

ASPE Chapter Meeting Integrations with ASPE Education



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Pipe Supports & Restraints

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Learning Objectives

- Be able to identify the difference between field-devised methods and engineered solutions
- Recognize the value and importance of disallowing field-devised methods
- Be able to effectively update plumbing specifications

Content

- Plumbing Specification Intent vs. Implementation
- Field-devised methods vs. engineered solutions
- How to eliminate field-devised methods
- Ideal piping support & restraint options
 - Overhead primary supports – MSS-SP-58/69
 - In-wall secondary supports – ICC/IPC, UPC (IAPMO)
 - No-hub pipe & fitting restraints – CISPI
- Summary
- Assessment

Plumbing Specification Intent vs. Implementation

- Plumbing Specification intent often missed during implementation
 - Not every task can be detailed by specification
 - Attempts to address tasks not detailed:
 - *“All work shall be done in a workmanship-like manner and in compliance with all building codes.”*

Plumbing Specification Intent vs. Implementation

- Vague language like this leaves a plumber with little guidance
 - Encourages field-devised or “make-shift” methods
 - What does a “workmanship-like manner” look like or consist of?

Plumbing Specification Intent vs. Implementation

When left to create solutions without guidance, these are commonly observed results



Plumbing Specification Intent vs. Implementation

- Two interpretations of “workmanship-like manner”
- Which one reflects specification intent?
- Which one would you prefer to see on your project?



Field-Devised Method



Engineered Solution

Field-Devised Methods

Drawback: Time-consuming

1. Locate scrap material (1 min)
2. Measure & cut (2min)
3. Shape to fit (3-5min)
4. Toe-nail in place (1 min)
5. Mount piping (1 min)

Installation Time: 8 – 10 min



Field-Devised Methods

Drawback: Inconsistent methods and results



Field-Devised Methods

Drawback: Subject to potential rejection by inspectors

PLUMBING INSPECTION RECORD CARD					
PLEASE READ CALL ()			PERMIT NO: <u>P00156</u> FOR INSPECTIONS		
Inspection	Date	Inspectors Initials	Inspection	Date	Inspectors Initials
Water Service			Under ground waste / vents		
Waste/Vent Rough-in			Under ground water		
Water Rough-in			Mobile Home/RV connection		
Backflow device			Pool/Hot Tub		
Gas Piping			Final Plumbing		
NOTES:					
UPC 314.5 PIPING, FITURES... SHALL BE ADEQUATELY					
SUPPORTED IN ACCORDANCE W/ THE CODE, MFG'S					
INSTALLATION INSTRUCTIONS, AND AS REQUIRED BY					
THE AUTHORITY HAVING JURISDICTION.					
* CORRECT NOTED DEFICIENCIES AND RESCHEDULE					
INSPECTION.					
24 HOURS NOTICE REQUIRED PRIOR TO NEED FOR INSPECTION					
NO WORK SHALL BE COVERED PRIOR TO INSPECTION AND APPROVAL					
FINAL APPROVAL REQUIRED PRIOR TO OCCUPANCY					
<small>There will be a \$100.00 charge to research and replace this Inspection Card</small>					
WARNING: The removal, mutilation or concealment of this notice prior to being signed below is punishable by fine and imprisonment.					
City Inspector: <u>JFL</u>			Date: <u>9/12/2013</u>		

Field-Devised Methods

- Drawback: May pose Life Safety hazards

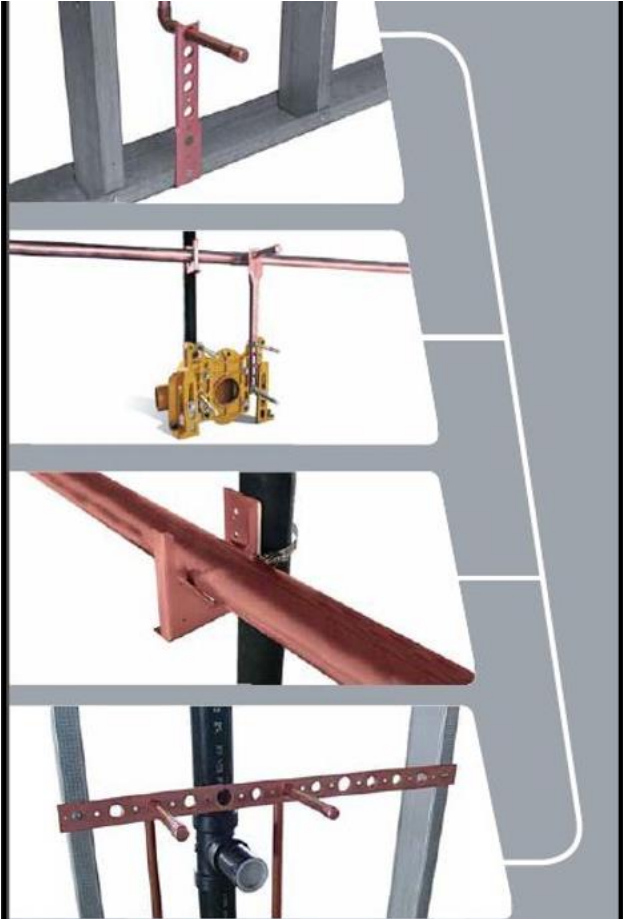


Field-Devised Method



Engineered Solution

How to Eliminate Field-Devised Methods



- Update your Master Specification
 - Incorporate language that disallows field-devised methods:

“All materials shall be new and manufactured for the specific purpose of supporting systems, equipment, pipes and accessories.”

How to Eliminate Field-Devised Methods

- Provide guidance for various installations:
“Hangers for uncovered (uninsulated) copper or brass piping, including medical gases, shall be factory-applied plastic-coated steel band similar to [Mfg.'s Name] [Model #] or copper plated.”



