavation" to remove and/or repair the obstruction. Furthermore, the term "compromised" is extremely vague and is not otherwise defined. It is questionable whether every pipe in need of repair would be considered "compromised". However, ASTM F1216 explicitly permits the repair of fully deteriorated pipe, which is pipe that is not structurally sound. Due to the vagueness and ambiguity of the TC's adopted language, it is impossible to determine when the use of CIPP is permitted and when the use of CIPP is prohibited. Again, these prohibitions included in the third sentence are in direct contradiction to the first sentence of Section 715.3 of the UPC; the resulting effect is that ASTM F1216 is rendered void.

IAPMO's Regulations were Violated during the Adoption of Section 715.3 of the 2018 UPC

Mr. LeVan Violated IAPMO's Regulations

The substantiation for Item # 204 (and the TC's reliance on that substantiation in its Committee Statement supporting the adoption as amended of Item # 205) violated IAPMO's Regulations and should be considered invalid. Mr. LeVan, as a Member of the TC and a participant in IAPMO's code development process, was obligated to:

- act honestly and in good faith, Regulations, §3-3(b);
- disseminate all information necessary to enable full and fair consideration of all points, *Id.* at §3-3(c);
- not withhold information, *Id.* at §3-3(d);
- be candid and forthcoming about any weakness in their position, *Id.* at §3-3(f);
- base all advocacy, voting, and other standards development activities on sound technical and scientific bases and should act in the interest of safety and IAPMO's other purposes and goals. TC Members are not appointed to the TC to further their business and commercial interests, *Id.* at §3-1(f); and

- refrain from disseminating false or misleading information or from withholding information necessary to a full, fair, and complete consideration of the issues before their committee. *Id.* at §3-1(h).

Mr. LeVan failed to abide by each of the cited provisions. He merely informed the TC that unidentified standards prohibited repair or replacement of cast iron soil pipes and fittings by any means and alleged that allowing repair or replacement would conflict with the manufacturer's instructions and product standards. He did not provide the TC with the standards, manufacturer's instructions, or product standards. He did not advise the TC that the standards he may be referring to applied to manufacturing defects, not defects arising over time to a cast iron soil pipe or fitting in use. The submission of Item # 204 with the substantiation characterizing the Referenced Standards as prohibiting the repair or replacement of cast iron soil pipes and fittings by any means and omitting or neglecting to advise the TC that the prohibition of repair applies only to manufacturing defects is at best misleading and not in good faith, if not intentionally deceptive and dishonest.

At the time the TC considered Item # 205, Mr. LeVan, a Member of the TC, was presented with a second opportunity to clarify the incorrect impression he created regarding the Referenced Standards. Despite being given this second opportunity, Mr. LeVan failed to (i) encourage and facilitate the full and open dissemination of all information necessary to enable full and fair consideration of all points of view; (ii) not withhold information; (iii) be candid and forthcoming about any weaknesses in his position; (iv) base all advocacy, voting, and other standards development activities on sound technical and scientific bases and act in the interest of safety and IAPMO's other purposes and goals; and (v) refrain from disseminating false or misleading information or from withholding information necessary to a full, fair, and complete consideration of the issues before the TC.

Mr. LeVan represented CISPI during his submission of Item # 204 and during the TC's consideration of Item # 204 and Item # 205. His misapplication of the manufacturer's instructions and product standards to require "like kind" replacement rather than repair of the manufacturer's products by trenchless methodology can be described as self-serving, especially without technical support for the requirement. The modifications to Section 715.3 directly benefited CISPI by eliminating one area of competition to CISPI's members through excluding the repair of cast iron soil pipes and fittings by trenchless methodology. This action was in direct contravention to the Regulations, which state, "TC Members are not appointed to the TC to further their business and commercial interests."

