NORTHEASTERN ENGINEERING CORP.

Structural Engineers & Construction Consultants

Proj. # 14-03112

www.Northeastereng.com

19 Campbell Street
Woburn MA 01801-9998

Specialty Engineers for Construction Systems

TEL. 781-503-0241
FAX 781-503-0247

Date of Project Submittal: June 4, 2014

Project Manager and Client: Steve Reade

Company Represented: Process Pipeline Services, Inc.
1600 Providence Hyw
Walpole MA 02081

Project Information:

Utility Crossing - Dover Landfill Sewer Pedestrian Bridge
Dover, New Hampshire

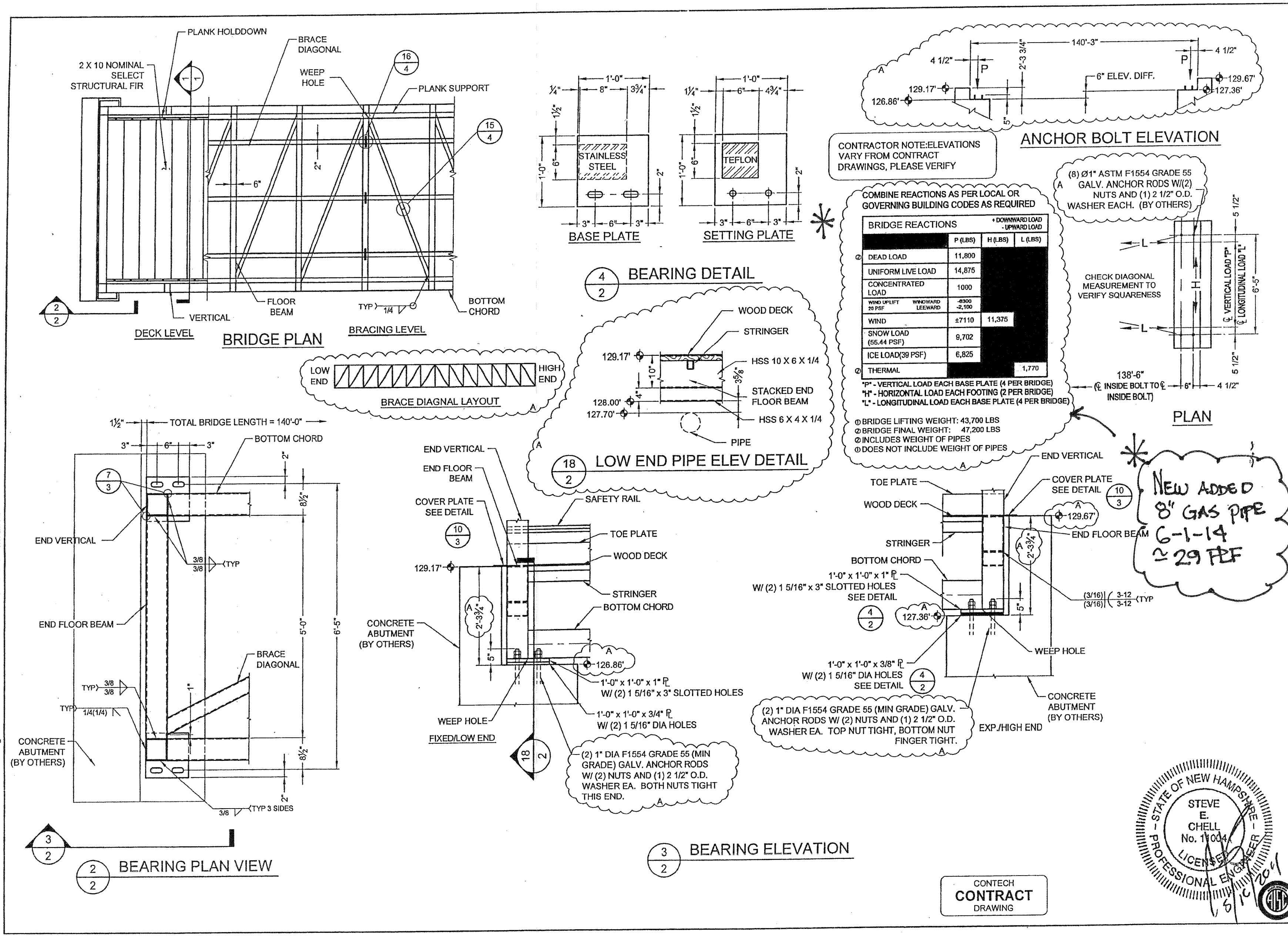
Project Submittal Scope:

Utility Piping Suspension Support Details

Engineering Performance Review - Pipe Loading Review on Superstructure

This memo is being sent to you as our documented review of the loading resulting from the addition of the proposed 8" gas pipe previously submitted under a separate cover to this memo. The basis of these interpretations are founded from the attached loading schedule the original bridge is qualified under. The new piping weighs 29 pounds per lineal foot of bridge, this approximately represents an 8% increase to the total dead load of the bridge structure. In addition to the self-weight of the bridge it is qualified for different live load combinations of snow, ice and occupancy which greatly exceed the weight of the new pipe. In addition to these superimposed load carrying abilities the bridge is further qualified for a concentrated point load of up to 1,000 pounds placed anywhere on the bridge, the new hanger loads are well within this, estimated at only 300 pounds at hanger locations and will be equally shared by the two trusses. Given the relative weight of the new piping the bridge superstructure is interpreted to be able to carry the additional pipe load without sacrificing the ability to perform its intended use.
If there are any future loads added to this structure it recommended that these new loads be documented onto a referenced plan and maintained for reference in the future servicing of this structure. This concludes our structural review of the existing bridge and our assessments of the new pipe loading, please call me if there are any inaccuracies or additional information not provided herewith.

Kevin M. Finnegan, P.E



COMBINE REACTIONS AS PER LOCAL OR GOVERNING BUILDING CODES AS REQUIRED

BRIDGE REACTIONS (+ DOWNWARD LOAD, - UPWARD LOAD)	P (LBS)	H (LBS)	L (LBS)
② DEAD LOAD	11,800		
UNIFORM LIVE LOAD	14,875		
CONCENTRATED LOAD	1000		
WIND UPLIFT 20 PSF WINDWARD / LEEWARD	-8300 / -2,100		
WIND	±7110	11,375	
SNOW LOAD (55.44 PSF)	9,702		
ICE LOAD(39 PSF)	6,825		
② THERMAL			1,770

"P" - VERTICAL LOAD EACH BASE PLATE (4 PER BRIDGE)
"H" - HORIZONTAL LOAD EACH FOOTING (2 PER BRIDGE)
"L" - LONGITUDINAL LOAD EACH BASE PLATE (4 PER BRIDGE)

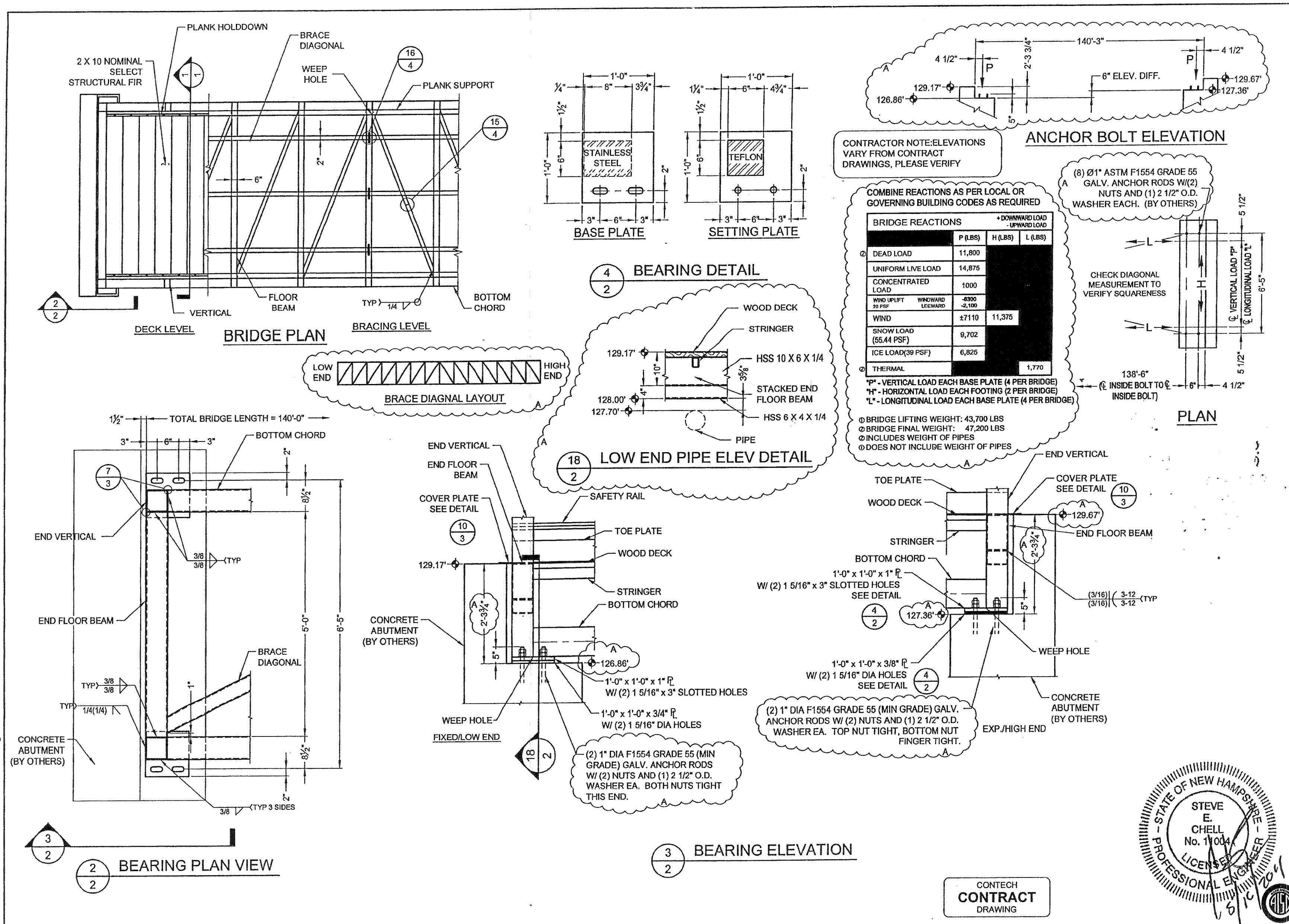
① BRIDGE LIFTING WEIGHT: 43,700 LBS
② BRIDGE FINAL WEIGHT: 47,200 LBS
② INCLUDES WEIGHT OF PIPES
① DOES NOT INCLUDE WEIGHT OF PIPES

MARK	DATE	REVISION DESCRIPTION	BY
A	05/16/11	ADDED PIPE MIDBAY SUPPORTS & ELEV. DIFF.	JEW

140'-0" X 5'-0"
DOVER LANDFILL SEWER
PEDESTRIAN BRIDGE
DOVER, NH

CONTECH CONSTRUCTION PRODUCTS INC.
CONTINENTAL BRIDGE

DATE: 4/12/2011	
DESIGNED: CBT	DRAWN: JEW
CHECKED: CBT	APPROVED: SEC
PROJECT No.: 425653	SEQUENCE No.: 1
SHEET: 2 OF 4	



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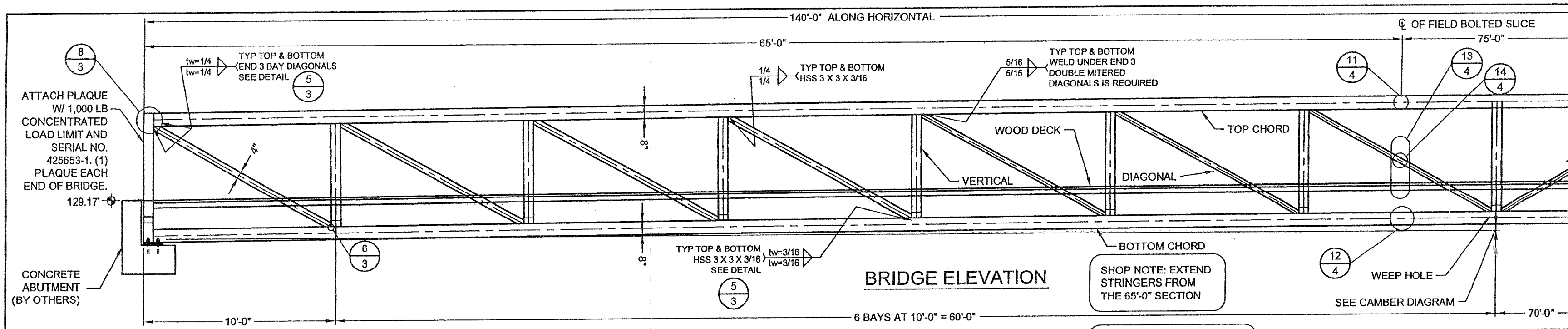
MARK	DATE	REVISION DESCRIPTION	BY
A	05/16/11	ADDED PIPE MIDBAY SUPPORTS & ELEV. DIFF.	JEW

140'-0" X 5'-0" DOVER LANDFILL SEWER PEDESTRIAN BRIDGE DOVER, NH

CONTECH CONSTRUCTION PRODUCTS INC.
CONTINENTAL BRIDGE

STATE OF NEW HAMPSHIRE – STEVE E. CHELL No. 11004 – LICENSED PROFESSIONAL ENGINEER

DATE: 4/12/2011	
DESIGNED: CBT	DRAWN: JEW
CHECKED: CBT	APPROVED: SEC
PROJECT No.: 425653	SEQUENCE No.: 1
SHEET: 2 OF 4	



GENERAL NOTES

1. DESIGN STRESSES ARE IN ACCORDANCE WITH THE MANUAL OF STEEL CONSTRUCTION FOR ALLOWABLE STRESS DESIGN AS ADOPTED BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).
2. BRIDGE MEMBERS ARE FABRICATED FROM HIGH STRENGTH, LOW ALLOY, ENHANCED ATMOSPHERIC CORROSION RESISTANT ASTM A847 COLD-FORMED WELDED SQUARE AND RECTANGULAR TUBING, AND ASTM A588, ASTM A606, OR ASTM A242 PLATE AND STRUCTURAL SHAPES (Fy=50,000 PSI).
3. BRIDGE DECKING NOMINAL 2-INCH THICK SELECT STRUCTURAL FIR (Fb=1,400 PSI min.). TIMBER DECK MATERIAL SHALL BE TREATED WITH ALKALINE COPPER QUATERNARY (ACQ) TO A 0.4 PCF RETENTION OR TO REFUSAL.
4. THE GAS METAL ARC WELDING PROCESS OR FLUX CORED ARC WELDING PROCESS WILL BE USED.
5. ALL TOP AND BOTTOM CHORD SHOP SPLICES TO BE COMPLETE PENETRATION TYPE WELDS. WELD BETWEEN TOP CHORD AND END VERTICAL SHALL BE AS DETAILED.
6. UNLESS OTHERWISE NOTED, WELDED CONNECTIONS SHALL BE FILLET WELDS (OR HAVE THE EFFECTIVE THROAT OF A FILLET WELD) OF A SIZE EQUAL TO THE THICKNESS OF THE LIGHTEST GAGE MEMBER IN THE CONNECTION. WELDS SHALL BE APPLIED AS FOLLOWS:
   A. BOTH ENDS OF VERTICALS, DIAGONALS, AND FLOOR BEAMS SHALL BE WELDED ALL AROUND.
   B. BRACE DIAGONALS WILL BE WELDED ALL AROUND.
   C. BOTTOM OF STRINGERS WILL BE STITCH WELDED TO TOP OF FLOOR BEAMS.
   D. MISCELLANEOUS NON-STRUCTURAL MEMBERS WILL BE STITCH WELDED TO THEIR SUPPORTING MEMBERS.
7. BRIDGE DESIGN WAS ONLY BASED ON COMBINATIONS OF THE FOLLOWING LOADS WHICH WILL PRODUCE MAXIMUM CRITICAL MEMBER STRESSES.
   A. 85 PSF UNIFORM LIVE LOADING ON THE FULL DECK AREA OR ONE 1,000 POUND CONCENTRATED LOAD DISTRIBUTED ON ANY 2.5' x 2.5' AREA ON THE BRIDGE. THE UNIFORM LIVE LOAD SHALL BE REDUCED TO 70 PSF FOR THE DESIGN OF THE MAIN TRUSS MEMBERS ONLY. THE CONCENTRATED LOAD SHALL BE LOCATED SO AS TO PRODUCE THE MAXIMUM STRESS IN EACH MEMBER, INCLUDING DECKING.
   B. 21 PSF WIND LOAD ON THE FULL HEIGHT OF THE BRIDGE, AS IF ENCLOSED.
   C. 20 PSF UPWARD FORCE APPLIED AT THE WINDWARD QUARTER POINT OF THE TRANSVERSE BRIDGE WIDTH (AASHTO 3.15.3).
   D. PIPELOAD 25 PLF
   E. SNOWLAOD 55.44 PSF
   F. ICE LOAD 39 PSF
8. CLEANING: ALL EXPOSED SURFACES OF STEEL SHALL BE CLEANED IN ACCORDANCE WITH STEEL STRUCTURES PAINTING COUNCIL SURFACES PREPARATION SPECIFICATIONS NO. 7 BRUSH-OFF BLAST CLEANING. SSPC-SP7-LATEST EDITION.