How to Eliminate Field-Devised Methods

- Invite qualified manufacturers to offer specification guidance
 - *Most are willing to provide specification guidance free of charge*
 - *Identify subject matter experts in the fields of practice*
 - *Their expertise makes the job of specifying easier*
 - *Clear, concise specifications can limit your exposure to frivolous claims*

The Engineered Solution

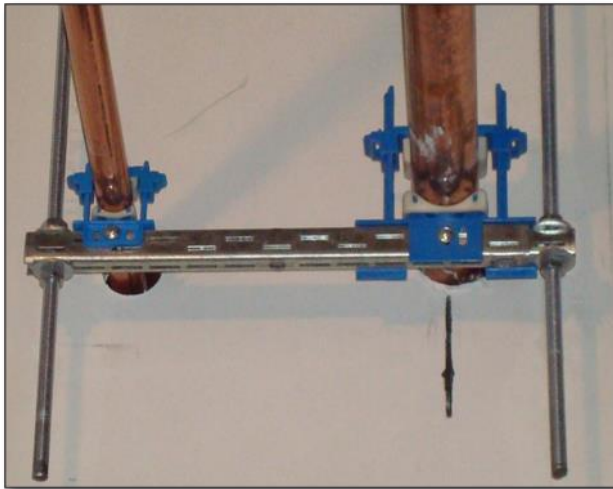
Delivers consistent and reliable results



The Engineered Solution

Designed to Meet the Intent of Plumbing Codes and Specifications

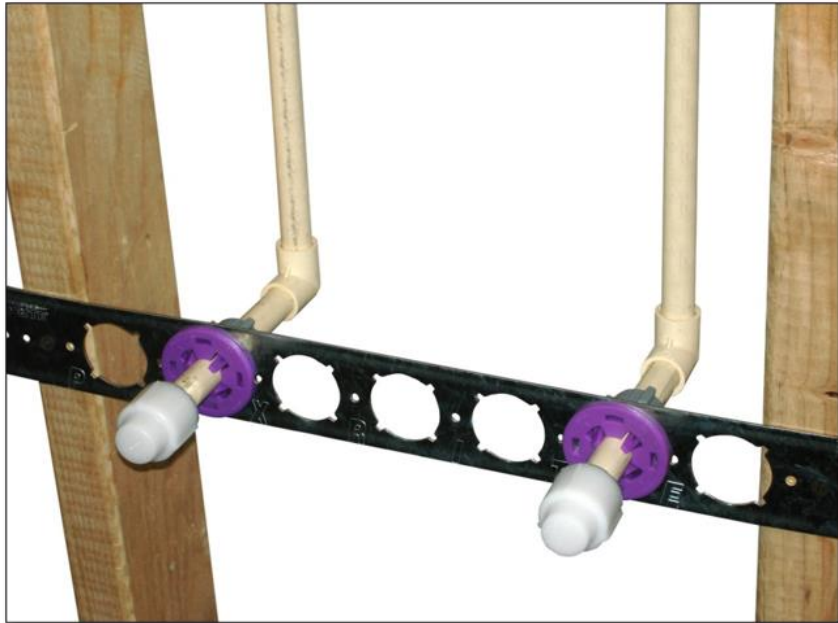
314.5 *Piping, fixtures, appliances and appurtenances shall be adequately supported in accordance with this code, the manufacturer's instructions, and as required by the Authority Having Jurisdiction. UPC 2010*



The Engineered Solution

Eliminates field-devised methods

Engineered Solution



Field-Devised Method



The Engineered Solution

- Fast, safe and easy to install
- Eliminates the need to measure & cut material for pipe supports



The Engineered Solution

Approved and accepted



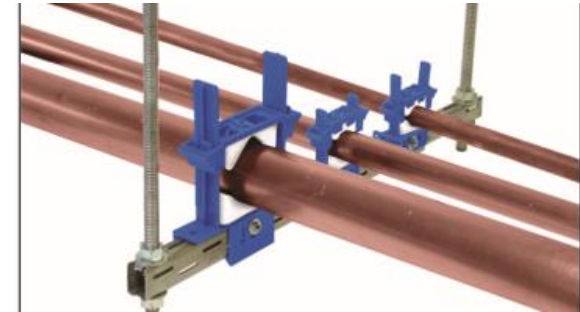
Ideal Piping Support & Restraint Options

- Overhead primary pipe supports
- In-wall secondary pipe supports
- Cast iron no-hub pipe & fitting restraints



Overhead Primary Pipe Supports

- Wide Range of Brands and Types
- Do they meet minimum standards?
 - ANSI/MSS SP-58: Material, design & manufacture
 - ANSI/MSS SP-69: Selection & application
 - ANSI/MSS SP-89: Fabrication & installation



Overhead Primary Pipe Supports

Engineered Solutions



In-Wall Secondary Supports

- Governed by ICC/IPC, UPC

“Piping shall be supported in such a manner as to maintain its alignment and prevent sagging.” California Plumbing Code 2010 Sec. 314.2

“Hangers, anchors and supports shall support the piping and contents of the piping...material shall be of approved material...” International Plumbing Code 2012 Sec. 308.3



In-Wall Secondary Supports

- IAPMO PS 42-2013 Pipe alignment & support
 - “...intended to help locate and align pipes in their proper position...”
- Area where make-shift methods are often observed

Field-Devised Method



Engineered Solution



In-Wall Secondary Supports

Engineered Solutions



No-Hub Pipe & Fitting Restraints

- Why is there increased focus on restraining Cast Iron Soil Pipe?
 - High-profile projects experiencing Cast Iron Soil Pipe system failures:
 - Lucas Oil Stadium, Indianapolis, IN – July 8th, 2008
 - Three 15” Rain Water Leaders failed causing millions of dollars in damage
 - [13 WTHR](#) stated a heavy rainstorm overwhelmed the roof drainage system, flooding three lower areas of the stadium housing electrical, telecom and meeting rooms
 - Frank E. Irish was the original plumbing contractor for [this project](#) but ceased operations May 2008, and General Piping took over plumbing/mechanical installation
 - It is unknown if the roof drainage system that failed was installed prior to May 2008
 - No forensic analysis is available to us to determine the exact cause of roof drainage system failure