The Technical Committee Violated IAPMO's Regulations

The TC accepted Item # 204 as submitted by a unanimous vote and accepted Item # 205 as amended by the TC. The Committee Statement provided by the TC did not identify the technical reason for the TC's action and was not "sufficiently detailed, so as to convey the TC's rationale for its action" as required by the Regulations. *See* Regulation §4-3.5.1. Adopting language in a standard code that creates a prohibition on the use of CIPP for any repair or replacement of cast iron soil pipes and fittings is a step that should only be taken if there are technical, scientific, or safety reasons clearly supporting the need for such prohibition. In the case of the adoption of Section 715.3 of the 2018 UPC, it appears the TC (i) did not review the vaguely referenced standards or perhaps even know what standards were being referenced by Mr. LeVan, (ii) did not make an independent determination that the vaguely referenced standards contained the prohibition as Mr. LeVan claimed, and (iii) did not question why the manufacturer's instructions prohibiting the repair of the manufacturer's product should be persuasive to the TC's action. Obviously, the manufacturer benefits if its instructions allow only for replacement of its product rather than repair – the manufacturer sells more product – hardly an unbiased, scientific, or technically based substantiation.

After the TC acted on the two proposals affecting Section 715.3, a public comment was submitted to the TC. Hugo Aguilar, on behalf of the American Supply Association, submitted a

Comment attempting to revise the language of Section 715.3 to provide that CIPP could be used to repair or replace cast iron soil pipes and fittings in accordance with the requirements of ASTM F1216. The amendment by the TC to the language proposed by Mr. Aguilar completely changed the nature of Mr. Aguilar's Comment by revising the language to prohibit the use of trenchless methodology, including CIPP, to repair or replace cast iron soil pipes and fittings. To support this action the TC relied on the same flawed substantiation it utilized when approving the proposals (Item # 204 and Item # 205).

Neither Mr. LeVan nor the TC have ever provided legitimate substantiation for the language added to Section 715.3 of the 2018 UPC despite being granted several opportunities. The only rationale provided was the oft recited "conflict with the manufacturer's instructions and the product standards" language. Mr. LeVan and the TC failed to cite or even describe the "manufacturer's instructions" or "product standards" to which they referred. Mr. LeVan and the TC failed to provide any explanation whatsoever in regard to how CIPP installed in accordance with ASTM F1216 "conflict[s]" with the manufacturer's instructions and the products standards. These are among the most basic details one would expect to find in a Committee Statement for the rationale behind implementing a change to the language of a Standard, particularly when the change bans the use of an effective, economical, and safer method to repair or replace cast iron soil pipes and fittings.

During the development of the 2021 UPC, Proposal #125 was submitted as part of an ongoing effort to correct the inconsistencies, internal conflict, and lack of technical substantiation prior to the inclusion of this restrictive language that is now published in the 2018 UPC. The Proposal and subsequent public comments in support of the Proposal were all rejected based on fallacious rationale. Throughout the development process of the 2021 UPC, those in support of the prohibitive language in Section 715.3 advanced misleading and deceptive statements and information. Neither the TC nor those making statements during proceedings provided any legitimate substantiation, technical or otherwise, to reject the Proposal or public comments. Rather, the TC including a regional representative of CISPI, has continued to provide meritless "Substantiation".

IAPMO's stated purpose is "to promote the interests of the arts and science of plumbing and mechanical building codes, and the officials in connections therewith, and to promote the interests of all persons whose responsibility it is to interpret plumbing and mechanical building laws and practices to the public, and those other purposes specified in the Association's Article of Incorporation." Unfortunately, the TC has failed to follow IAPMO's Regulations and to abide by IAMPO's mission to promote and protect the public's health and safety and to implement comprehensive plumbing systems around the world. Instead, the IAPMO standards development process was utilized as a means to benefit one segment of the industry to the detriment of the public and other segments within the industry.

Section 715.3 of the 2021 UPC under development creates an unreasonable restraint on trade and constitutes unfair methods of competition and unfair or deceptive acts or practices, thus, exposes IAPMO to potential antitrust litigation or enforcement action. By prohibiting the use of trenchless methods to repair or replace cast iron soil pipes and fittings in existing building sewers and building storm sewers, Section 715.3 decreases the efficiency of the competitive process involved in the rehabilitation of existing cast iron soil pipes and fittings in building sewers and building storm sewers by artificially limiting consumer options without a scientific, technical, or safety justification that could support such a restraint on trade. Owners of cast iron soil pipes and fittings in building sewers and building storm sewers, such as individuals, small business, municipalities, utility companies, and state governments are denied use of CIPP, a more efficient, less expensive, and safer method of repairing or replacing those pipes and fittings. Rather, because of Section 715.3, those owners are restricted to replacement of "like kind" pipes and fittings, which involve increased time and expense, as well as increased safety concerns and dangers associated with open trench and other construction hazards.