MILL CERTS REQUIRED

SCHEDULE OF MEMBERS

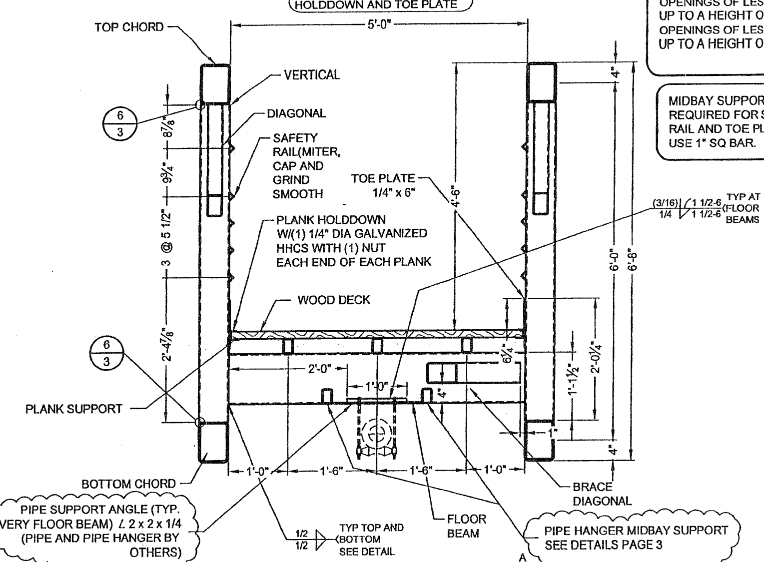
TOP CHORD	HSS 8 x 6 x 3/8	
BOTTOM CHORD	HSS 8 x 6 x 3/8	
VERTICAL	HSS 6 x 6 x 1/4	
END VERTICAL	HSS 6 X 6 X 3/8	
STRINGER	HSS 3 X 2 X 3/16	
DIAGONAL	HSS 3 x 3 x 3/16	①
BRACE DIAGONAL	HSS 4 x 4 x 3/16	
FLOOR BEAM	HSS 10 x 6 x 1/4	
END FLOOR BEAM(STACKED)	HSS 10 X 6 X 1/4 HSS 6 X 4 X 1/4	
SAFETY RAIL	∠ 1 1/4 x 1 1/4 x 1/8	
PLANK SUPPORT	∠ 2 X 2 X 3/16	
PLANK HOLDDOWN	∠1 1/4 X 1 1/4 X 1/8	

① USE HSS 6 x 4 x 1/4 FOR END 4 BAY DIAGONALS DOUBLE MITER ALL DIAGONALS.

SHOP NOTE: CUT DECKING TO 4'-11" TO ENSURE CLEARANCE BETWEEN DECK HOLDDOWN AND TOE PLATE

SPACING OF SAFETY RAIL AND TOE PLATE PRODUCES OPENINGS OF LESS THAN 4" UP TO A HEIGHT OF 27" AND OPENINGS OF LESS THEN 8" UP TO A HEIGHT OF 54"

MIDBAY SUPPORTS ARE REQUIRED FOR SAFETY RAIL AND TOE PLATE. USE 1" SQ BAR.



SAFETY RAIL AND TOE PLATE ARE NOT SHOWN IN ELEVATION FOR CLARITY. SEE BRIDGE SECTION FOR CORRECT NUMBER AND LOCATION.

BRIDGE SECTION (1/2)

CONTECH CONTRACT DRAWING

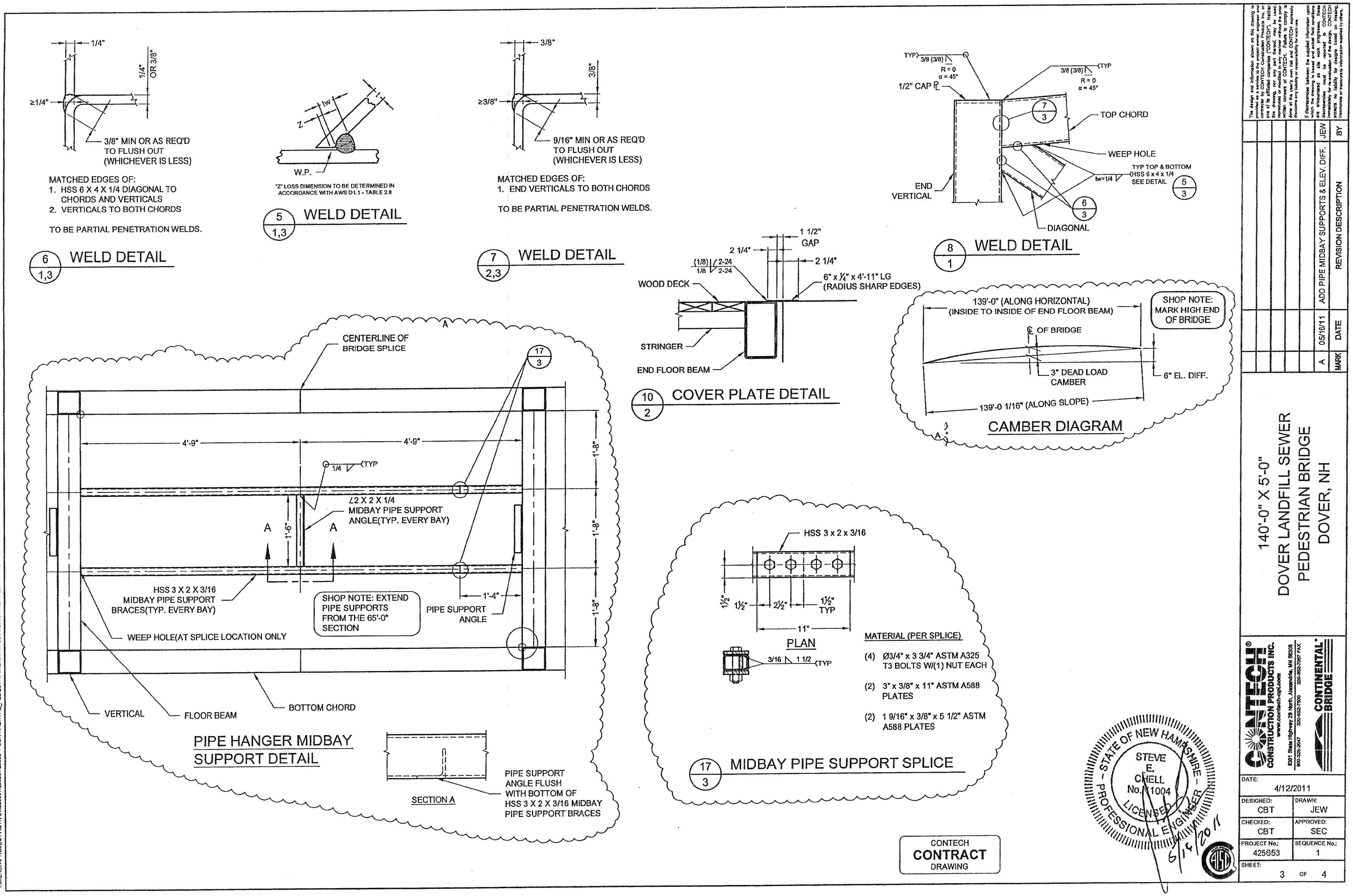
STATE OF NEW HAMPSHIRE — STEVE E. CHELL No. 11004 — LICENSED PROFESSIONAL ENGINEER — 5/16/2011

MARK	DATE	REVISION DESCRIPTION	BY
A	05/16/11	ADDED PIPE MIDBAY SUPPORTS & ELEV. DIFF.	JEW

140'-0" X 5'-0"
DOVER LANDFILL SEWER
PEDESTRIAN BRIDGE
DOVER, NH

CONTECH CONSTRUCTION PRODUCTS INC. www.contech-cpi.com — CONTINENTAL BRIDGE

DATE: 4/12/2011	
DESIGNED: CBT	DRAWN: JEW
CHECKED: CBT	APPROVED: SEC
PROJECT No.: 425653	SEQUENCE No.: 1
SHEET: 1 OF 4	


WELD DETAIL 6 1,3
3/8" MIN OR AS REQ'D TO FLUSH OUT (WHICHEVER IS LESS)
MATCHED EDGES OF:
1. HSS 6 X 4 X 1/4 DIAGONAL TO CHORDS AND VERTICALS
2. VERTICALS TO BOTH CHORDS
TO BE PARTIAL PENETRATION WELDS.
WELD DETAIL 5 1,3
"Z" LOSS DIMENSION TO BE DETERMINED IN ACCORDANCE WITH AWS D1.1 - TABLE 2.8
W.P.
WELD DETAIL 7 2,3
9/16" MIN OR AS REQ'D TO FLUSH OUT (WHICHEVER IS LESS)
MATCHED EDGES OF:
1. END VERTICALS TO BOTH CHORDS
TO BE PARTIAL PENETRATION WELDS.
WELD DETAIL 8 1
1/2" CAP PL
TOP CHORD
WEEP HOLE
END VERTICAL
DIAGONAL
TYP TOP & BOTTOM HSS 6 x 4 x 1/4 SEE DETAIL
COVER PLATE DETAIL 10 2
WOOD DECK
STRINGER
END FLOOR BEAM
1 1/2" GAP
2 1/4"
6" x 1/4" x 4'-11" LG (RADIUS SHARP EDGES)
CAMBER DIAGRAM
139'-0" (ALONG HORIZONTAL) (INSIDE TO INSIDE OF END FLOOR BEAM)
SHOP NOTE: MARK HIGH END OF BRIDGE
℄ OF BRIDGE
3" DEAD LOAD CAMBER
6" EL. DIFF.
139'-0 1/16" (ALONG SLOPE)
PIPE HANGER MIDBAY SUPPORT DETAIL
CENTERLINE OF BRIDGE SPLICE
4'-9"
1'-8"
1'-6"
1'-4"
∠2 X 2 X 1/4 MIDBAY PIPE SUPPORT ANGLE(TYP. EVERY BAY)
HSS 3 X 2 X 3/16 MIDBAY PIPE SUPPORT BRACES(TYP. EVERY BAY)
SHOP NOTE: EXTEND PIPE SUPPORTS FROM THE 65'-0" SECTION
PIPE SUPPORT ANGLE
WEEP HOLE(AT SPLICE LOCATION ONLY
VERTICAL
FLOOR BEAM
BOTTOM CHORD
SECTION A
PIPE SUPPORT ANGLE FLUSH WITH BOTTOM OF HSS 3 X 2 X 3/16 MIDBAY PIPE SUPPORT BRACES
MIDBAY PIPE SUPPORT SPLICE 17 3
HSS 3 x 2 x 3/16
PLAN
11"
MATERIAL (PER SPLICE)
(4) Ø3/4" x 3 3/4" ASTM A325 T3 BOLTS W/(1) NUT EACH
(2) 3" x 3/8" x 11" ASTM A588 PLATES
(2) 1 9/16" x 3/8" x 5 1/2" ASTM A588 PLATES
CONTECH CONTRACT DRAWING
STATE OF NEW HAMPSHIRE STEVE E. CHELL No. 11004 LICENSED PROFESSIONAL ENGINEER
A 05/16/11 ADD PIPE MIDBAY SUPPORTS & ELEV. DIFF. JEW
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140'-0" X 5'-0"
DOVER LANDFILL SEWER
PEDESTRIAN BRIDGE
DOVER, NH
CONTECH CONSTRUCTION PRODUCTS INC.
CONTINENTAL BRIDGE
DATE: 4/12/2011
DESIGNED: CBT
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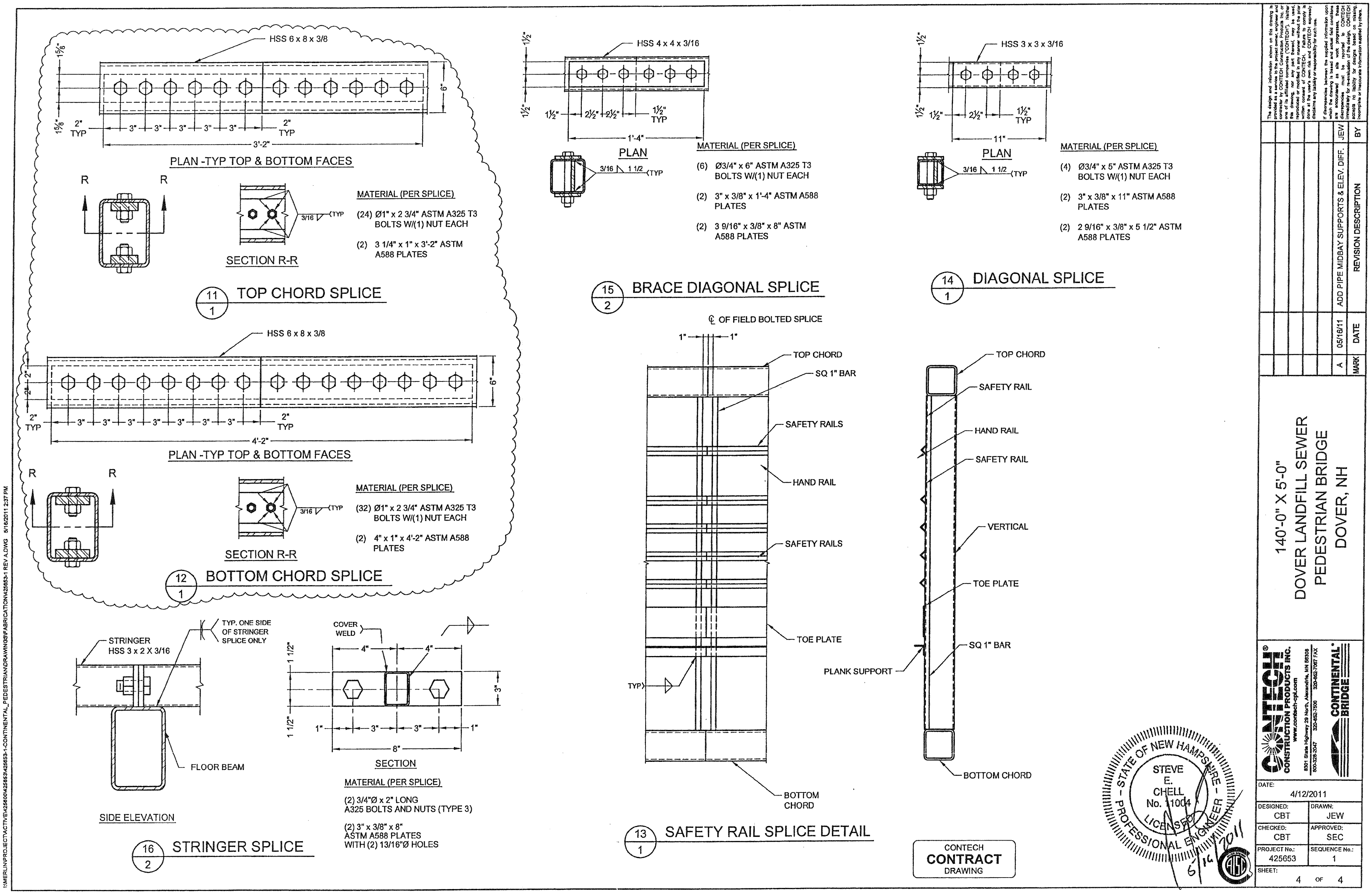
SHEET: 3 OF 4