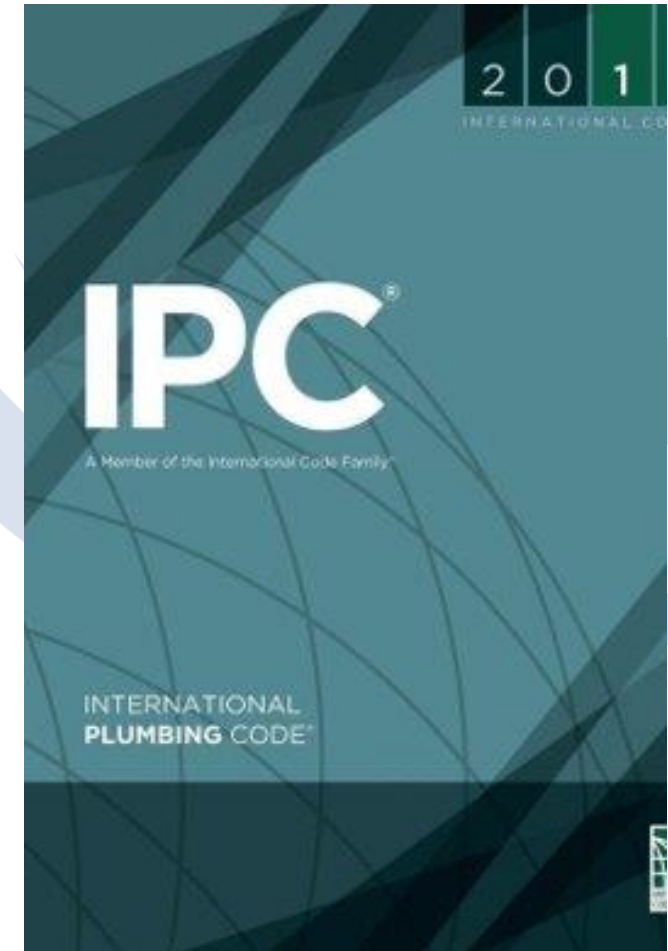
No-Hub Pipe & Fitting Restraints

- 2009 International Plumbing Code adds Section 308.7.1
 - Language mirrors Cast Iron Soil Pipe Institute's Installation Recommendation
- MEP Engineers enforce compliance with CISPI Installation Recommendations
 - MEP firm SSR requires contractors to restrain hubless pipe drainage
 - Orlando Magic Stadium 2009
 - The “birth” of Engineered Solution for No-hub Pipe and Fitting Restraints
- Translational Medical Research Facility, University of Pennsylvania Health System, Philadelphia, PA – 2012
 - 12” Rain Water Leader failed also causing millions of dollars in damage

No-Hub Pipe & Fitting Restraints

International Plumbing Code 2018

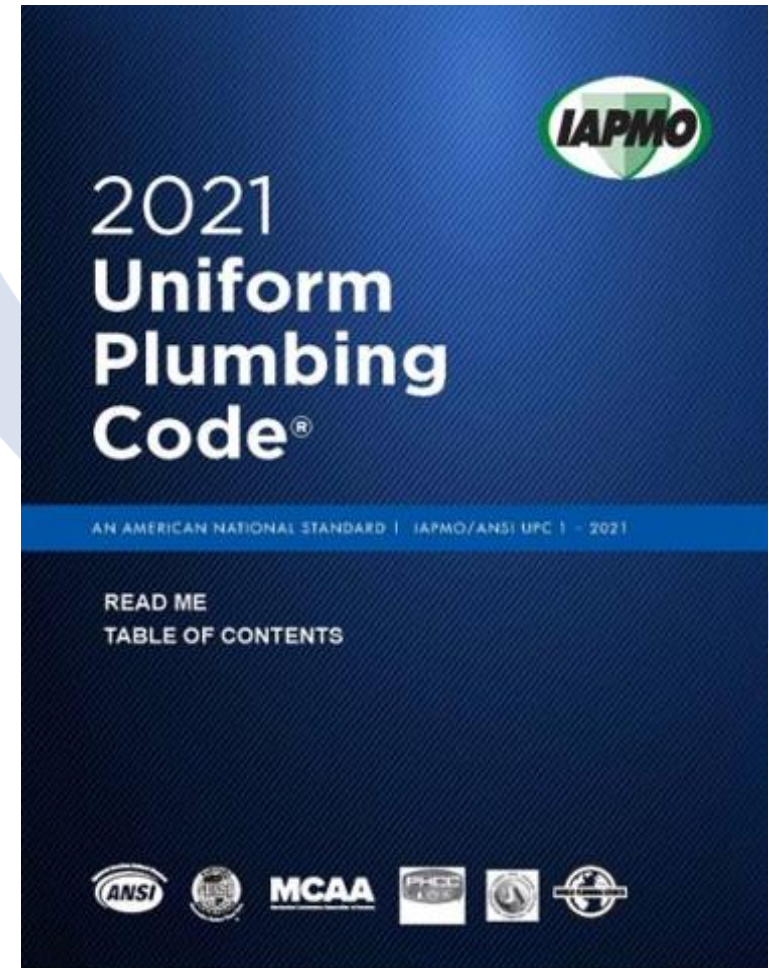
308.7.1 Location. For pipe sizes greater than 4 inches (102mm), restraints shall be provided for drain pipes at all changes of direction and at all changes in diameter greater than two pipe sizes. Braces, blocks, rodding and other suitable methods as specified by the coupling manufacturer shall be utilized.