This Appeal seeks to restore consumer choice and eliminate the unsupported, anti-competitive restriction imposed by Section 715.3 of the 2021 UPC under development.

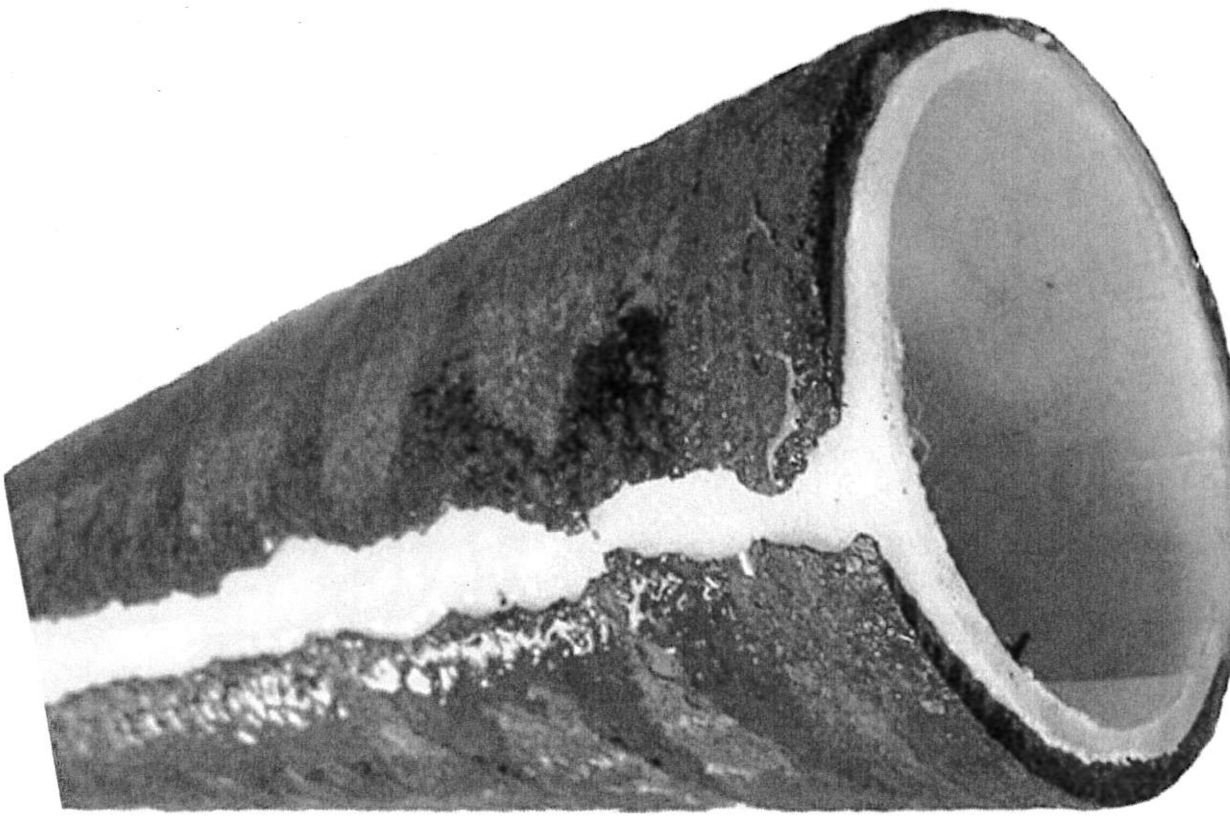
I hereby grant IAPMO all and full rights in copyright in the Proposed Language, and I understand that I acquire no rights in any publication of IAPMO in which this Proposed Language appears in this or another similar or analogous form.