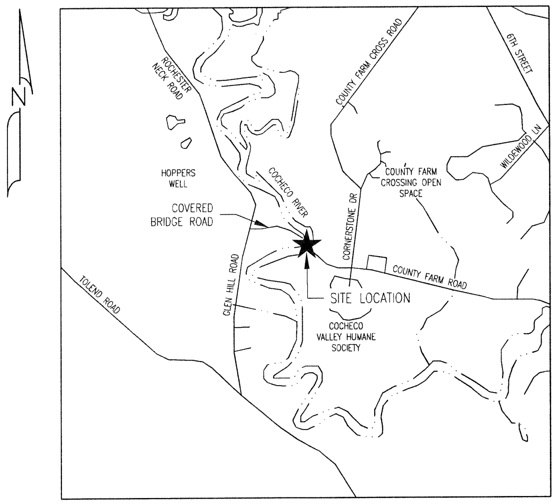

HSS 6 x 8 x 3/8
PLAN -TYP TOP & BOTTOM FACES
SECTION R-R
MATERIAL (PER SPLICE)
(24) Ø1" x 2 3/4" ASTM A325 T3 BOLTS W/(1) NUT EACH
(2) 3 1/4" x 1" x 3'-2" ASTM A588 PLATES
11 TOP CHORD SPLICE 1
HSS 6 x 8 x 3/8
PLAN -TYP TOP & BOTTOM FACES
SECTION R-R
MATERIAL (PER SPLICE)
(32) Ø1" x 2 3/4" ASTM A325 T3 BOLTS W/(1) NUT EACH
(2) 4" x 1" x 4'-2" ASTM A588 PLATES
12 BOTTOM CHORD SPLICE 1
HSS 4 x 4 x 3/16
PLAN
MATERIAL (PER SPLICE)
(6) Ø3/4" x 6" ASTM A325 T3 BOLTS W/(1) NUT EACH
(2) 3" x 3/8" x 1'-4" ASTM A588 PLATES
(2) 3 9/16" x 3/8" x 8" ASTM A588 PLATES
15 BRACE DIAGONAL SPLICE 2
HSS 3 x 3 x 3/16
PLAN
MATERIAL (PER SPLICE)
(4) Ø3/4" x 5" ASTM A325 T3 BOLTS W/(1) NUT EACH
(2) 3" x 3/8" x 11" ASTM A588 PLATES
(2) 2 9/16" x 3/8" x 5 1/2" ASTM A588 PLATES
14 DIAGONAL SPLICE 1
℄ OF FIELD BOLTED SPLICE
TOP CHORD
SQ 1" BAR
SAFETY RAILS
HAND RAIL
SAFETY RAILS
TOE PLATE
BOTTOM CHORD
SAFETY RAIL
HAND RAIL
SAFETY RAIL
VERTICAL
TOE PLATE
SQ 1" BAR
PLANK SUPPORT
BOTTOM CHORD
13 SAFETY RAIL SPLICE DETAIL 1
STRINGER HSS 3 x 2 X 3/16
TYP. ONE SIDE OF STRINGER SPLICE ONLY
FLOOR BEAM
SIDE ELEVATION
COVER WELD
SECTION
MATERIAL (PER SPLICE)
(2) 3/4"Ø x 2" LONG A325 BOLTS AND NUTS (TYPE 3)
(2) 3" x 3/8" x 8" ASTM A588 PLATES WITH (2) 13/16"Ø HOLES
16 STRINGER SPLICE 2
CONTECH CONTRACT DRAWING
STATE OF NEW HAMPSHIRE STEVE E. CHELL No. 11004 LICENSED PROFESSIONAL ENGINEER
A 05/16/11 ADD PIPE MIDBAY SUPPORTS & ELEV. DIFF. JEW
MARK DATE REVISION DESCRIPTION BY
140'-0" X 5'-0"
DOVER LANDFILL SEWER
PEDESTRIAN BRIDGE
DOVER, NH
CONTECH CONSTRUCTION PRODUCTS INC.
www.contech-cpi.com
CONTINENTAL BRIDGE
DATE: 4/12/2011
DESIGNED: CBT
DRAWN: JEW
CHECKED: CBT
APPROVED: SEC
PROJECT No.: 425653
SEQUENCE No.: 1
SHEET: 4 OF 4

Unitil

Northern Utilities, Inc.

PEDESTRIAN BRIDGE CROSSING

COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE



LOCUS
SCALE: NTS

Engineering Certification:
Component submittal for project use and approval.
The enclosed engineering package has been prepared
under the supervision of the undersigned
and according to the code based design criteria herewith.

STATE OF NEW HAMPSHIRE
KEVIN
FINNEGAN
PROFESSIONAL ENGINEER

ISSUED FOR CONSTRUCTION

	ISSUE STATUS	DATE	REVIEWED	CHECKED	APPROVED
	25% SUBMISSION				
	50% SUBMISSION				
	75% SUBMISSION				
	90% SUBMISSION				
	ISSUED FOR BID				
■	ISSUED FOR CONSTRUCTION	05/12/14			
	AS CONSTRUCTED				

	SIZE	SHEET	REV
FILE NAME: 5138_P00.DWG PLOT DATE: 05/12/2014 11:55 AM	22X34	T01	
	SHEET 1 OF 6		

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2

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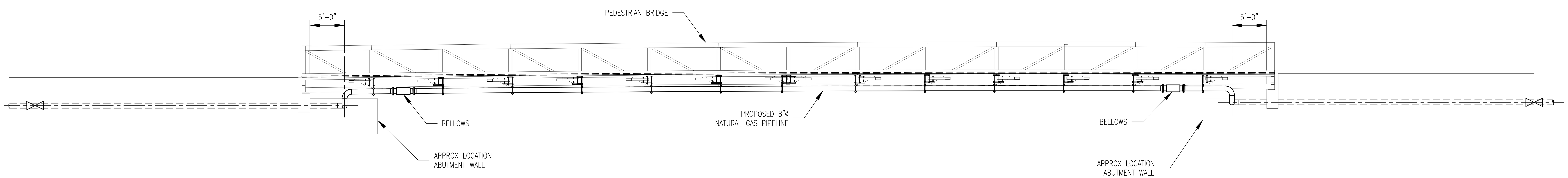
PLAN
SCALE: 1/8" = 1'-0"



PROFILE
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE 1/8" = 1'-0"
8' 4' 0 8' 16' 24'

ISSUED FOR CONSTRUCTION

REV	BY	DATE	DESCRIPTION	DWG NO.	REFERENCE DRAWINGS	SEAL AND SIGNATURE

PRJ MANAGER: MARK D. WOOD
PRJ ENGINEER: STEPHEN M. READE
PRJ NAME: PEDESTRIAN BRIDGE CROSSING
PRJ NUMBER: 5138
PRJ MILESTONE: ISSUED FOR CONSTRUCTION
PRJ PHASE: ISSUED FOR CONSTRUCTION

DESIGNED BY:	MDW	05/12/14			
DRAFTED BY:	RPG	05/12/14	DESIGN MANAGER: T. BICKFORD	REVIEWED BY:	
CHECKED BY:	SMR	05/12/14	DESIGN ENGINEER: M. DUPUIS	CHECKED BY:	
APPROVED BY:	MDW	05/12/14	ACTIVATION ORDER:	APPROVED BY:	

CLIENT INFORMATION
Unitil
Granite State Gas Transmission

SHEET TITLE
SITE PLAN AND PROFILE

PROJECT NAME
PEDESTRIAN BRIDGE CROSSING

PROJECT LOCATION
COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE

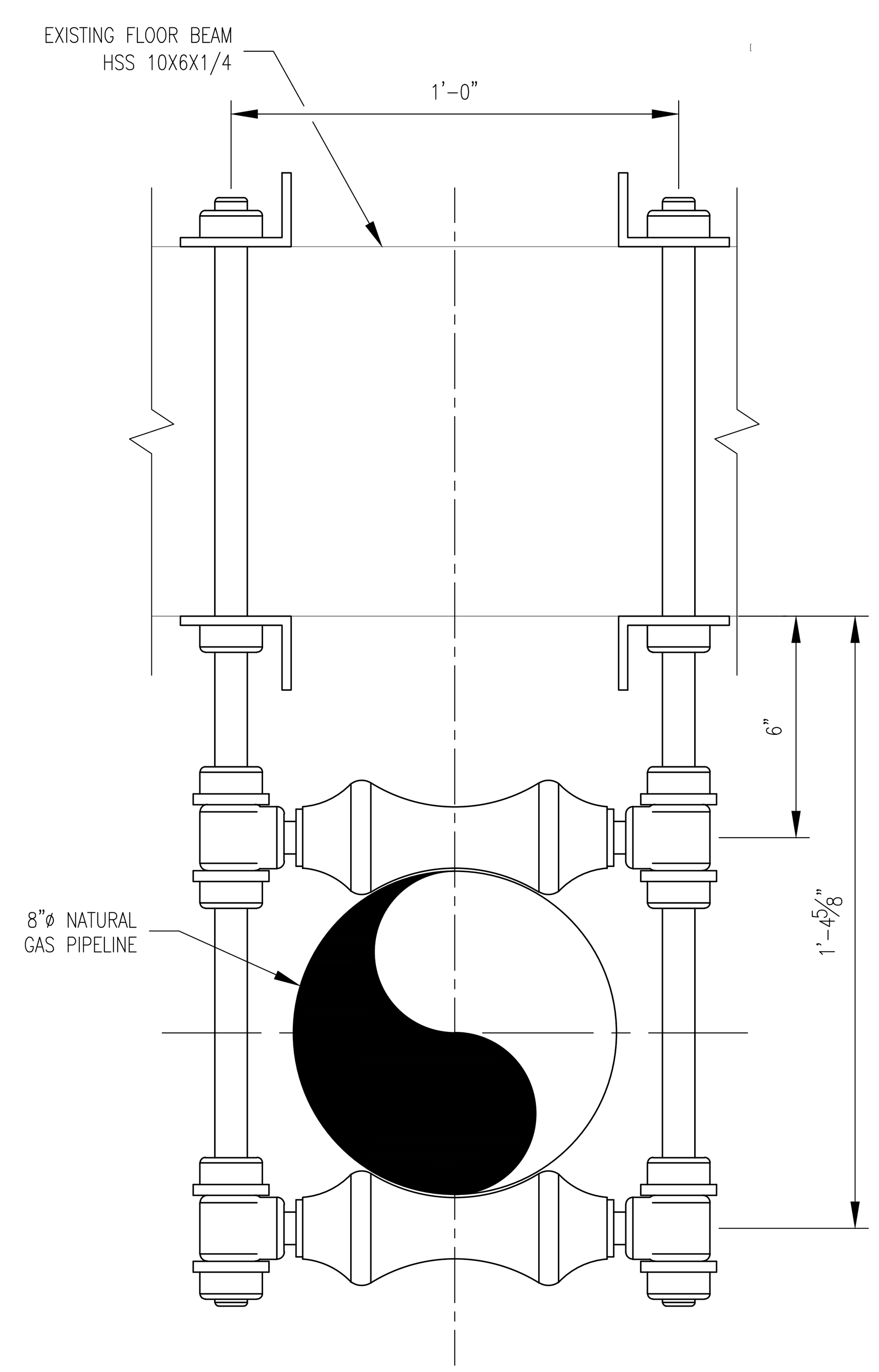
PROCESS PIPELINE SERVICES
1600 Providence Highway
Walpole, MA 02081
781.829.0524
processpipelineservices.com

FILE NAME: 5138_P00.DWG
PLOT DATE: 05/12/2014 11:55 AM
SCALE: 1/8" = 1'-0"

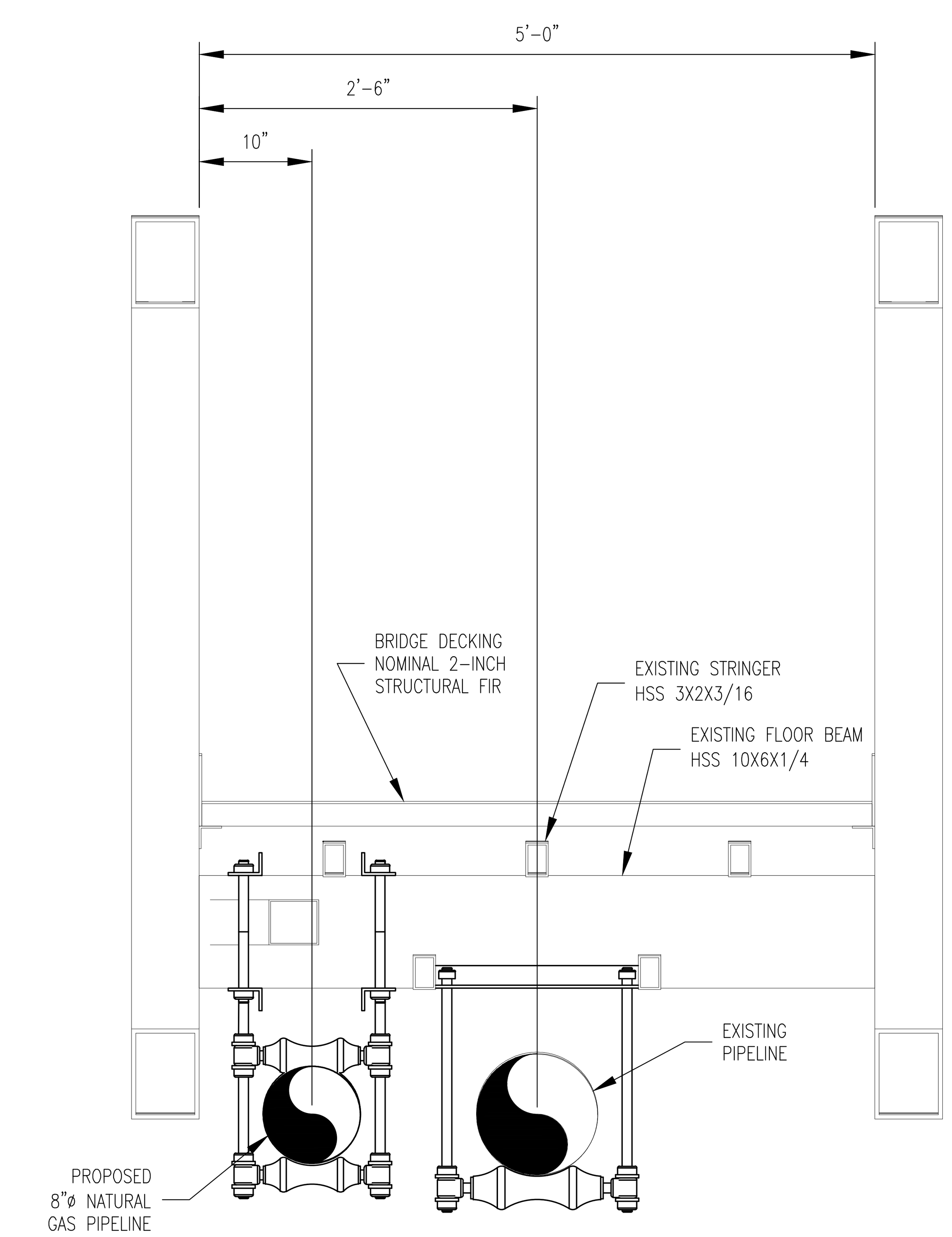
SIZE	SHEET	REV
22X34	P02	G

SHEET 2 OF 6

FRAMING PLAN
SCALE: 3/16" = 1'-0"



UTILITY PIPELINE SUPPORT
SCALE: 3" = 1'-0"
(TYP X13)



UTILITY SUPPORT BRACKET (A / P03)
SCALE: 1" = 1'-0"
(TYP X13)

ISSUED FOR CONSTRUCTION

REV	BY	DATE	DESCRIPTION	DWG NO.	REFERENCE DRAWINGS	SEAL AND SIGNATURE

PRJ MANAGER: MARK D. WOOD
PRJ ENGINEER: STEPHEN M. READE
PRJ NAME: PEDESTRIAN BRIDGE CROSSING
PRJ NUMBER: 5138
PRJ MILESTONE: ISSUED FOR CONSTRUCTION
PRJ PHASE: ISSUED FOR CONSTRUCTION