No-Hub Pipe & Fitting Restraints

Uniform Plumbing Code 2021

309.4 Installation Practices. *Plumbing systems shall be installed in a manner that is in accordance with this code, applicable standards, and the manufacturer's installation instructions.*



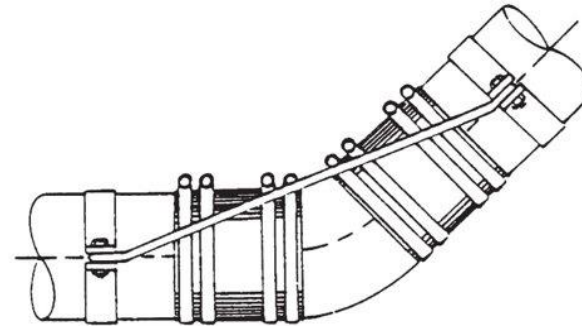
No-Hub Pipe & Fitting Restraints

CISPI 301-21

“Horizontal pipe and fittings five (5) inches and larger must be suitably braced to prevent horizontal movement. This shall be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement or joint separation.”

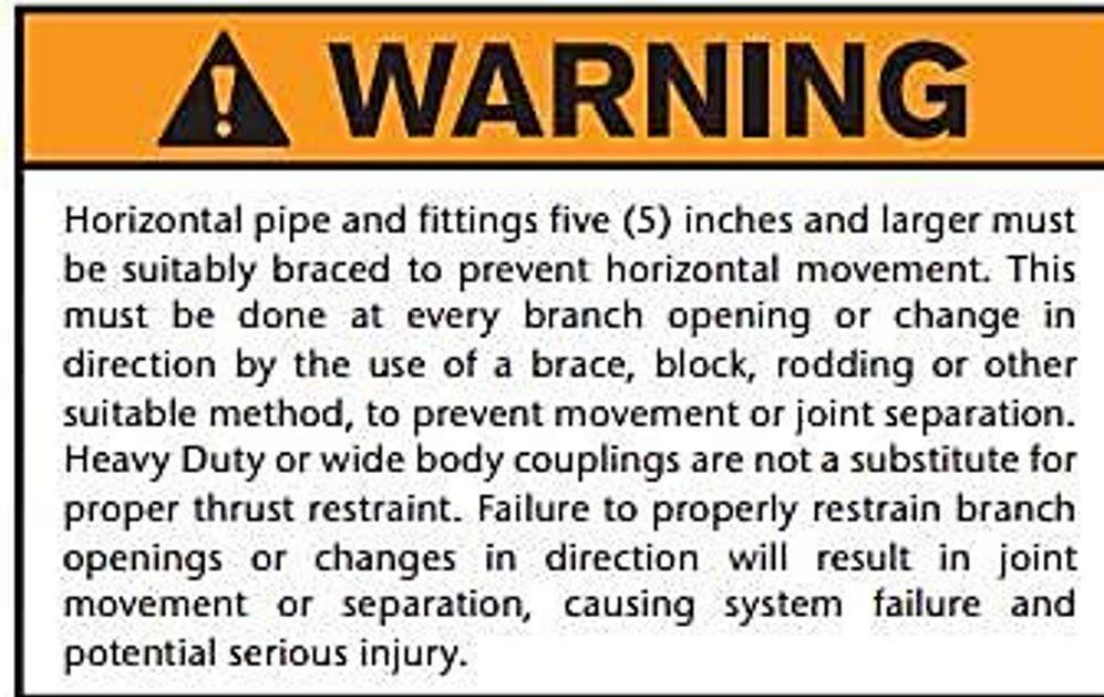
Large Diameter Fittings

Horizontal pipe and fittings five (5) inches and larger shall be suitably restrained to prevent horizontal movement. This shall be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement.



No-Hub Pipe & Fitting Restraints

Cast Iron Soil Pipe Manufacturer's Warning Label



Source: Charlotte Pipe and Foundry "Cast Iron Technical and Installation Manual" Updated 4/24/2015

No-Hub Pipe & Fitting Restraints

Cast Iron Soil Pipe Manufacturer's Installation Recommendation

Bracing:

To prevent movement, horizontal pipe and fittings 5" and larger should be suitably braced by the use of blocks, rodding or other suitable methods at every branch or change of direction.

Source: Tyler Pipe <http://www.tylerpipe.com/resources/technical-data/installation-guides>

No-Hub Pipe & Fitting Restraints

- No-hub pipe, fittings & couplings rated to withstand 10' head of water for testing purposes
 - Internal thrust forces often exceed this such as in rain leader stacks during heavy flows
 - Waste piping receiving forced-discharge
 - Blockages causing elevated head pressure

No-Hub Pipe & Fitting Restraints

THRUST TABLE
*Thrust or Displacement Forces Encountered in
Hydrostatic Testing of Hubless Cast Iron Soil Pipe*

PIPE SIZE		1½"	2"	3"	4"	5"	6"	8"	10"	12"	15"
HEAD, Feet of Water	PRESSURE PSI	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.	THRUST lb.
10	4.3	12	19	38	65	95	134	237	377	538	847
20	8.7	25	38	77	131	192	271	480	762	1088	1714
30	13.0	37	56	115	196	287	405	717	1139	1626	2562
40	17.3	49	75	152	261	382	539	954	1515	2164	3409
50	21.7	62	94	191	327	479	676	1197	1900	2714	4276
60	26.0	74	113	229	392	574	810	1434	2277	3252	5124
70	30.3	86	132	267	457	668	944	1671	2654	3790	5971
80	34.7	99	151	306	523	765	1082	1914	3039	4340	6838
90	39.0	111	169	344	588	860	1216	2151	3416	4878	7685
100	43.4	123	188	382	654	957	1353	2394	3801	5429	8552
110	47.7	135	208	420	719	1052	1487	2631	4178	5967	9400
120	52.0	147	226	458	784	1147	1621	2868	4554	6505	10247
AREA, OD. in. ²		2.84	4.34	8.81	15.07	22.06	31.17	55.15	87.58	125.09	197.06