Submitter Sheila Joy

Signature: ____________________ Date: October 14, 2019

Sheila Joy, NASSCO Executive Director

Attachment 1



Attachment 2

Determining Rehabilitated Sewer Flow Capacity

By the ASCE Task Committee on Flow Characteristics of Pipeline Infrastructure Committee of the Pipeline Division

(Reviewed by the Pipeline Division)

Abstract: The flow capacity of existing sanitary and storm sewers is a significant issue when making decisions on the optimal method of rehabilitation. At times the resulting flow capacity is an important factor during the design of a sewer rehabilitation program. In the United States, the flow capacity is usually determined using the Manning formula, which includes the empirical parameter n. This committee report discusses the principal elements of the Manning formula, coefficient and field variables that contribute to the selection of values for n, and provides typical values for n for mature sewers in need of rehabilitation and for mature sewers rehabilitated with many currently available rehabilitation materials. The report then discusses a rationale for selecting a design n within a range of values and predicting the resulting change in flow capacity of the sewer. A field example is given where n values were measured. The report is intended to provide guidance to engineers making decisions related to rehabilitation of gravity flow sewers.

INTRODUCTION

The purpose of this technical discussion is to give guidance to the designer in determining any change in pipe flow capacity in sanitary and storm sewer rehabilitation projects. This paper is not intended to be used for new sewer construction; it is to be used only to determine the impact of rehabilitation of old pipes on flow capacity. Variables are discussed that will affect the flow factor selected for both the pipe to be rehabilitated and the pipeline rehabilitation process to be utilized. This will aid the designer in determining the impact of the rehabilitation project on the flow capacity of the system. Whenever possible, a more accurate method of estimating flow in the existing pipe is through actual field measurements. This method removes doubt from the quantification of the existing flow and may provide better information in selecting a pipe rehabilitation methodology.

The hydraulic design of sanitary sewers and storm drains in the United States is generally based upon the "Manning formula." This formula is widely used today due to its simplicity and satisfactory accuracy. Although the Manning coefficient, n, is often interpreted as a characteristic of "channel roughness," it is also dependent upon coefficient and field variables. As an empirically derived indicator of overall pipe or channel flow characteristics, it is fitted to the equation to make the formula reflect observed flow results. This application of a factor is true for all flow equations currently used.

Turbulent flows lose energy from two sources: losses due to boundary shear and losses due to changes in boundary geometry. These losses are due to induced turbulence.

As sewers deteriorate, the Manning n factor is affected by changing boundary conditions and the resulting change in turbulence loss. Rehabilitating sewers can dampen effects due to changes in boundary geometry and reduce turbulence due to boundary shear, thus increasing flow. This paper provides guidance to engineers in the estimation of energy loss and the resulting Manning n factor for mature sewers and pipeline rehabilitation materials.

This paper was written with the following assumptions:

- The sewer is mature, at least 2–5 years old.
- The sewer has a nominal degree of sliming.
- The sewer operates with self-cleaning velocity.
- The sewer is relatively clean with little deposition of foreign materials or physical obstructions.
- The sewer operates at uniform or gradually varied flow.
- The channel or pipe has a constant shape with a constant alignment or a curvature sufficiently small to be considered a constant alignment.
- The slope of the pipe and vertical curvature are small enough for the flow to be considered gravity flow.
- The n value chosen may vary up to 30%. This is generally acceptable because, in many cases, it is not possible to predict the long-term capacity requirements or existing flow rate within 30%.
- Sanitary sewers are not designed to flow full, based on design flows. A variation in n is easily covered by the reserve flow capacity above the flow line.

ELEMENTS OF THE MANNING FORMULA

Shown next is the most commonly used version of the Manning formula

$$Q = VA = (k/n)R^{2/3}S^{1/2}A \qquad (1)$$

where V = velocity, m/s (ft/sec); R = hydraulic radius, m (ft); n = Manning coefficient; k = 1.000 (SI units) and 1.486 (in.-lb units); S = slope, m/m (ft/ft); A = cross-sectional flow area, m^2 (sq ft); and Q = flow, m^3/sec (ft^3/sec).

Following is a more detailed discussion of some elements:

n: The Manning coefficient is an estimation of a pipe's interior surface frictional characteristics and is used in designing for gravity flow. This number is empirically derived through laboratory and field observations. It is a range of values dependent upon pipe material, depth of flow, pipe diameter, and velocity. Some variables cause n to increase, while other variables cause n to decrease.

R: The hydraulic radius denotes the relationship between the cross-sectional area of the flow system and its wetted perimeter. It is obtained by dividing the cross-sectional flow area by the length of the internal pipe perimeter in contact with the pipe flow (i.e., wetted perimeter)

$$R = A \div P, \text{ m (ft)} \qquad (2)$$

where A = flow cross-section, m^2 (sq ft); and P = wetted perimeter, m (ft).