DESIGNED BY:	MDW	05/12/14
DRAFTED BY:	RPG	05/12/14
CHECKED BY:	SMR	05/12/14
APPROVED BY:	MDW	05/12/14

CLIENT INFORMATION
Unitil
Granite State Gas Transmission

DESIGN MANAGER: T. BICKFORD	REVIEWED BY:
DESIGN ENGINEER: M. DUPUIS	CHECKED BY:
ACTIVATION ORDER:	APPROVED BY:

SHEET TITLE
PIPING SUPPORTS

PROJECT NAME
PEDESTRIAN BRIDGE CROSSING

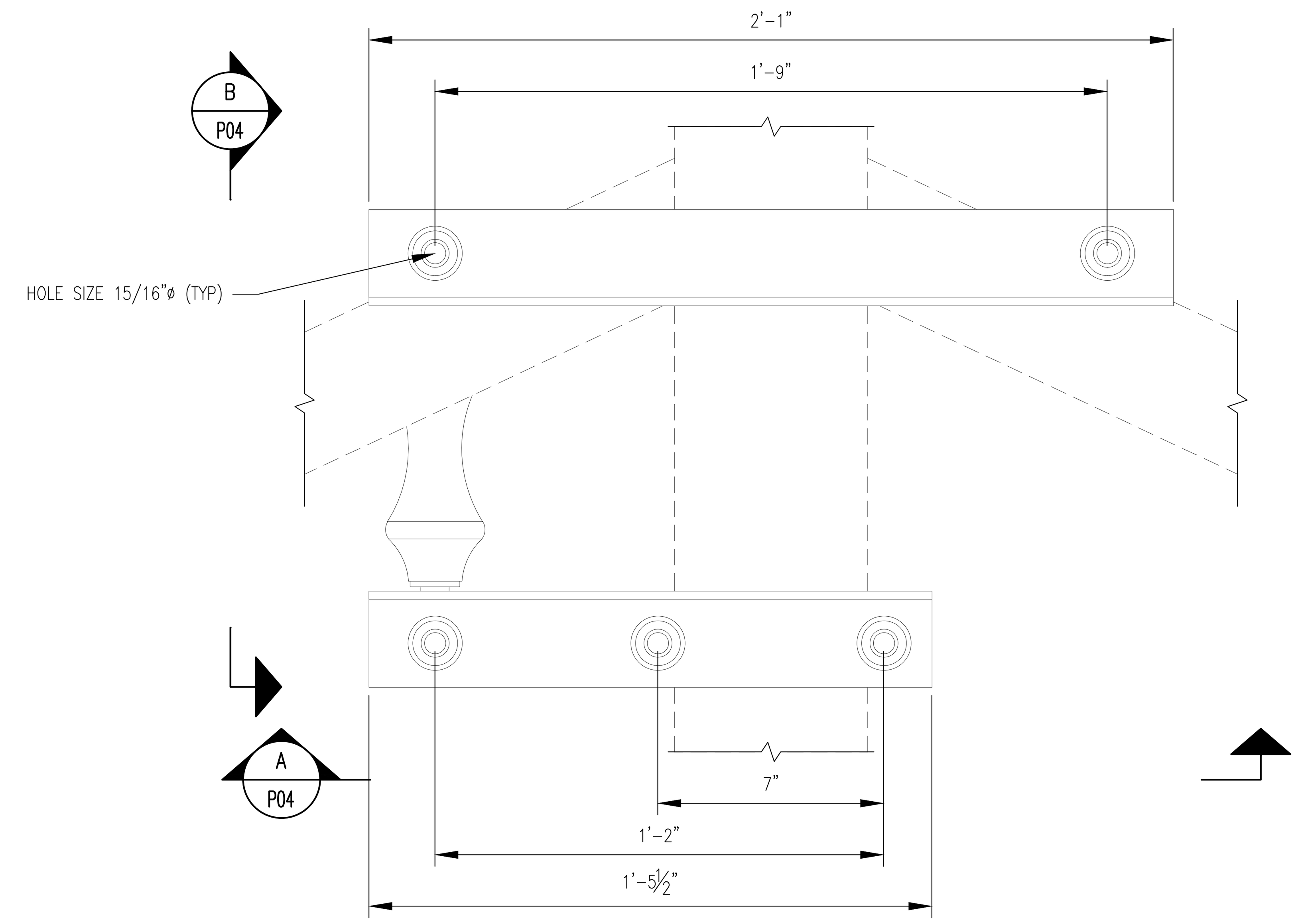
PROJECT LOCATION
COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE

PROCESS PIPELINE SERVICES
1600 Providence Highway
Walpole, MA 02081
781.829.0524
processpipelineservices.com

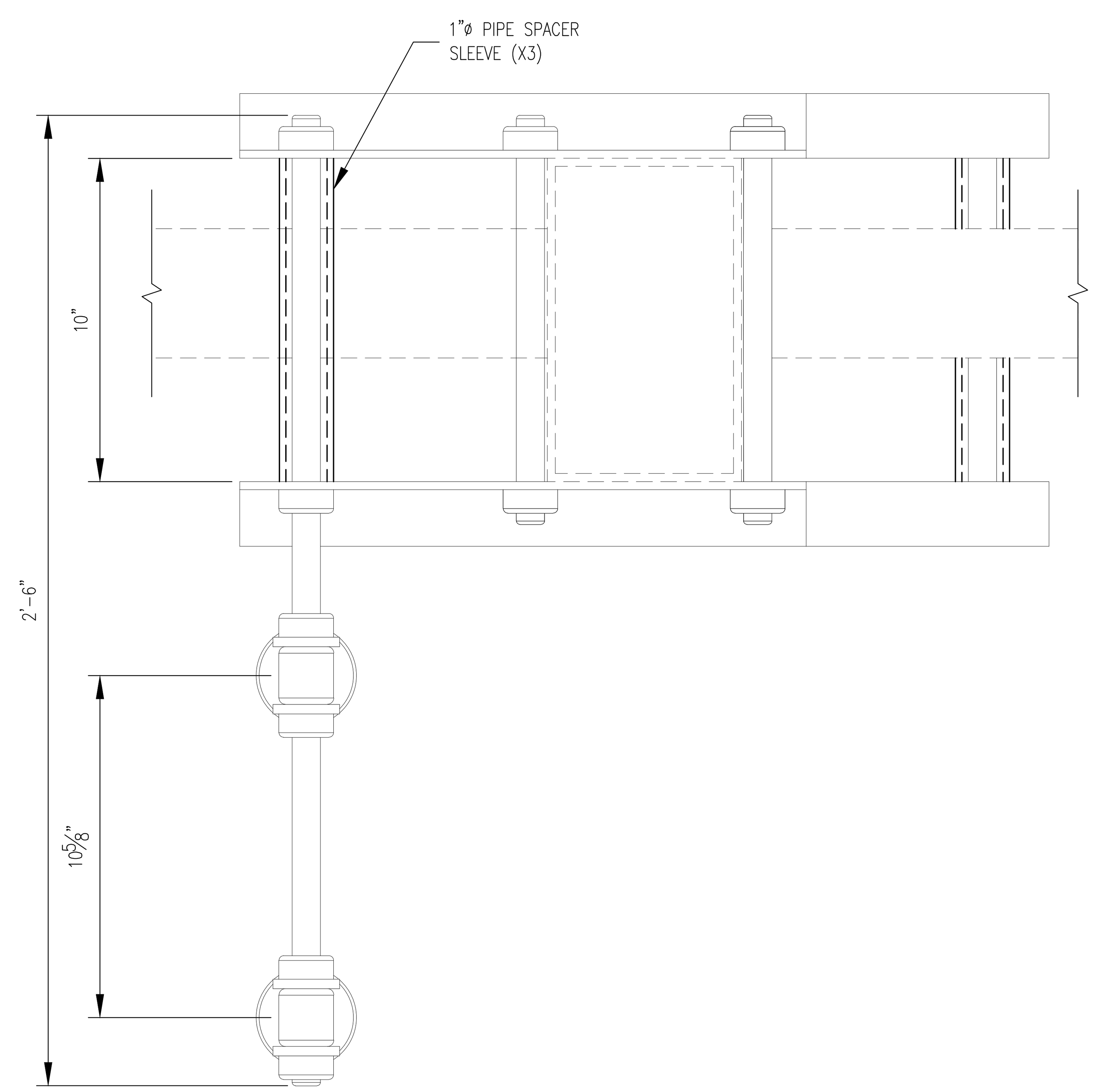
FILE NAME: 5138_P00.DWG
PLOT DATE: 05/12/2014 11:55 AM
SCALE: AS SHOWN

SIZE	SHEET	REV
22X34	P03	G

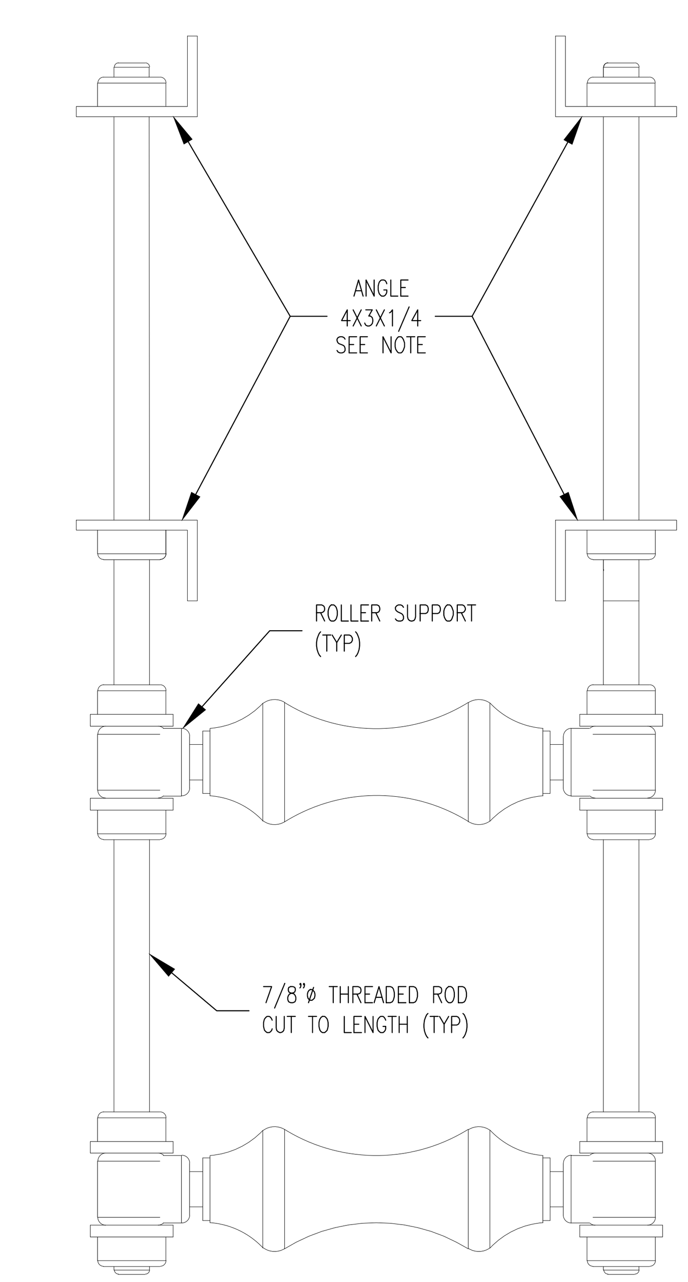
SHEET 3 OF 6



UTILITY SUPPORT CENTER FABRICATION
SCALE: 3" = 1'-0"



UTILITY SUPPORT CENTER FABRICATION (A / P04)
SCALE: 3" = 1'-0"



UTILITY SUPPORT CENTER FABRICATION (B / P04)
SCALE: 3" = 1'-0"

GRAPHIC SCALE 3" = 1'-0" (4" 2" 0 4' 8" 1')

ISSUED FOR CONSTRUCTION

NOTES:
1. APPLY COLD GALVANIZING TO CUT END OF ANGLE.

REV	BY	DATE	DESCRIPTION	DWG NO.	REFERENCE DRAWINGS	SEAL AND SIGNATURE

PRJ MANAGER: MARK D. WOOD			
PRJ ENGINEER: STEPHEN M. READE			
PRJ NAME: PEDESTRIAN BRIDGE CROSSING			
PRJ NUMBER: 5138			
PRJ MILESTONE: ISSUED FOR CONSTRUCTION			
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DESIGNED BY:	MDW	05/12/14	
DRAFTED BY:	RPG	05/12/14	DESIGN MANAGER: T. BICKFORD / REVIEWED BY:
CHECKED BY:	SMR	05/12/14	DESIGN ENGINEER: M. DUPUIS / CHECKED BY:
APPROVED BY:	MDW	05/12/14	ACTIVATION ORDER: / APPROVED BY:

CLIENT INFORMATION
Unitil
Granite State
Gas Transmission

SHEET TITLE
PIPE SUPPORT FABRICATION
SHEET 1 OF 2

PROJECT NAME
PEDESTRIAN BRIDGE CROSSING

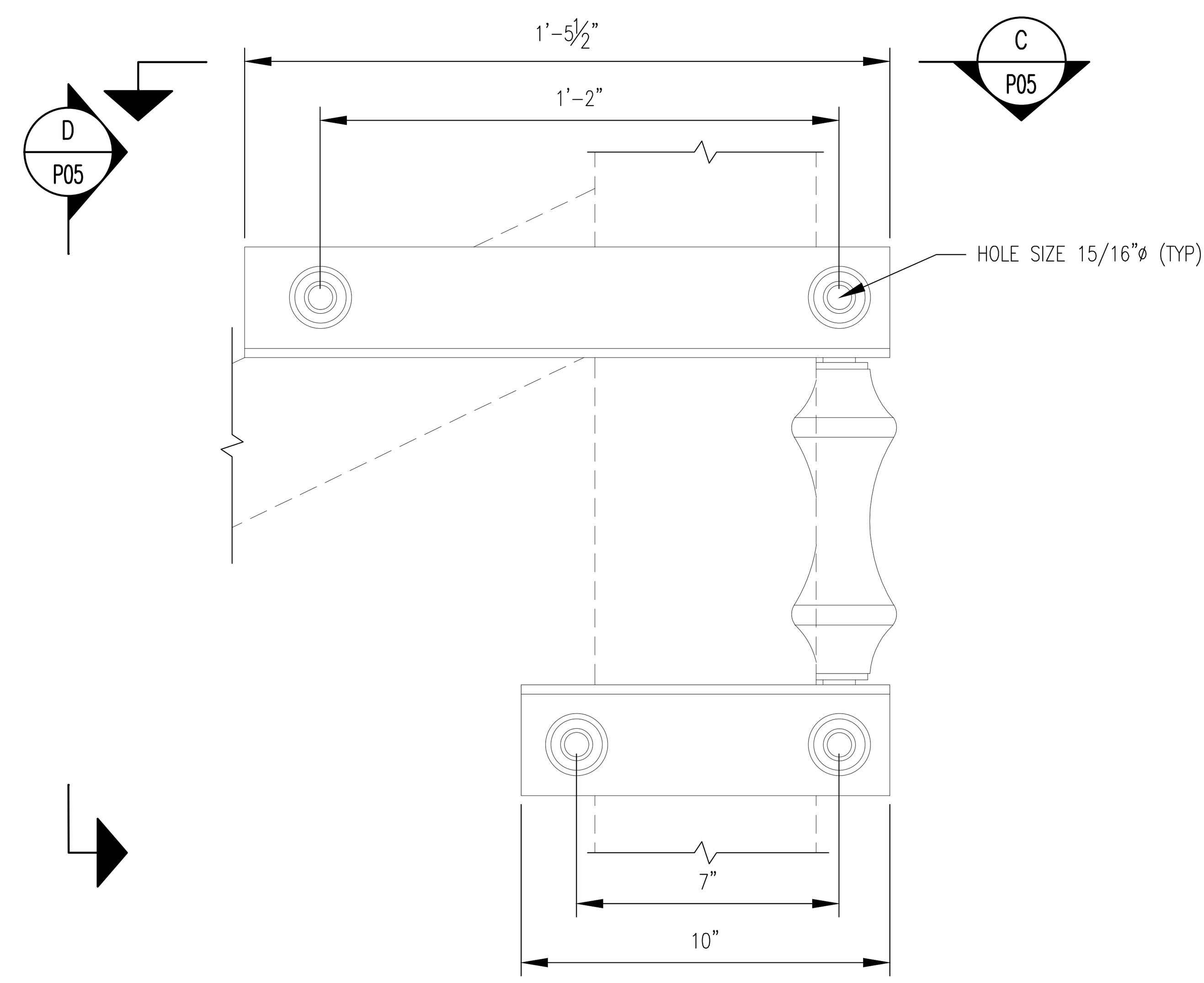
PROJECT LOCATION
COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE

PROCESS PIPELINE SERVICES
1600 Providence Highway
Walpole, MA 02081
781.829.0524
processpipelineservices.com

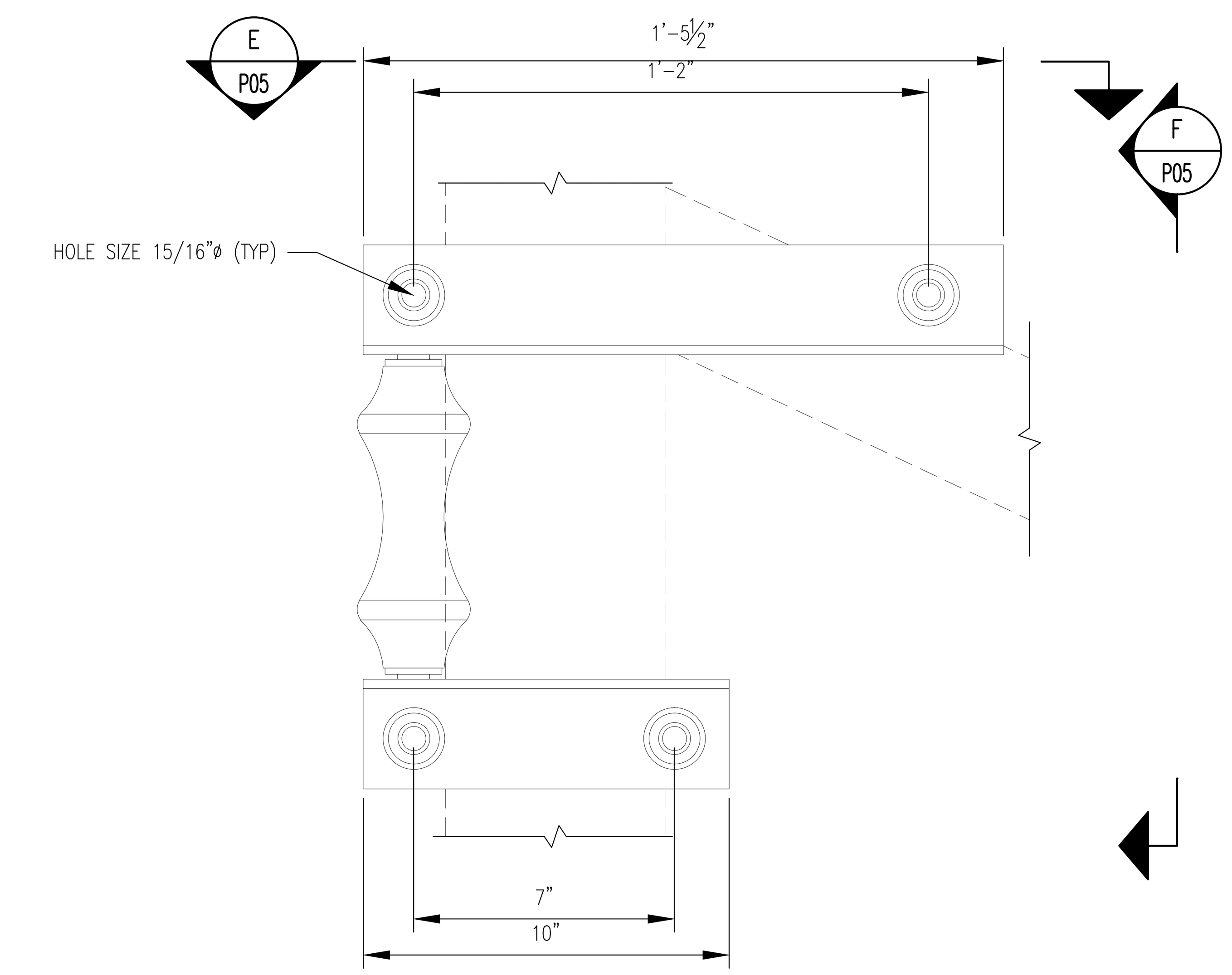
FILE NAME: 5138_P00.DWG
PLOT DATE: 05/12/2014 11:55 AM
SCALE: 3" = 1'-0"

SIZE	SHEET	REV
22X34	P04	G

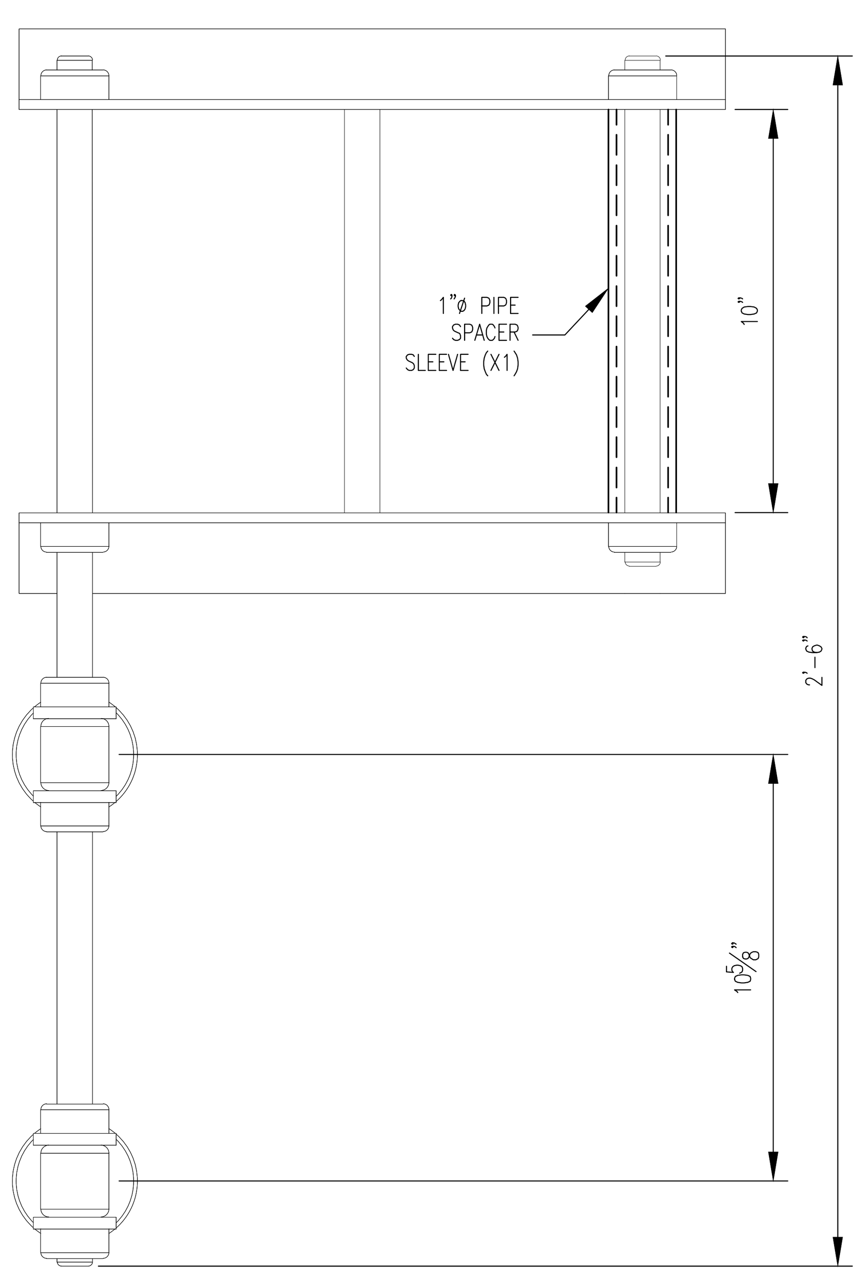
SHEET 4 OF 6



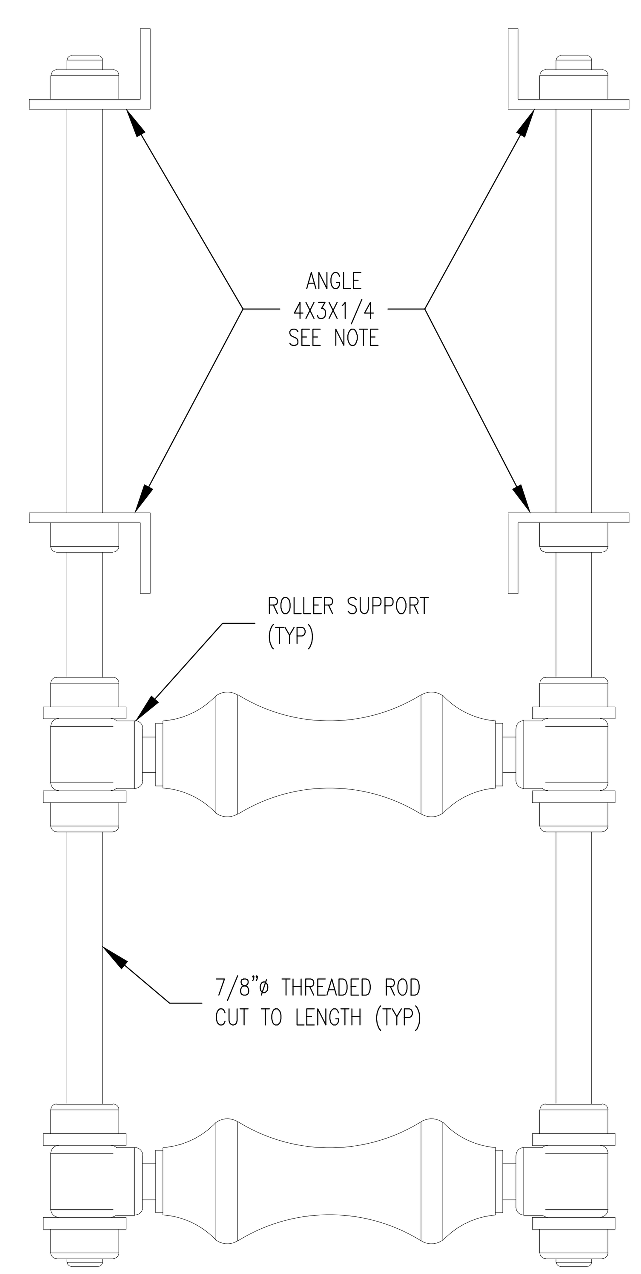
UTILITY SUPPORT EAST FABRICATION
SCALE: 3" = 1'-0"
(TYP X6)



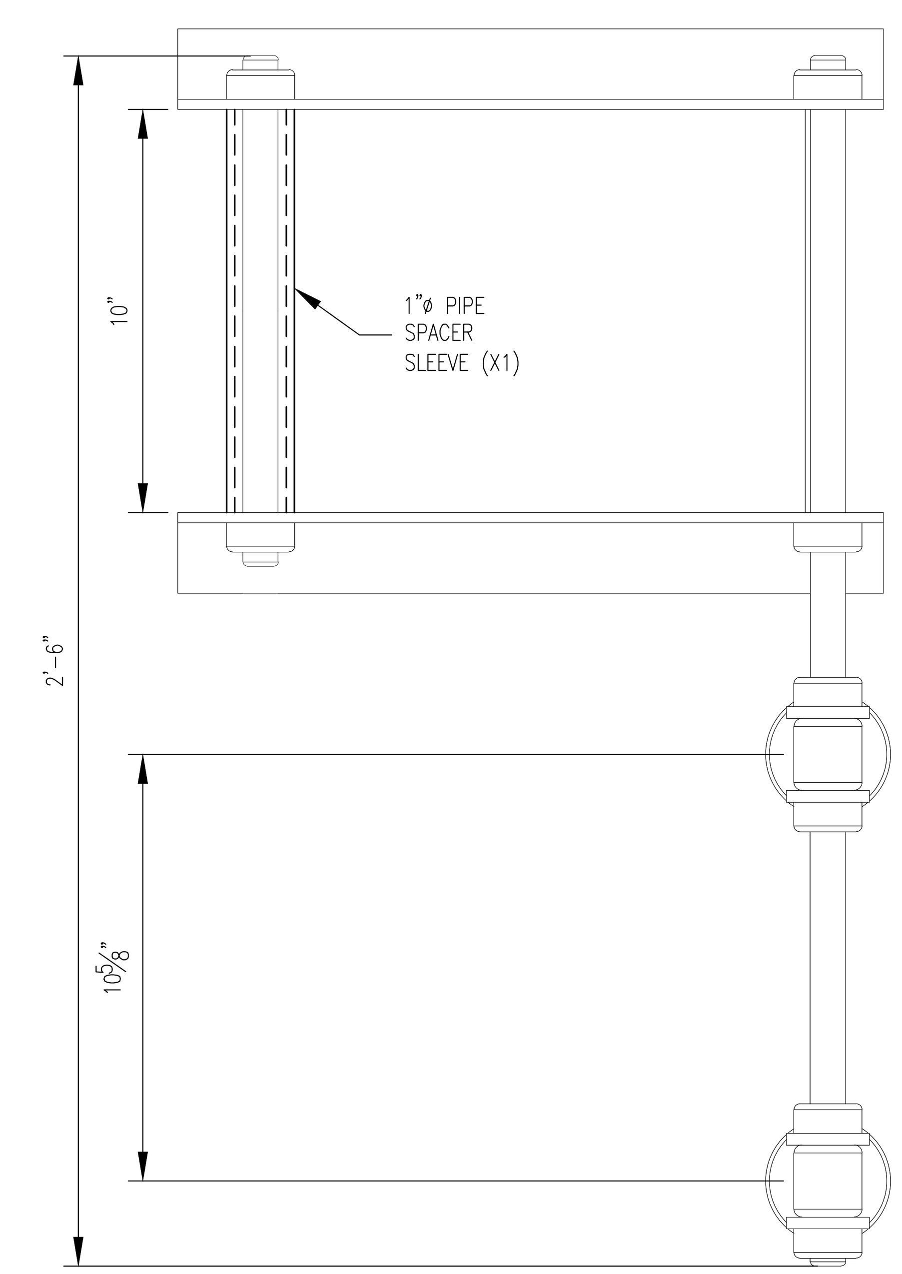
UTILITY SUPPORT WEST FABRICATION
SCALE: 3" = 1'-0"
(TYP X6)



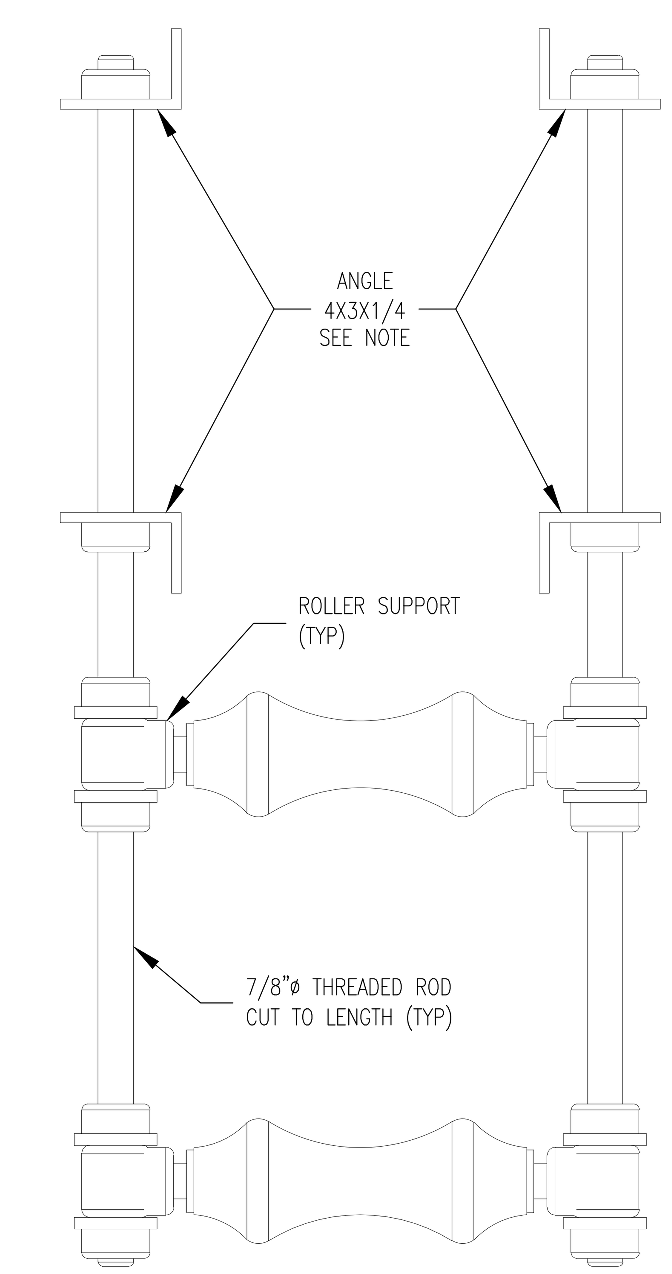
UTILITY SUPPORT EAST FABRICATION C / P05
SCALE: 3" = 1'-0"



UTILITY SUPPORT EAST FABRICATION D / P05
SCALE: 3" = 1'-0"



UTILITY SUPPORT WEST FABRICATION E / P05
SCALE: 3" = 1'-0"



UTILITY SUPPORT WEST FABRICATION F / P05
SCALE: 3" = 1'-0"

GRAPHIC SCALE 3" = 1'-0"
4" 2" 0 4" 8" 1'

ISSUED FOR CONSTRUCTION

NOTES:
1. APPLY COLD GALVANIZING TO CUT END OF ANGLE.