Thrust = Pressure X Area

No-Hub Pipe & Fitting Restraints

UPHSTRANSLATIONAL RESEARCH CENTER
RAIN WATER CONDUCTOR RWC-1 FAILURE ANALYSIS

7.17.2012
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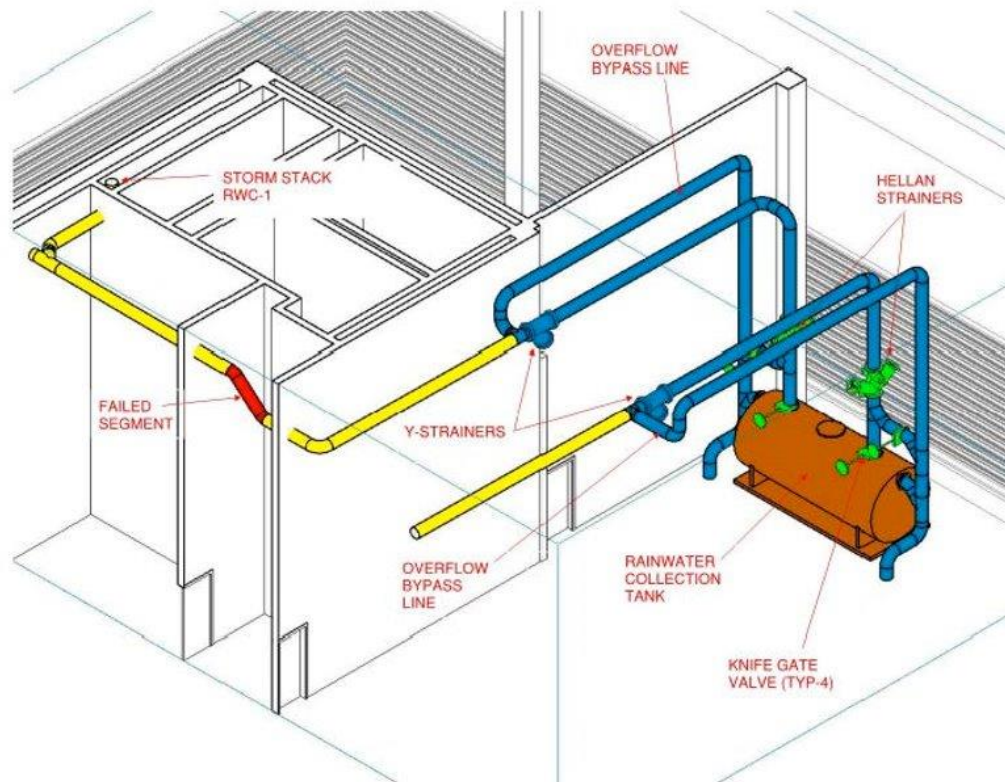


Figure 2: Excerpt from 3D Revit Model with Components Noted

Pipe color coding - Red=failed; Yellow=No-Hub Cast Iron; Blue=Victaulic; Green=Flanged

In this example of a no-hub pipe system failure, the red section of piping (12" dia. hubless cast iron soil pipe) separated from the system, falling to the floor during a 5 inch/hour rain storm.

No-Hub Pipe & Fitting Restraints

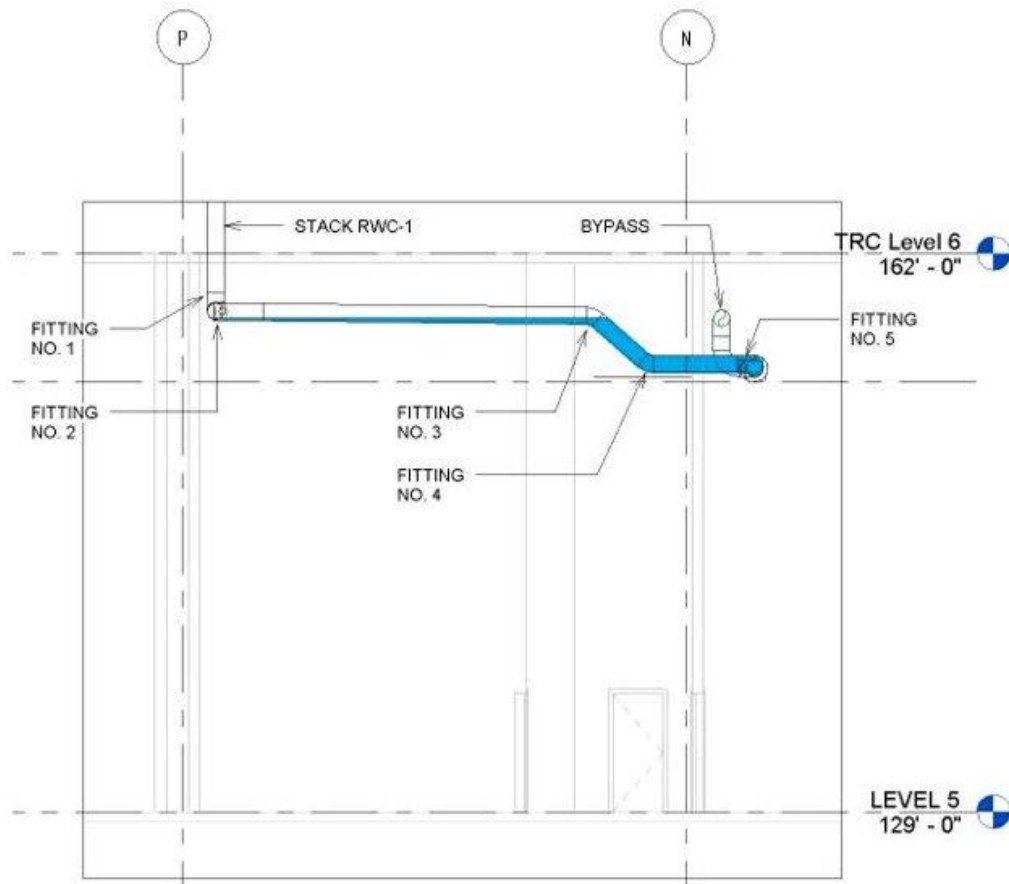


Figure 3: Section through 12" RWC Pipe Showing Water Level During Overflow Scenario

In the same example, the forensic engineer calculated just **82 lbs** of thrust at fitting No. 5 at time of failure.