Note. Discussion open until November 1, 1996. To extend the closing date one month, a written request must be filed with the ASCE Manager of Journals. The manuscript for this paper was submitted for review and possible publication on November 20, 1995. This paper is part of the *Journal of Transportation Engineering*, Vol. 122, No. 3, May/June, 1996. ©ASCE, ISSN 0733-947X/96/0003-0258–0261/$4.00 + $.50 per page. Paper No. 11235.

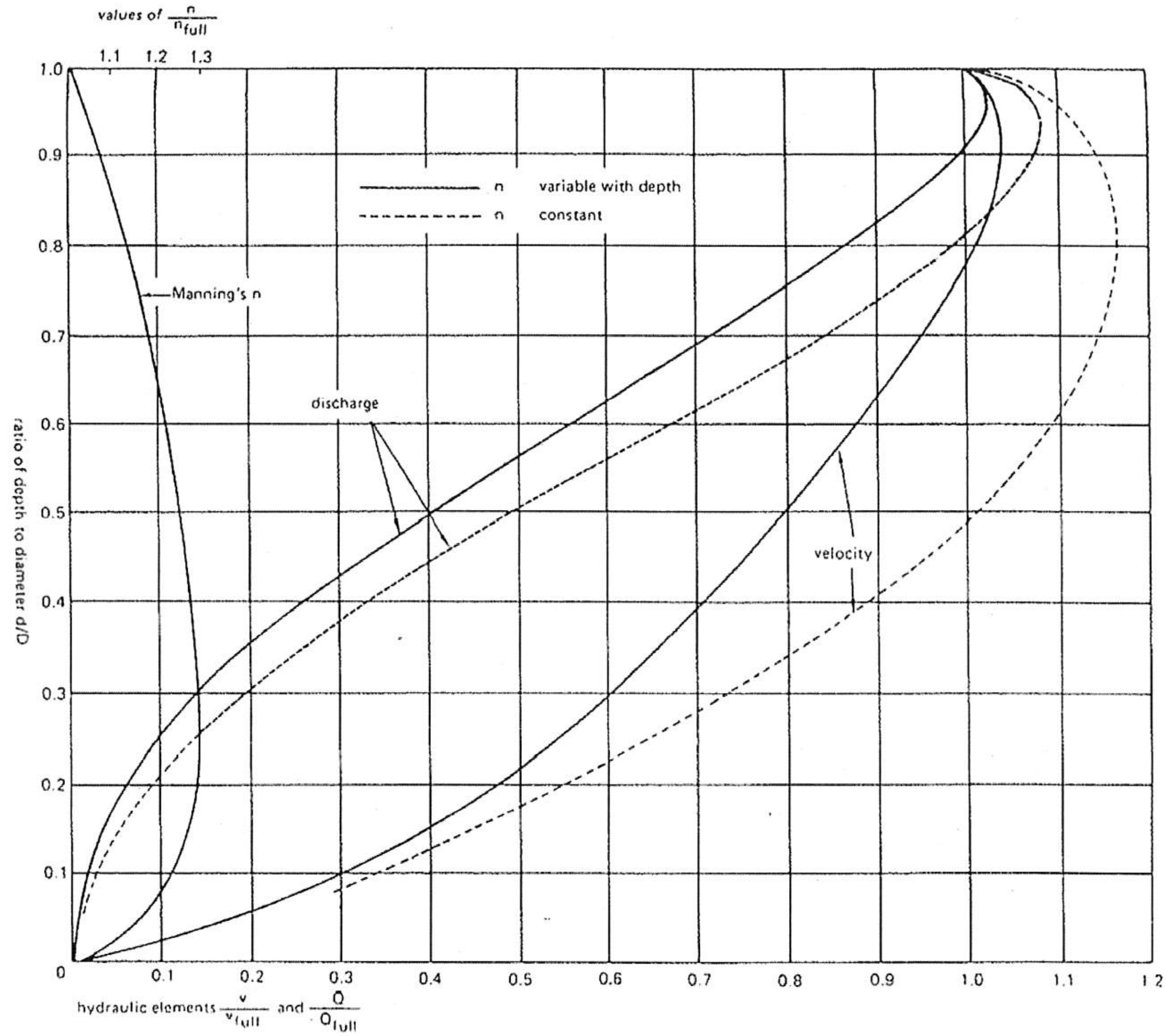


FIG. 1. Hydraulic Properties of Circular Sewers

V: The average velocity of flow is given in m (ft) per sec and represents an average over the wetted cross section.