REV	BY	DATE	DESCRIPTION	DWG NO.	REFERENCE DRAWINGS	SEAL AND SIGNATURE

PRJ MANAGER: MARK D. WOOD
PRJ ENGINEER: STEPHEN M. READE
PRJ NAME: PEDESTRIAN BRIDGE CROSSING
PRJ NUMBER: 5138
PRJ MILESTONE: ISSUED FOR CONSTRUCTION
PRJ PHASE: ISSUED FOR CONSTRUCTION

DESIGNED BY:	MDW	05/12/14
DRAFTED BY:	RPG	05/12/14
CHECKED BY:	SMR	05/12/14
APPROVED BY:	MDW	05/12/14

CLIENT INFORMATION
Unitil
Granite State Gas Transmission

DESIGN MANAGER: T. BICKFORD
DESIGN ENGINEER: M. DUPUIS
ACTIVATION ORDER:
REVIEWED BY:
CHECKED BY:
APPROVED BY:

SHEET TITLE
PIPE SUPPORT FABRICATION
SHEET 2 OF 2

PROJECT NAME
PEDESTRIAN BRIDGE CROSSING

PROJECT LOCATION
COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE

PROCESS PIPELINE SERVICES
1600 Providence Highway
Walpole, MA 02081
781.829.0524
processpipelineservices.com

FILE NAME: 5138_P00.DWG
PLOT DATE: 05/12/2014 11:55 AM
SCALE: 3" = 1'-0"

SIZE	SHEET	REV
22X34	P05	G

SHEET 5 OF 6

BILL OF MATERIALS

ITEM	QTY	UOM	SIZE (IN)	DESCRIPTION	RATING	THICKNESS (IN)	STANDARD	MATERIAL SPEC	MANUFACTURER	NOTES
1	160	LF	8	PIPE	SCHD 40	0.322	–	API 5L, GR B		PRITEC 1080 COATED – NISOURCE GAS TRANSMISSION AND STORAGE SPECIFICATION OEP-13
2	4	EA	8	ELBOW, 90 DEG, LR	STD	0.322	ANSI B16.9	ASTM A-234, WPB		
3	2	EA	8	TRANSITION FITTING	–	–	–	–		
4	26	EA	8	ROLLER GUIDE SUPPORT	–	–	–	–	LB&A, Inc	MODEL : 1B, (1 ROLLER AND 2 SOCKETS WITH EACH AXLE)
5	52	EA	4 X 3 X 1/4	SUPPORT BRACKET, CUSTOM	–	–	–	–		HOT DIPPED GALVANIZED ANGLE, CUT TO LENGTH, WITH 15/16" DIAMETER HOLES, (4 ANGLES PER ASSEMBLY)
6	15	EA	1	PIPE, SPACER SLEEVE	SCHD 80	0.179	–	API 5L, GR B	–	HOT DIPPED GALVANIZED SPACER SLEEVE, LENGTH 10-INCH (1 PER ASSEMBLY, EXCEPT CENTER UTILITY SUPPORT)
7	53	EA	7/8 X 30"	THREADED ROD	–	–	–	ASTM A-193 GR B7	–	WITH 6 EACH, ASTM A-194 GR 2H HEX NUTS AND 6 HARDENED ASTM F436 STEEL WASHERS, ALL TO BE XYLAN OR TEFLON COATED
8	2	EA	11-1/2 x 36"	BELLOWS, RF X RF	ANSI 150	–	–	ASTM A-106 SA240-T321	AMERICAN BOA, Inc	EXTERNALLY PRESSURIZED EXPANSION JOINT MODEL NO: 8" XFS-0100-36"-M0, OR EQUIVALENT
9	4	EA	8	GASKET	ANSI 150	0.125	ASME B16.20	–	FLEXITALLIC	STYLE CGI SPIRAL WOUND, 304 SS WITH NON-ASBESTOS FLEXITE FILLER, CS GAUGE RING AND INNER RING
10	32	EA	3/4 X 4-3/4	STUD BOLTS	–	–	–	ASTM A-193 GR B7	–	WITH 2 EACH, ASTM A-194 GR 2H HEX NUTS AND 2 HARDENED ASTM F436 STEEL WASHERS, ALL TO BE XYLAN OR TEFLON COATED (8" ANSI 150 – 8/SET)
11	4	EA	8	FLG, RFWN, STD BORE	ANSI 150	0.322	ASME B16.5	ASTM A-105	–	–

ISSUED FOR CONSTRUCTION

REV	BY	DATE	DESCRIPTION	DWG NO.	REFERENCE DRAWINGS	SEAL AND SIGNATURE

PRJ MANAGER: MARK D. WOOD
PRJ ENGINEER: STEPHEN M. READE
PRJ NAME: PEDESTRIAN BRIDGE CROSSING
PRJ NUMBER: 5138
PRJ MILESTONE: ISSUED FOR CONSTRUCTION
PRJ PHASE: ISSUED FOR CONSTRUCTION

DESIGNED BY:	MDW	05/12/14
DRAFTED BY:	RPG	05/12/14
CHECKED BY:	SMR	05/12/14
APPROVED BY:	MDW	05/12/14

CLIENT INFORMATION
Unitil
Granite State Gas Transmission

DESIGN MANAGER: T. BICKFORD
DESIGN ENGINEER: M. DUPUIS
ACTIVATION ORDER:
REVIEWED BY:
CHECKED BY:
APPROVED BY:

SHEET TITLE
BILL OF MATERIALS

PROJECT NAME
PEDESTRIAN BRIDGE CROSSING

PROJECT LOCATION
COVERED BRIDGE ROAD
DOVER, STRAFFORD COUNTY, NEW HAMPSHIRE

PROCESS PIPELINE SERVICES
1600 Providence Highway
Walpole, MA 02081
781.829.0524
processpipelineservices.com

FILE NAME: 5138_P00.DWG
PLOT DATE: 05/12/2014 11:55 AM
SCALE: N/A

SIZE	SHEET	REV
22X34	P06	G

SHEET 6 OF 6

Project Number
14-03118

NORTHEASTERN ENGINEERING CORP.
Structural Engineers & Construction Consultants
www.NortheasternEng.com
19 Campbell Street
Woburn MA 01801-9998
Specialty Engineers for Construction Systems
TEL. 781-503-0241
FAX 781-503-0247

Date of Project Submittal: April 7, 2014

Project Manager and Client: Mr. Stephen Reade

Company Represented:
Process Pipeline Services Inc.
1600 Providence Highway
Walpole, MA 02081
tel. 781-829-0524

Project Information:

Utility Crossing - Dover Landfill Sewer Pedestrian Bridge
Dover, New Hampshire

Project Submittal Package Includes:
Utility Crossing Details and Computations

Matthew W. Rizzo, Project Manager

Utility Crossing - Dover Pedestrian Bridge

Dover, New Hampshire

Suggested Specifications

- The contractor shall verify all dimensions and conditions in the field prior to commencing work. Where dimensions and elevations of existing construction could affect the new construction, it is the Contractor's responsibility to make field measurements in time for their incorporation in the Shop Drawings. The Architect and Engineer shall be notified of any discrepancies that may exist.
- The Contractor shall be completely responsible for the safety of adjacent structures, property, his workmen, and the public, as affected by the construction of this project.

STRUCTURAL STEEL:

- Structural steel design conforms AISC Steel Construction Manual
- Structural steel rolled shapes, plates, and bars shall conform to the following ASTM designations:

ASTM A-572, Grade 50 .... All columns, beams and girders unless noted otherwise

ASTM A-36 .... Plates and bars unless noted otherwise

ASTM A-500, Grade B .... HSS (square, rect.)

ASTM A-53, Grade B .... Steel pipe

ASTM A-325 ..... All bolts for connecting structural members

ASTM A-307 .... All anchor bolts, unless noted otherwise

- All steel exposed to the weather in the completed building shall be hot dip galvanized. Or have approved coating.
- Shop painting of structural steel is not required unless otherwise noted.
- Welding shall conform to "Structural Welding Code – Steel"
- Shop connections unless otherwise noted, shall be made by welding.
- All shop and field welds shall be made by certified welders, and shall conform to the AWS D1.1. Unless noted otherwise, all welds shall develop the full strength of the members or components being connected.
- Electrodes for all field and shop welding shall conform to AWS E–70 Series.
- All welding shall be inspected in the field by qualified welding inspectors.
- Field connections shall be made by bolting with 3/4" diameter A325 bolts, minimum, unless otherwise noted.
- A325 bolts installed with the bolt tension specified in Table J3.1 of the AISC Specification, shall be used.
- All structural steel details and connections shall conform to the standards of the AISC.
- Connections completely detailed in the Contract Drawings may not be altered without written approval by the Engineer. Where approved, altered connections shall be completely detailed by the fabricator's engineer clearly on the shop drawings.
- Alterations of schematic connection details may impact architectural concept and shall not be made without prior written approval of the Engineer.
- Connections shown on these drawings are generally schematic. They are intended to define the spacial relationship of the framed members and show a feasible method of making the connection. Any connection that is not shown or is not completely detailed on the structural drawings shall be designed by a registered professional Engineer, retained by the fabricator. Connections may be designed to conform to AISC Manuals.
detailed means the following information is shown on the shop detail drawings:

a. All plate dimensions and grade.
b. All weld sizes, lengths, pitches and returns.
c. All hole sizes and spacings.
d. Number and type of bolts: where bolts are shown but no number is given, the connection has not been completely detailed.
e. Where partial information is given, it shall be the minimum requirement for the connection.
f. Method of design.

Design Assumptions

Project Location:	**Dover Pedestrian Bridge - Dover, New Hampshire**
References:	**-IBC 2006 W/ ASCE 7 - 05**

Engineering Certification:
Component Submittal for project use and approval.
The enclosed engineering package has been prepared under the supervision of the undersigned and according to performance based design criteria herewith.

STATE OF NEW HAMPSHIRE
KEVIN M. FINNEGAN
No. 12234
LICENSED PROFESSIONAL ENGINEER

Prepared For:

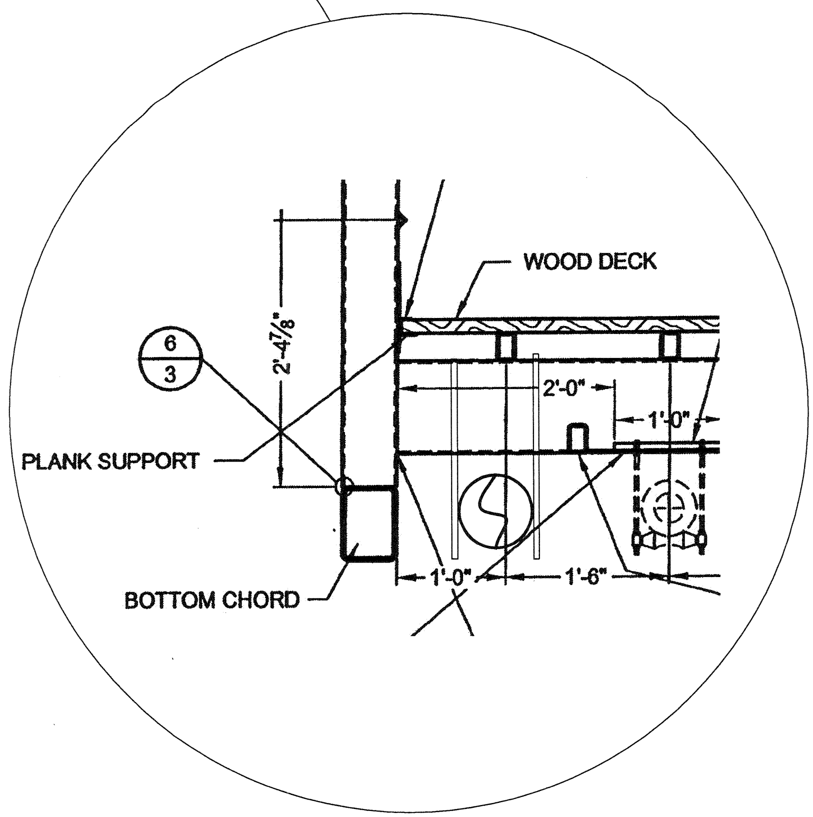
Process Pipeline Services Inc.
1600 Providence Highway
Walpole, MA 02081
tel. 781-829-0524

NORTHEASTERN ENGINEERING CORP.
Structural Engineers and Construction Consultants
www.northeasterneng.com
19 Campbell St. Woburn, MA 01801 tel. 781-503-0241 fax. 781-503-0247

Utility Crossing - Dover Pedestrian Bridge
Dover, New Hampshire

Date. March 2014	Sheet Title Cover Sheet
Drawn By. mwr	Sheet No.
Scale. As Noted	C-1