Note: a 10-foot head pressure test would have exerted 538 lbs. of thrust on this same fitting.

No-Hub Pipe & Fitting Restraints

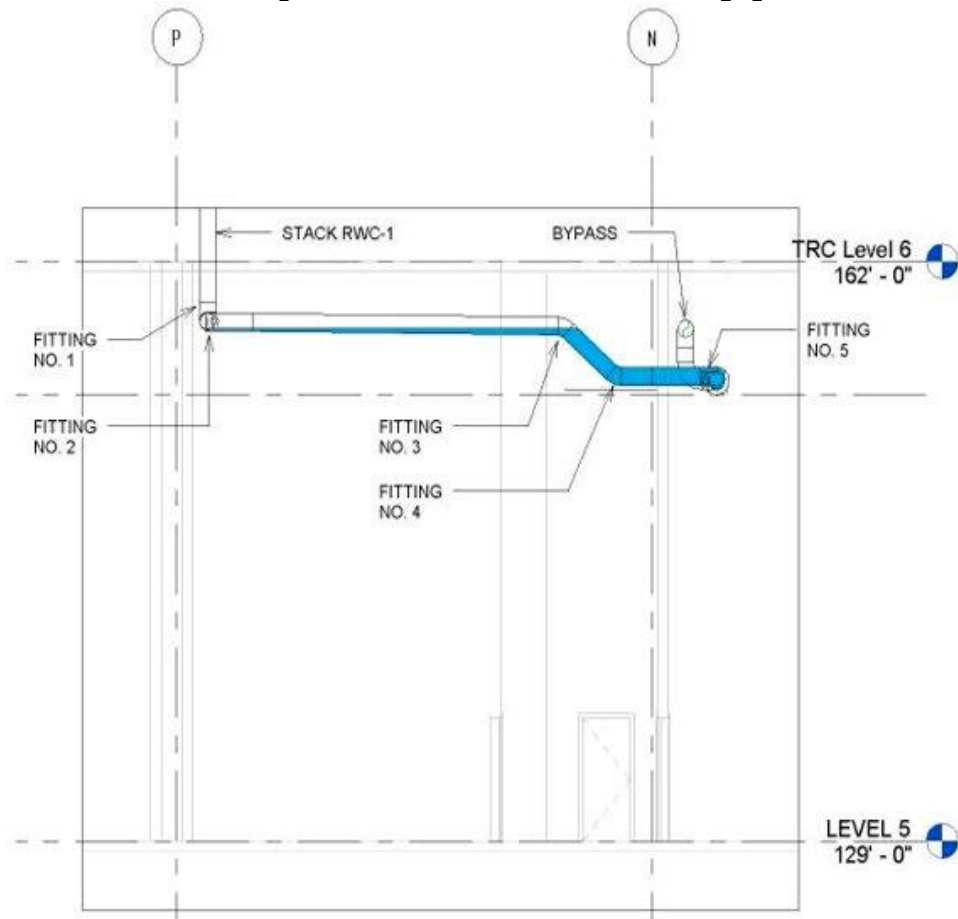


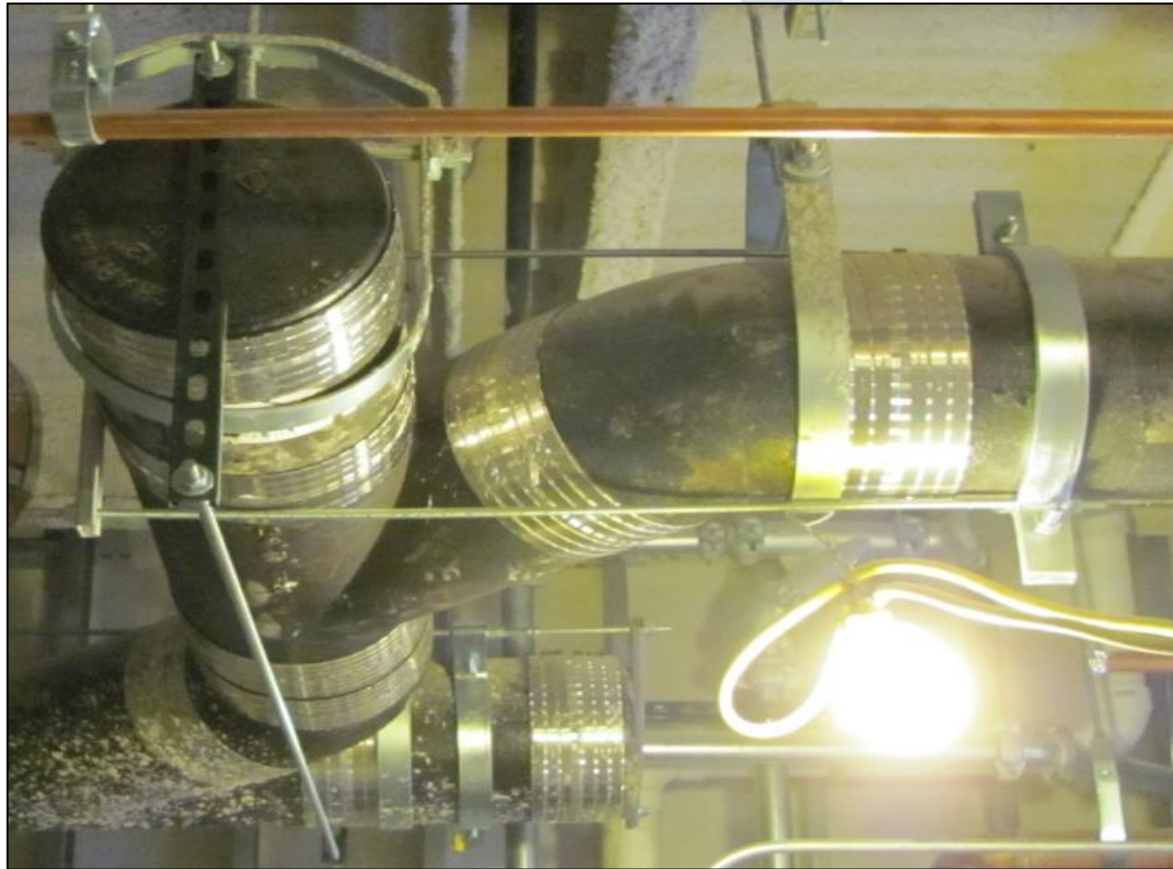
Figure 3: Section through 12" RWC Pipe Showing Water Level During Overflow Scenario

When properly restrained using the engineered solution, fitting Nos. 3 and 4 would not have separated from the system.