S: This is the slope of the energy-gradient. In uniform, open channel flow, it is essentially equal to the slope of the pipe. It is a dimensionless number or it may have units of m/m (ft/ft). In the formula, it is normally expressed as a decimal value without units.

COEFFICIENT VARIABLES

As previously stated, n is not a singular value, but rather a coefficient that exhibits a range of values around a practical initial design value for mature but relatively clean or rehabilitated pipes. The increase or decrease of n from the initial design value is affected by several variables such as pipe size, depth of flow, the slope and velocity of flow and field conditions as described later.

Pipe diameter influences n. Within a 100 mm (4 in.) pipe, the maximum velocity at the flow stream center is influenced by the pipe wall friction 50 mm (2 in.) away, thus increasing the n factor. Within a 1,200 mm (48 in.) pipe, the flow stream center velocity is little influenced by the pipe wall friction 600 mm (24 in.) away. Hence, n should slightly decrease with increasing pipe size or diameter for equal depths of flow as a percentage of diameter.

The depth of flow will affect n. The depth of flow increases the wetted perimeter, changing the frictional contact surface, which influences the velocity and the n value. The Manning's n generally increases at shallow, partial flow conditions, as compared to deep or full flow conditions. This physical effect is called the "Camp relationship" (Camp 1944, 1945) and is demonstrated by Fig. 1.

The Manning coefficient may also vary with average velocity. Because of relatively low velocities in gravity sewers, this is generally not significant.

In summary, n may vary up to 30% from its initial hydraulic design value for clean, aged sewers. The coefficient, n, exhibits a zone or band of values, not a point, and should be evaluated for each situation. It varies with pipe size, pipe material, depth of flow, flow conditions, and field conditions.

FIELD VARIABLES

Based on an initial n design value, the designer may further adjust n to accommodate field variables which may disrupt flow, reduce velocity, and increase n.

Variations of *n* Due to Variable Flow Conditions

Based on the actual flows and the Camp relationship previously indicated, n may rise or fall as the depth of flow and/or velocity changes.

Deposition of Sand, Debris, and Foreign Material

Operating sewers encounter deposits from street dirt, construction dirt, or from ground water infiltration conveying soil through cracked pipe or joints. Sanitary and storm sewers can be partially obstructed by bricks, stones, or other debris. This deposition will increase *n*.

Buildup of Slime and Grease on Pipe Surfaces

All pipes slime to a certain degree. Slime is a buildup of bacteria and grease on the pipe wall. While sliming increases the *n* factor, nonporous pipes have less slime buildup than porous pipes. Sliming is also minimized when scouring velocities are induced at least once per day. Although 0.6 m/s (2 ft/sec) has historically been accepted as an adequate scouring velocity, under some circumstances more than 1.2 m/s (4 ft/sec) may be required. Refer to the bibliography ("Minimum velocities" 1942; Camp 1945; "Gravity" 1982) for more details on self-cleaning velocities. The misconception that all sanitary sewers, regardless of pipe material, tend to have similar *n* values due to growth of biological slime on the pipes' inside diameter has been shown to be not valid (Harris 1993).

Loss of Hydraulic Capacity Due to Pipe Ring-Deflection

The loss of flow capacity in flexible pipes up to a ring deflection of 10% is small. Walker (1989) reports a 2% loss at 10% deflection. However, Erdos (1987) discusses hydraulic problems such as insufficient freeboard at deflections of 7 1/2% or greater.

Poor Alignment and Grade Due to Settlement or Lateral Soil Movement

All pipes are subject to soil movements. Segmented, jointed pipes are more subject to displacement of individual joints. This occurrence tends to increase *n* due to flow disruption and induced turbulence.

Open or Offset Joints

For jointed pipes, the induced turbulence at each joint causes *n* to increase, especially over time where joints can become open or offset. Although welded joint pipes and jointless rehabilitation products are not subject to open joints, internal weld bends and wrinkling can increase the *n* factor.