UTILITY CROSSING ALONG UNDERSIDE SIDE OF BRIDGE
SEE S-1 FOR SECTION AND DETAIL NOTES



KEY PLAN

NORTHEASTERN ENGINEERING CORP.
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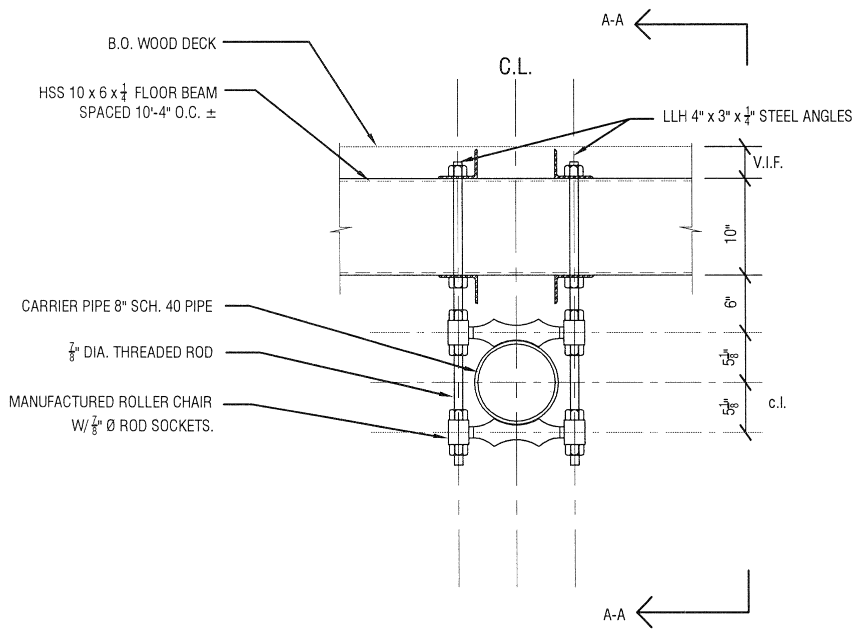
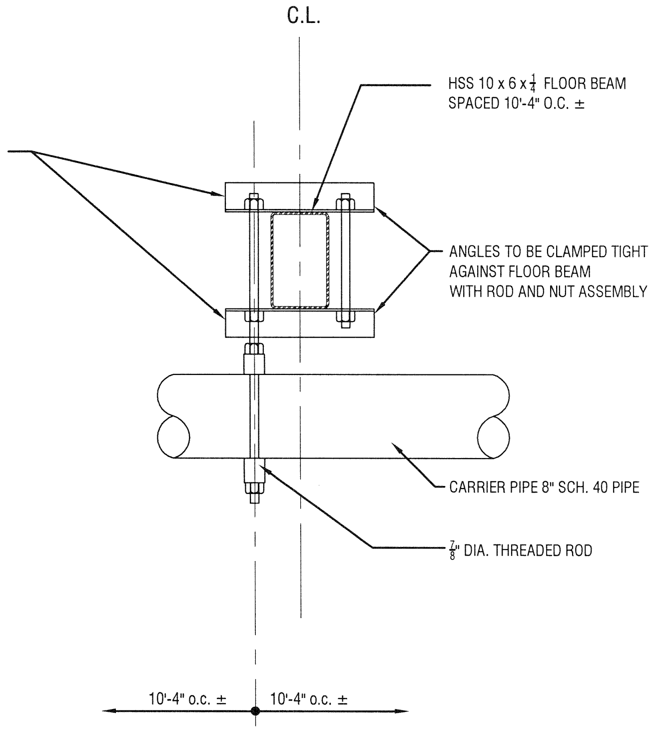
Utility Crossing - Dover Pedestrian Bridge
Dover, New Hampshire

Date. March 2014
Drawn By. mwr
Scale. As Noted

Sheet Title: Section Sheet
Sheet No. K-1



SECTION VIEW



A-A ELEVATION VIEW

Sheet Title
Section Sheet
Sheet No.
S-1

Date.
March 2014
Drawn By.
mwr
Scale.
As Noted

Utility Crossing - Dover Pedestrian Bridge
Dover, New Hampshire

NORTHEASTERN ENGINEERING CORP.
Structural Engineers and Construction Consultants
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NORTHEASTERN ENGINEERING CORP.		JOB:	Utility Crossing
		DONE BY:	mwr
		DATE:	4/7/2014
		SHEET #:	

Structural Engineers & Construction Consultants
19 Campbell St. | Woburn, MA 01801 | tel. 781-503-0241 www.NortheasternEng.com

Piping and Pipeline Wind Assumptions ASCE 7 - 05

Calculate Velocity Pressure

$$qz = .00256\ K_z\ K_{zt}\ K_d\ V^2\ I$$ (Eq. 6-15)

Based on Exposure C

Kz =	**0.98**	height factor. Calculate or use table (6-3) and (6-2)
Kzt =	**1.00**	use 1.0 unless specified in construction documents
Kd =	**0.95**	Table 6-4 round structures such as pipe.
V =	**100**	mph
I =	**1.15**	Table 1-1 piping facility Category IV
q_p =	**27.52**	psf
Cf =	**0.7**	Force component factor for rounds (Fig. 6-21)
G =	**0.85**	Rigid Pipe Gust Factor (6.5.8.1)

Design Wind Loads on structures

$$F = qz\ G\ C_f\ A_f$$ (Eq. 6-28)

Pipe Diameter =	0.67	feet
Pipe Radius =	0.335	feet

Af = **0.67** ft^2/ft area of pipe cross section perp to wind, per foot of pipe length

F = **10.97** plf

NORTHEASTERN ENGINEERING CORP.	JOB:	Utility Crossing
	DONE BY:	mwr
	DATE:	4/7/2014
	SHEET #:	

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19 Campbell St. | Woburn, MA 01801 | tel. 781-503-0241 www.NortheasternEng.com

Ice Load on Pipe ASCE 7 Sect. 10.4

$A_i = \pi$ td (Dc + td) cross sectional area of ice.

$td = 2.0\ t\ I_i\ f_z\ (K_{zt})^{0.35}$ design ice thickness in inches.

solve td

t =	1.00	in.	(fig. 10-2)
I_i =	1.25	multiplier on ice thickness category IV structure.	
f_z =	0.99	calculated height factor (eq. 10-4)	
K_{zt} =	1.00	use 1.0 unless specified in construction documents.	
∴ td =	2.48	in.	
Dc =	8.63	in.	cross sectional dimension (fig. 10-1)

solve A_i

∴ A_i =	86.36	in^2
∴ A_i =	0.60	ft^2

Ice density shall not be less than **56** # / ft^3

Weight of Ice = 33.58 plf

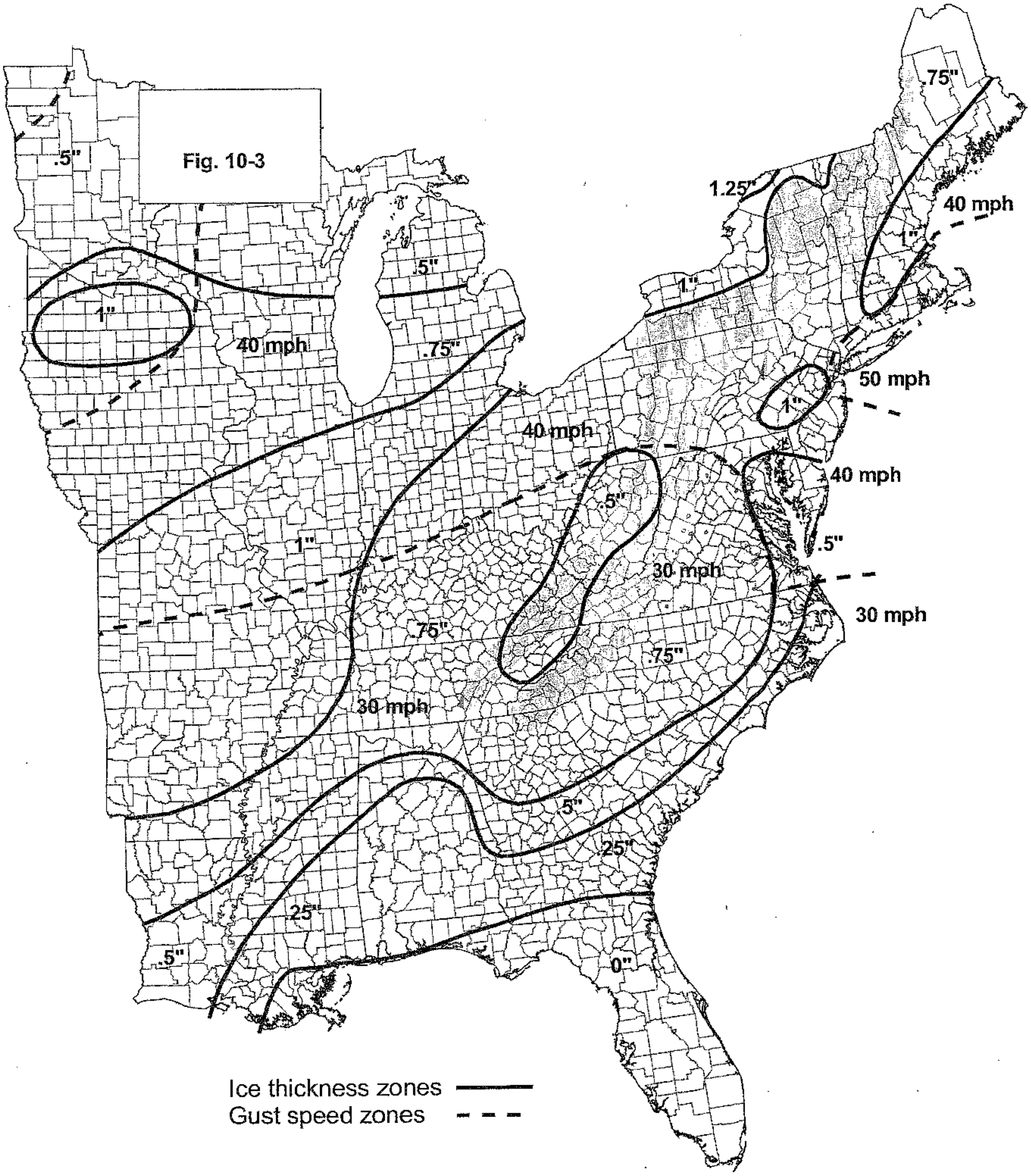


FIGURE 10-2 (continued) 50-YEAR MEAN RECURRENCE INTERVAL UNIFORM ICE THICKNESSES DUE TO FREEZING RAIN WITH CONCURRENT 3-SECOND GUST SPEEDS: CONTIGUOUS 48 STATES.

"IBC2009E.xls" Program
Version 1.1

SEISMIC FORCE FOR COMPONENTS
Per IBC 2009 and ASCE 7-05 Specifications
For Mechanical and Electrical Components

Job Name:		Subject:			
Job Number:		Originator:		Checker:	

Input Data:

Occupancy Category =	IV	IBC 2009, Table 1604.5, page 307
Soil Site Class =	D	IBC 2009 Table 1613.5.2, page 341
Location Zip Code =		(not required)
Spectral Accel., Ss =	0.300	ASCE 7-05 Figures 22-1 to 22-14
Spectral Accel., S_1 =	0.120	ASCE 7-05 Figures 22-2 to 22-14
Average Roof Height, h =	30.000	ft.
Height of attachment, z =	30.000	ft.
Importance Factor, I_p =	1.50	ASCE 7-05 Section 13.1.3, page 143
Component Weight, W_p =	28.60	lbs., ASCE 7-05 Section 13.3.1, page 144
Component Type =	3b	Piping in accordance with ASME B31, including in-line components, constructed of high- or limited deformability materials, with joints made by threading, bonding, compression couplings, or grooved couplings (ASCE 7-05 Table 13.6-1)

Results:

Site Coefficients:

F_a =	1.560	IBC 2009 Table 1613.5.3(1), page 341
F_v =	2.320	IBC 2009 Table 1613.5.3(2), page 341

Maximum Spectral Response Accelerations for Short and 1-Second Periods:

S_{MS} =	0.468	$S_{MS} = F_a*Ss$, IBC 2009 Eqn. 16-36, page 340
S_{M1} =	0.278	$S_{M1} = Fv*S_1$, IBC 2009 Eqn. 16-37, page 340

Design Spectral Response Accelerations for Short and 1-Second Periods :

S_{DS} =	0.312	$S_{DS} = 2*S_{MS}/3$, IBC 2009 Eqn. 16-38, page 342
S_{D1} =	0.186	$S_{D1} = 2*S_{M1}/3$, IBC 2009 Eqn. 16-39, page 342

Seismic Design Category:

Category(for S_{DS}) =	C	IBC 2009 Table 1613.5.6(1), page 343
Category(for S_{D1}) =	D	IBC 2009 Table 1613.5.6(2), page 343
Use Category =	D	Most critical of either category case above controls

Amplification Factor and Response Modification Coefficient:

Amplification Factor, a_p =	2.50	ASCE 7-05 Table 13.6-1, page 149
Response Mod. Coef., R_p =	6.00	ASCE 7-05 Table 13.6-1, page 149

Component Horizontal Seismic Force:

F_{ph} =	6.69	lbs., $F_{ph} = (0.4*a_p*S_{DS}*W_p)*(1+2*z/h)/(R_p/I_p)$, Eqn. 13.3-1, page 144
$F_{ph(max)}$ =	21.42	lbs., $F_{ph} = 1.6*S_{DS}*I_p*W_p$, ASCE 7-05 Eqn. 13.3-2, page 144
$F_{ph(min)}$ =	4.02	lbs., $F_{ph} = 0.3*S_{DS}*I_p*W_p$, ASCE 7-05 Eqn. 13.3-3, page 144
Use: F_{ph} =	6.69	lbs. *Note: Fph is to be applied independently in both transverse and longitudinal directions relative to seismic restraint.*

Component Vertical Seismic Force:

F_{pv} =	1.78	lbs., $F_{pv} = 0.2*S_{DS}*W_p$, ASCE 7-05 Eqn. 12.4-4, page 126

Say 5 PSF min.

Comments:

Note: Units are in PSF

4/7/2014 9:02 AM

IBC 2006 SECTION 1605 - LOAD COMBINATIONS

Load Inputs:

				spacing	10.33	ft / o.c.
Dead Load **D** =	28.6	plf			295.44	lbs
					0.00	lbs
Live Load **L** =	0	plf			0.00	lbs
					0.00	lbs
Live Load Roof **Lr** =	0	plf			0.00	lbs
					0.00	lbs
Snow Load / ICE **S** =	34	plf	ice load		351.22	lbs
					0.00	lbs
Wind Load **W** =	11	plf			113.63	lbs
					0.00	lbs
Earthquake **E** =	5	plf			51.65	lbs
					0.00	lbs
Fluid **F** =	0	plf			0.00	lbs
					0.00	lbs
Earth Pressure **H** =	0	plf			0.00	lbs
					0.00	lbs
Rain **R** =	0	plf			0.00	lbs
					0.00	lbs
Temperature Change **T** =	0	plf			0.00	lbs
				total load =	**811.94**	**lbs**

Basic Load Combinations Where Allowable Stress Design is used: 1605.3.1

D + F =	28.6	plf	**(Equation 16-8)**
D + H + F + L + T =	28.6	plf	**(Equation 16-9)**
D + H + F + Lr =	28.6	plf	**(Equation 16-10)**
D + H + F + S =	62.6	plf	
D + H + F + R =	28.6	plf	
D + H + F + 0.75(L + T) + 0.75(Lr)	28.6	plf	**(Equation 16-11)**
D + H + F + 0.75(L + T) + 0.75(S)	54.1	plf	
D + H + F + 0.75(L + T) + 0.75(R)	28.6	plf	
D + H + F + W	39.6	plf	**(Equation 16-12)**
D + H + F + 0.7(E)	32.1	plf	
D + H + F + 0.75(W) + 0.75(L) + 0.75(Lr)	36.85	plf	**(Equation 16-13)**
D + H + F + 0.75(W) + 0.75(L) + 0.75(S)	62.35	plf	
D + H + F + 0.75(W) + 0.75(L) + 0.75(R)	36.85	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(Lr)	32.1	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(S)	57.6	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(R)	32.1	plf	
0.6 (D) + W + H	28.16	plf	**(Equation 16-14)**
0.6 (D) + 0.7(E) + H	20.66	plf	**(Equation 16-15)**

Worst Case Load Combination = 62.60 plf = 646.66 lbs @ 10.33 ft / o.c.

assume 100 lb misc vertical load say 750 lbs total.