NOTE: No-hub couplings may still leak when exposed to thrust forces greater than 10feet/head pressure, however the parts of the system will remain intact.

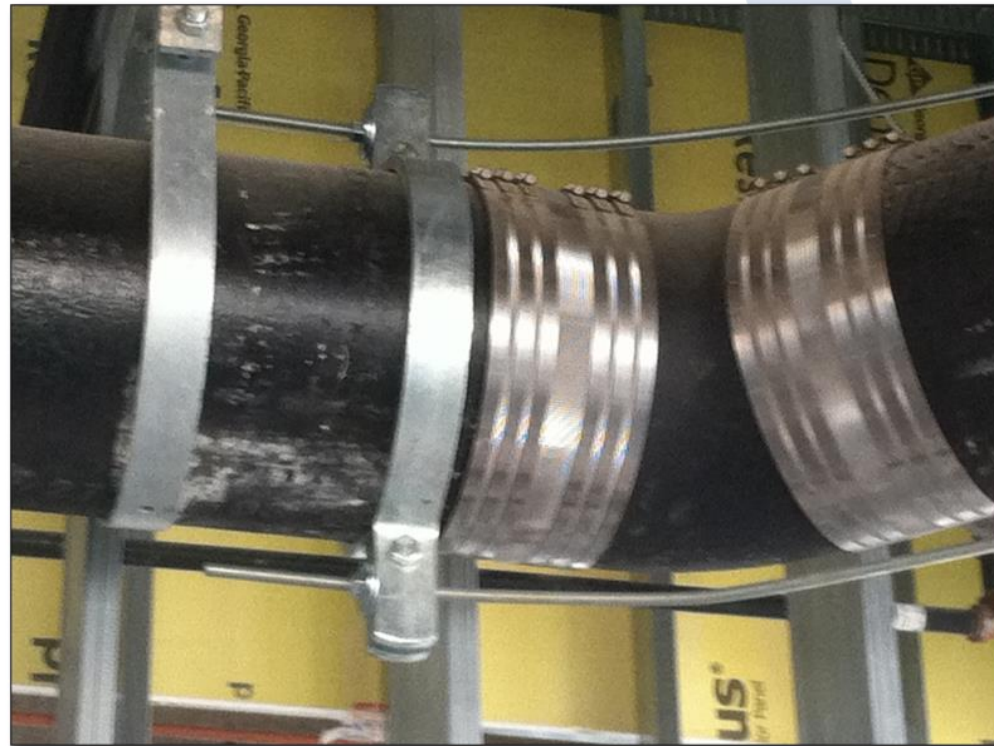
No-Hub Pipe & Fitting Restraints

Most attempts to meet CISPI 301-21 are field-devised



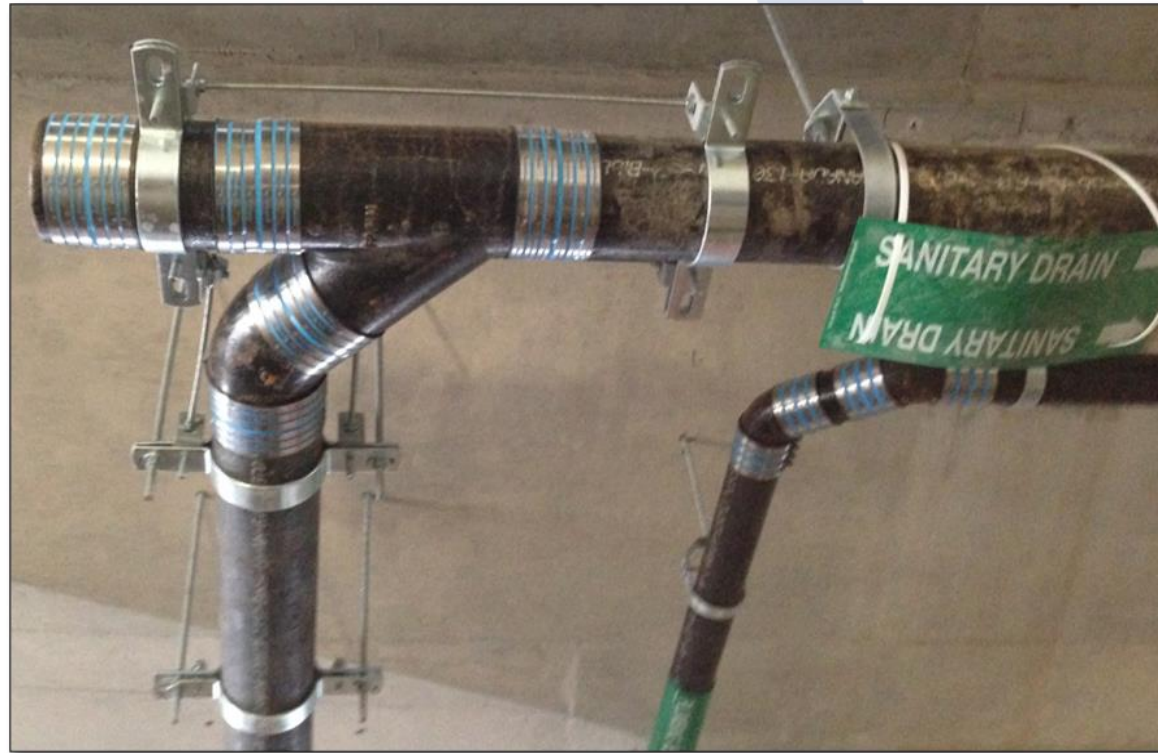
No-Hub Pipe & Fitting Restraints

Most attempts to meet CISPI 301-21 lack reliable engineering test or load data



No-Hub Pipe & Fitting Restraints

Most attempts to meet CISPI 301-21 lack material component specifications



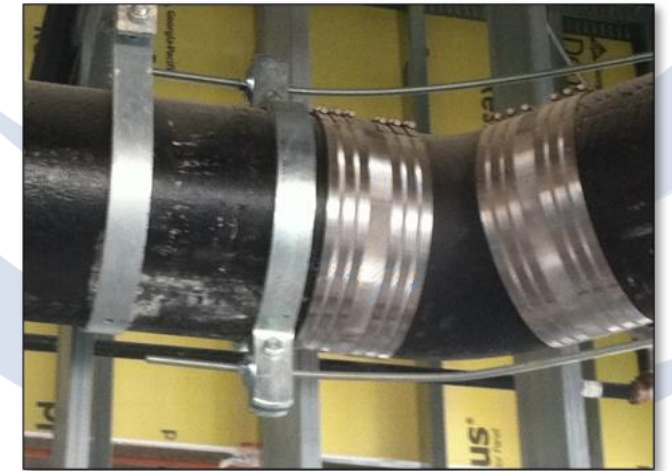
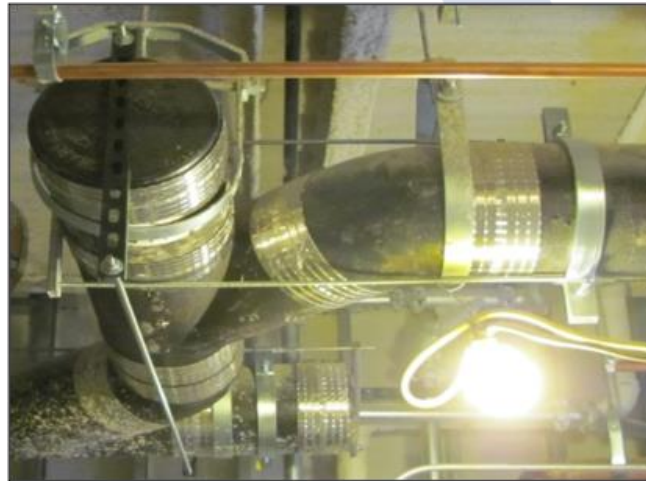
No-Hub Pipe & Fitting Restraints

Most attempts to meet CISPI 301-21 are interesting to say the least



No-Hub Pipe & Fitting Restraints

Most attempts to meet CISPI 301-21 results are varied and inconsistent



No-Hub Pipe & Fitting Restraints

- In 2010, an engineered solution was brought to market
 - Designed and tested to restrain 50' head of water
 - Specific installation instructions
 - Fast, safe and easy to install
 - Accommodates No-Hub pipe & fittings 2" through 15"



No-Hub Pipe & Fitting Restraints

PART 2 PRODUCTS

- 2.1 Pipe Hangers and Supports
 - A. Manufacturers: ...
 - B. Furnish Materials...
 - C. Plumbing Piping – DWV