Tree Root Infestation through Deteriorated Joints or Cracks

Tree roots seek available water from leaking or cracked sewers. The fibrous root structures impede sewage flow while constricting cross-sectional flow areas, causing the *n* value to increase.

Pipe Materials

Traditional sewer and storm drain pipe materials include concrete, polyethylene, clay-tile, brick and mortar, polyvinyl chloride (PVC), ductile iron, corrugated metal, fiberglass, thermoset resin, and steel pipe. Increasing pipe surface roughness and porosity tend to increase *n*.

Aging

The Manning coefficient can increase with time because of changes in pipe geometry and surface roughness and pipe wall deterioration. Aging may be a factor depending upon the pipe material and the corrosiveness of the sewage. The significance of aging can be estimated by physical or closed circuit television inspection.

MANNING *n* COEFFICIENT FOR MATURE PIPE

Table 1 gives *n* values for mature gravity pipes along with average worst case values. The coefficients shown for mature sewers are values that can be used to estimate the percentage of change in flow capacity before and after pipeline rehabilitation. For tight-fitting rehabilitation products that mirror irregularities in the host pipe, a higher *n* for the existing pipe may cause a higher *n* in the finished rehabilitation product.

DETERMINATION OF *n* FOR DESIGN

Based on the case-specific conditions for each sanitary sewer or storm drain to be rehabilitated, begin with the mature design *n* coefficient. Consider the hydraulic elements and field variables pertinent to the specific project and adjust *n* accordingly. For a more conservative design, the designer may approach the worst field conditions. Once a flow coefficient has been selected for the existing pipe, apply a similar technique for estimating the *n* for the rehabilitated pipeline. For example, a relatively clean, mature concrete sewer may have an *n* factor of 0.013. If the pipe is heavily slimed and is suffering from offset joints and misalignment, the *n* factor could be estimated at 0.015. Rehabilitation with slip lining could reduce the *n* factor to 0.010–0.012. Of course, another method for determining the existing pipe flow is through in-pipe flow measurements.

Data collected by the County Sanitation Districts of Los Angeles County further demonstrate this procedure. A 35 year old reinforced concrete pipe with a slope of approximately

TABLE 1. Mature Gravity Pipe *n* Values

Type of Conduit (1)	Mature Sewer Design Values[a] (2)	Average Worst Case Field Values[b] (3)
Polyethylene sliplining	0.010	0.013
PVC	0.011	0.013
Fiberglass	0.010	0.013
CIPP	0.010	0.013
Corrugated ID HDPE	0.022	0.025
Spiral wound PVC	0.013	0.016
PVC fold and formed	0.010	0.013
HDPE deformed	0.010	0.013
Concrete:	—	—
Precast	0.013	0.016
Cast-in-place	0.013	0.017
Concrete box	0.013	0.018
Vitrified clay	0.013	0.015
Glazed brickwork	0.013	0.015
Brick and mortar	0.015	0.020
Cast iron	0.016	0.018
Ungalvanized steel	0.016	0.018
Cement mortar lined ductile iron	0.012	0.017
Corrugated metal/angular helical corrugations (CMP):	—	—
68 × 13 mm (2 2/3 in. × 1/2 in.)	0.024/0.017	0.026/0.020
76 × 25 mm (3 in. × 1 in.)	0.027/0.024	0.029/0.027
127 × 25 mm (5 in. × 1 in.)	0.025/0.023	0.027/0.024
152 × 51 mm (6 in. × 2 in.)	0.035	0.036
229 × 64 mm (9 in. × 2 1/2 in.)	0.035	0.037
Paved invert	0.021	0.024
Fully paved	0.013	0.019

Note: Because field conditions vary widely, the designer must decide which *n* value to use from the range shown.
[a]Expected values when full extent of field variables has occurred.
[b]Typical value with expected worst case field variables.