*Support hubless cast iron pipe and fittings per CISPI Installation Handbook Ch IV. Brace hubless cast iron pipe and fittings 5 inches and larger using **[Manufacturer] [Model #]** No Hub Pipe and Fitting Restraints or approved equivalent.*

No-Hub Pipe & Fitting Restraints

Model Specification Language (non-proprietary):

PART 2 PRODUCTS

- 2.1 Pipe Hangers and Supports
 - A. Manufacturers: ...
 - B. Furnish Materials...
 - C. Plumbing Piping – DWV

Support hubless cast iron pipe and fittings per CISPI Installation Handbook Ch IV. Brace hubless cast iron pipe and fittings 5 inches and larger using a system designed and manufactured for the specific purpose of restraining hubless cast iron pipe and fittings against separation under high-thrust conditions. Restraint devices shall be designed to withstand a minimum of 50 feet head pressure.

No-Hub Pipe & Fitting Restraints

Example of an Engineered Solution (10" – 15" CISP)



No-Hub Pipe & Fitting Restraints

Example of an Engineered Solution (2" – 8" CISP)



Summary

- Review your Plumbing Specifications
- Introduce language disallowing field-devised or make-shift methods – *We can help (CSI Format)*
- Add appropriate standard, code and/or guideline
- Replace field-devised methods with engineered solutions

Thank You!

Questions or Comments?

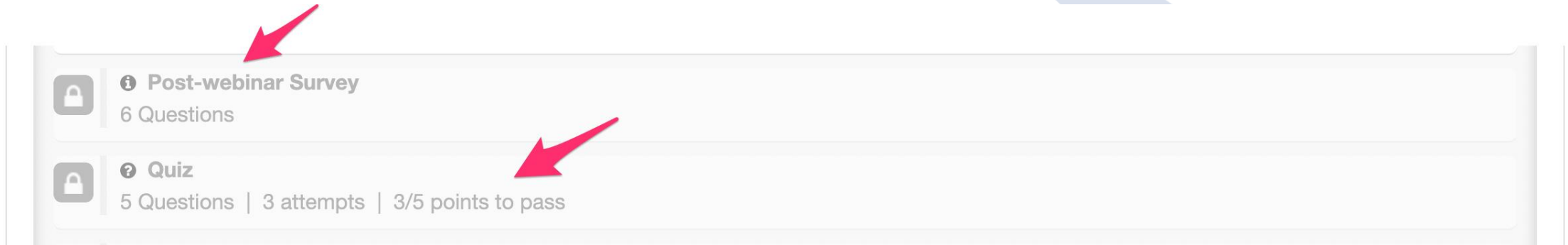
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	Post-webinar Survey 6 Questions
	Quiz 5 Questions 3 attempts 3/5 points to pass