0.0004 was flowing at a depth of 45–60% of pipe diameter. The 1,980 mm (78 in.) sewer was rehabilitated with 1,830 mm (72 in.) polyethylene slip lining. Flow measurements before and after yielded n coefficients of 0.0146 and 0.0117, respectively. Neither pipe was cleaned prior to measuring flows. With the slope constant, comparison of before and after flow capacity can be determined as shown by

$$\frac{\text{Rehabilitated Flow Capacity}}{\text{Old Pipe Flow Capacity}} = \left(\frac{n_{\text{old pipe}}}{n_{\text{rehab pipe}}}\right)\left(\frac{D_{\text{rehab}}}{D_{\text{old pipe}}}\right)^{8/3} \quad (3)$$

$$1.01 = \left(\frac{0.0146}{0.0117}\right)\left(\frac{1,830}{1,980}\right)^{8/3} \quad (4)$$

where D = inside diameter m (ft).

Even though the diameter was reduced from 1,980 mm (78 in.) to 1,830 (72 in.), the flow capacity remained approximately the same.

In conclusion, this paper addresses the elements of the Manning formula and the coefficient variables that affect the Manning n. Field variables that will allow the designer to better estimate the Manning n are also discussed. Finally, n coefficients are estimated for various pipeline materials along with a rationale for determining rehabilitated pipe to existing pipe flow capacity ratios. Although the Manning n can be a difficult factor to quantify, this discussion should help the designer make better estimations of n factors to be used for design.

ACKNOWLEDGMENTS

Each of the following individuals is a contributing author of this paper: Tony Almeida, Joe Barsoom, Bob Bailey, Timothy McGrath, Lynn Osborn, Jay Schrock, John Struzziery, Harvey Svetlik, and Rick Turkopp.

APPENDIX. BIBLIOGRAPHY

Barnes, H. H. (1967). "Roughness characteristics of natural channels." *Water Supply Paper No. 1847 Prepared for U.S. Geological Survey*, Reston, Va.

Bloodgood, D. E., and Dell, J. M. (1961). "Manning's coefficient calculated from test data." *J. Water Pollution Control Federation*, 33, 176.

Camp, T. R. (1944). "Discussion of 'determination of Kutter's n for sewers partly filled,' by C. Frank Johnson." *Trans., ASCE*, 109, 240.

Camp, T. R. (1945). "Design of sewers to facilitate flow." *Sewer Works J.*, 18, 3.

Chow, V. T. (1959). *Open channel hydraulics*. McGraw-Hill Book Co., Inc., New York, N.Y.

Erdos, L. I. (1987). "Hydraulic design limitations for gravity flexible (nonrigid) plastic pipes flow with a free water surface." *Proc., 1987 Nat. Conf. on Hydr. Engrg.*, ASCE, New York, N.Y., 165.

Fair, G. M., Geyer, J. C., and Okun, D. A. (1966). *Water supply & wastewater removal*. John Wiley & Sons, Inc., New York, N.Y.

"Gravity sanitary sewer design and construction." (1982). *ASCE Manuals and Reports on Engrg. Pract. 60*, ASCE, 67–77; 93–111.

Handbook of channel design for soil and water conservation. (1954). Publ. No. SCS-TP-61, U.S. Govt. Printing Ofc., Washington, D.C.

Harris, L. I., and Oliver, L. J. (1993). "Flow study of in-service sanitary sewers rehabilitated with insitupipe." *Proc., Int. Conf. Pipeline Infrastructure* II, ASCE, New York, N.Y., 129.

"Manning's n-values for alternative pipe materials." (1990). *Highway design manual* and *Hydraulic design of highway culverts*. Calif. Dept. of Transp., Sacramento, Calif., Table 851.2 and HDS No. 5-Appendix B.

"Minimum velocities for sewers." (1942). *J. Boston Soc. of Civ. Engrg.*, 23, 286.

Progress Report of the Task Force on Friction Factors in Open Channels of the Committee on Hydromechanics of the Hydraulics Division. (1963). "Friction factors in open channels." *J. Hydr. Div.*, ASCE, 89(2), 97–143.

Rouse, H. (1950). "Fundamental principles of flow." *Engineering hydraulics*. John Wiley & Sons, Inc., New York, N.Y.

Schmidt, O. J. (1959). "Measurement of Manning's coefficient." *Sewage & Industrial Wastes*, 31, 995.

Walker, R. (1989). "The effects of deflection on sewer hydraulics." *Unibell PVC Pipe News*, 12(1), 8.

Wilcox, E. R. (1924). "A comparative test of the flow of water in 8" concrete and vitrified clay sewer pipe." *Experimental Station Ser. Bull. No. 27*, Univ. of Washington Press, Seattle.