IBC 2006 SECTION 1605 - LOAD COMBINATIONS

Load Inputs:

Load	Value	Unit	Note
Dead Load **D** =	0	plf	
Live Load **L** =	0	plf	
Live Load Roof **Lr** =	0	plf	
Snow Load / ICE **S** =	0	plf	ice load
Wind Load **W** =	11	plf	
Earthquake **E** =	5	plf	
Fluid **F** =	0	plf	
Earth Pressure **H** =	0	plf	
Rain **R** =	0	plf	
Temperature Change **T** =	0	plf	

spacing	10.33	ft / o.c.
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	113.63	lbs
	0.00	lbs
	51.65	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
	0.00	lbs
total load =	**165.28**	**lbs**

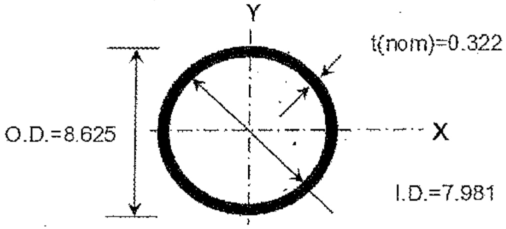
Basic Load Combinations Where Allowable Stress Design is used: 1605.3.1

Combination	Value	Unit	Equation
D + F =	0	plf	**(Equation 16-8)**
D + H + F + L + T =	0	plf	**(Equation 16-9)**
D + H + F + Lr =	0	plf	**(Equation 16-10)**
D + H + F + S =	0	plf	
D + H + F + R =	0	plf	
D + H + F + 0.75(L + T) + 0.75(Lr)	0	plf	**(Equation 16-11)**
D + H + F + 0.75(L + T) + 0.75(S)	0	plf	
D + H + F + 0.75(L + T) + 0.75(R)	0	plf	
D + H + F + W	11	plf	**(Equation 16-12)**
D + H + F + 0.7(E)	3.5	plf	
D + H + F + 0.75(W) + 0.75(L) + 0.75(Lr)	8.25	plf	**(Equation 16-13)**
D + H + F + 0.75(W) + 0.75(L) + 0.75(S)	8.25	plf	
D + H + F + 0.75(W) + 0.75(L) + 0.75(R)	8.25	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(Lr)	3.5	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(S)	3.5	plf	
D + H + F + 0.7(E) + 0.75(L) + 0.75(R)	3.5	plf	
0.6 (D) + W + H	11	plf	**(Equation 16-14)**
0.6 (D) + 0.7(E) + H	3.5	plf	**(Equation 16-15)**

Worst Case Load Combination = 11.00 plf = 113.63 lbs @ 10.33 ft / o.c.

assume 100 lb misc. lateral load say 250 lbs total

Round HSS & Pipes

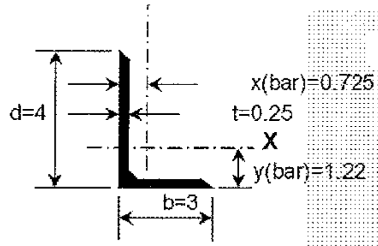


	Pipe8STD	
A =	7.85	in.^2
O.D. =	8.625	in.
I.D. =	7.981	in.
t(nom) =	0.322	in.
t(des) =	0.3	in.
wt./ft. =	28.60	plf.
Ix = Iy =	68.1	in.^4
Sx = Sy =	15.8	in.^3
rx = ry =	2.95	in.
Zx = Zy =	20.8	in.^3
J =	136	in.^4
C =	---	in.^3

Load capacity of threaded hanger rods are indicated in the table below:

Nominal Rod Diameter (inches)	Root Area (in2)	Maximum Load (lbs)	(kg)
3/8	0.07	600	270
1/2	0.13	1100	500
5/8	0.2	1800	820
3/4	0.3	2700	1220
→ 7/8	0.42	3800	1720
1	0.55	4900	2220
1 1/8	0.69	6200	2810
1 1/4	0.89	8000	3630
1 1/2	1.29	11600	5260
1 3/4	1.74	14700	6670
2	2.3	20700	9390
2 1/4	3.02	27200	12340
2 1/2	3.72	33500	15200
3	5.62	50600	22960
3 1/4	6.72	60500	27440
3 1/2	7.92	71300	32340
4	10.6	95400	43270
4 1/2	13.7	123000	55780
5	17.2	154000	69900

allowable tensile stress 9 kpsi



.24

	L4X3X1/4	
A =	1.69	in.^2
d =	4	in.
b =	3	in.
t =	0.25	in.
k =	0.6250	in.
wt./ft. =	5.80	plf.
eo =	0.21	in.
Ix =	2.75	in.^4
Sx =	0.99	in.^3
rx =	1.270	in.
y(bar) =	1.220	in.
Zx =	1.770	in.^3
yp =	0.618	in.
Iy =	1.33	in.^4
Sy =	0.59	in.^3
ry =	0.887	in.
x(bar) =	0.725	in.
Zy =	1.030	in.^3
xp =	0.211	in.
Iz =	0.69	in.^4
Sz =	0.32	in.^3
rz =	0.639	in.
TAN(α) =	0.558	
Qs(36) =	0.912	
J =	0.0386	in.^4
Cw =	0.0356	in.^6
a =	1.55	in.
ro(bar) =	1.99	in.
H =	0.000	

Flexural Design of Single Angles
per AISC Specification 13th Edition

Prin Axis UnEq Leg Long Leg Dwn

Principal Axis Bending
UnEqual Leg Angles Only
Long Leg Down

Shape	L4X3X1/4		
Long Leg	4	inch	
Short Leg	3	inch	
t	0.25	inch	
Sw long tip, major axis	1.22	inch^3	Section modulus to long leg tip for bending about major axis
Sw short tip, major axis	1.56	inch^3	Section modulus to short leg tip about major axis
Sz long leg tip, minor axis	0.73	inch^3	Section modulus to long leg tip for bending about minor axis
Sz short leg tip, minor axis	0.46	inch^3	Section modulus to short leg tip for bending about minor axis
Iw, major axis	3.39	inch^4	
Iz, minor axis	0.69	inch^4	
rz, minor axis	0.64	inch	
tan α	0.56		Angle between vertical and minor axis.
β_w	1.65	inch	Positive value from Table C-F10.1in AISC Specification Commentary.
Fy	36	ksi	
Span length	1	feet	
Cb	1	≤ 1.5, per Table 3-1, 13th Ed. AISC Manual	

Major Axis Bending

F10.2	Lateral Torsional Buckling			Assume no lateral torsional restraint
	Me	790.2	inch. kips	Eqn (F10-6)
	My	43.9	inch. kips	
	Mn	65.8	inch. kips	

F10.3	Leg Local Buckling			Short Leg
	b/t	12.00		
	b/t Limits:			
	Compact	15.33		
		Mn	Compact, Leg Local Buckling does not apply	
	Noncompact	25.83		
		Mn	——	inch. kips
	Slender			
		Mn	——	inch. kips
	Mn	N/A	inch. kips	

Major Axis Flexural Capacity		
Mnw	65.8	inch kips
LRFD, ΦMnw	59.2	inch kips
ASD, Mnw/Ω	39.4	inch kips

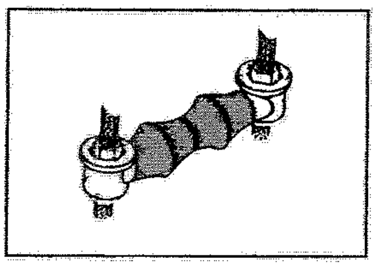
Minor Axis Bending

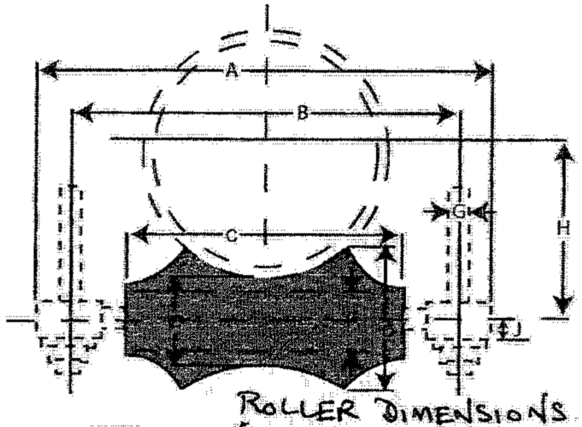
F10.1	Yielding			Tips in Tension
		My	122.0378	inch. kips
		Mn	183.0566	inch. kips

MInor Axis Flexural Capacity		
Mnz	183.1	in. kips
LRFD, ΦMnz	164.8	inch kips
ASD, Mnz/Ω	109.6	inch kips

SINGLE PIPE ROLL

1B





SINGLE PIPE ROLL INCLUDES:
2 ADJUSTABLE SOCKETS
1 ROLL AXLE

SPECIFICATIONS MAY VARY - All Dimensions in inches

Pipe Size	Rod Size	Adj. Socket No.	Max. Load lbs.	Wt. lbs/ea.	A	B*	C	D	E	F	H	J
2	3/8	#1-3/8	600	.57	5 1/4	4 1/8	2 5/8	1 3/16	3/4	3/8	1 5/8	9/16
3	1/2	#2-1/2	700	1.1	6 7/8	5 1/2	3 3/4	1 7/16	7/8	1/2	2 1/4	11/16
4	5/8	#3-1/2	750	1.7	8 1/4	6 3/4	4 3/4	1 3/4	1	1/2	2 13/16	3/4
5	5/8	#3-5/8	750	2.6	9 11/16	8 1/16	5 13/16	2	1 1/8	5/8	3 7/16	7/8
6	3/4	#4-3/4	1070	4.5	11 7/16	9 9/16	6 7/8	2 5/16	1 1/4	3/4	4	1
8	7/8	#5-7/8	1350	7.2	14 1/16	11 15/16	8 7/8	2 13/16	1 1/2	7/8	5 1/8	1 1/8
10	7/8	7/8	1730	9.5	16 3/16	14 1/16	11	3 3/8	1 3/4	7/8	6 3/8	1 1/8
12	7/8	7/8	2400	15.9	17 15/16	15 13/16	12 1/2	3 7/8	2	1	7 7/16	1 1/4
14	1	1	3130	24.3	20 1/8	17 3/4	14 1/4	4 5/8	2 1/2	1 1/8	8 3/8	1 3/8
16	1	1	3970	31.9	22 1/8	19 3/4	16 1/4	5	2 5/8	1 1/4	9 7/16	1 1/2
18	1	1	4200	35.5	24 1/2	21 7/8	18 1/4	5 7/16	2 3/4	1 1/4	10 1/2	1 1/2
20	1 1/4	1 1/4	4550	47.0	27 1/4	24 1/4	20 1/4	6	3	1 1/4	11 5/8	1 5/8
24	1 1/2	1 1/2	6160	76.3	32 1/8	28 5/8	24 1/4	7 3/16	3 5/8	1 1/2	14	1 3/4
30	1 1/2	1 1/2	7290	129.9	39	35 1/2	30 1/4	8 15/16	4 1/2	1 3/4	17 7/16	2 7/16

*Axle lengths may affect B dimension. Contact supplier before pre drilling holes.

LB&A, INC
LINN BROWN & ASSOCIATES
A UTILITY SERVICE COMPANY

UNITIL / PPS | Pedestrian Bridge | DOVER , NH

GENERAL INFORMATION

Bridge Location: Pedestrian Bridge Crossing
Work Description: 8" dia - 140 ft. long

PIPE INFORMATION

Input Pipe Data:

Pipe Material:	Steel		Bridge Span (L_T):	140.0	feet
Pipe Size:	8	inches	No. of supports:	13	each
Outside Diameter (D):	8.625	inches	Support Spacing (L)	10.00	feet
Wall Thickness (t):	0.322	inches	Test Pressure:	100	psi
MAOP (P):	99	psi			

Pipe Properties (from [Pipe Properties] sheet):

Modulus of Elasticity (E):	30,000,000	psi
Coefficient of Linear Expansion (e):	0.0000065	in./in./° F
Specified Minimum Yield Strength:	35,000	psi
Ambient Installation Temperature (T1):	60	Deg. F
Lowest Ambient Operating Temperature (T2):	-20	Deg. F
Highest Ambient Operating Temperature (T3):	100	Deg. F
Max Ambient Operating Temperature Range (T4):	80	Deg. F
Inside Diameter (d):	7.981	inches
Area of Pipe wall (A):	8.40	$inches^2$
Weight of Pipe per Foot:	28.56	lbs/ft
Coating Weight per Foot(10%):	2.86	lbs/ft
Total Weight per Foot (w):	31.42	lbs/ft
Moment of Inertia (I):	72.50	$inches^4$
Section Modulus (S):	16.80	$inches^3$
Radius of Gyration (r):	2.94	inches
Maximum Allowable Expansion Stress:	25,200	psi

THERMAL CALCULATIONS

Resultant Pipe Movement:

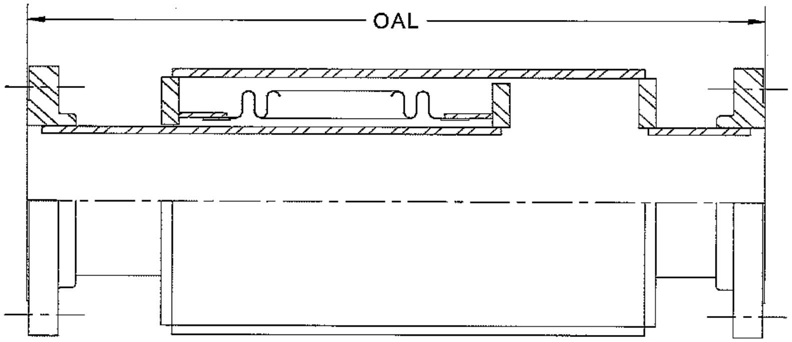
$\Delta L = (e)(\Delta T)(L_T)$ where e = coefficient of linear expansion
Contraction ΔL = **-0.8736** inches — ΔT = operating temperature range from install temp
Expansion ΔL = **0.4368** inches — L_T = Total Pipe Span

Bellows Unit Selected

Axial Compression per Unit :	0.90	inches
Axial Extension per Unit :	0.90	inches
Number of Units Installed :	2	
Overall Allowable Contraction	1.80	inches
Overall Allowable Extension :	1.80	inches

Manufacturer : American BOA, Inc.
Model Number : 8" XFS-0100-36"-M0

This sketch is for quotation purposes only. The Actual production part may vary slightly from the depiction below.



Cross-Section
OAL= 36"

1) 5 PLY EX-PRESS BELLOWS WITH INTERNAL AND EXTERNAL PLIES 625 ALL
2) OTHER PLIES ARE 321SS. THIS IS SUPRESSES LON TERM CORROSSION
3) 8" SCH STD A106 INTERNAL LINER PIPE
4) 12" SCH STD A106 EXTERNAL CASING PIPE
5)516-70 BELLOWS ABSE RINGS, GUIDES AND END CAPS
6)8" 150# RFSO A105 FIXED FLANGES EACH END
7)VIBRATES IN ELASTIC RANGE OF METAL UP T

Description	Material
Bellows	SA240-T321
End Ring	

Design Conditions			
Des. Pres. (psig)	100	Spring Rates:	
Des. Temp. (deg. F)	300	Axial (lbs/in)	343
Axial Compression: (in.)	0.90	Lateral (lbs/in)	336
Axial Extension: (in.)	0.90	Angular (in-lbs/deg)	87
Lateral: (+) (in.)	0.15	Torsional (in-lbs/deg)	2.76E+05
Lateral: (-) (in.)	0.00	Fatigue Life:	1,000,000
Angular: (+) (deg.)	0.00	Design Code:	EJMA
Angular: (-) (deg.)	0.00	Presure. Thrust:	9,093

Quote:	By:	Date:
0	ej	4/21/2014

American BOA, Inc.
P.O. Box 1301
Cumming, GA 30028

Model No.
8" XFS-0100-36"-M0

For Reference Only	Quotation#: I-0
	Customer: 0
	Date: 4/21/2014
American BOA, Inc.	Prepared By: ej
Expansion Joint Division	Exp. Jt. Item #: 0

BELLOWS DESIGN CALCULATION

Author: L. Pinion — Revision 2, 07/10/13

	Design Basis:	The Expansion Joint Manufacturer's Association Standard, 9th Edition 2011 Addenda		
	Allowable Stress Basis:	ASME Sect. II, Part D, 2013 Edition		
	Bellows Element Geometry			
	Bellows Material:		SA240-T321	
	Collar Material:		SA240-T304	
	Bellows Inside Diameter (in.)			10.00
	Bellows Outside Diameter (in.)	H= 0.700		11.52
	Number of Convolutions			18
	Individual Ply thickness (in.)			0.012
	Number of Plies			5
	Bellows Element Length (in.)	2r= 0.310		13.00
	Bellows Effective Area (in.^2)			90.9
	Design Information			
	Condition Type (i.e design, upset)			Design
	Design Pressure (Psig)			-100
	Design Temperature (deg. F)			300
	Axial Compression (in.)			0.90
	Axial Extension (in.)			0.90
	Lateral (+) (in.)			0.15
	Lateral (-) (in.)			0.00
	Angular (+) (deg.)			0.00
	Angular (-) (deg.)			0.00
	Bellows Stress Analysis			
			Actual Stress	Allow. Stress
S1	Tangent Circumferential Membrane Stress Due to Pressure, psi		5,154	19,100
S'1	Collar Circumferential Membrane Stress Due to Pressure, psi		5,278	18,900
S2	Circumferential Membrane Stress Due to Pressure, psi		4,080	19,100
S'2	Reinforcing Ring Membrane Stress Due to Pressure, psi	**	N/A	N/A**
S3	Meridional Membrane Stress Due to Pressure, psi		605	N/A
S4	Meridional Bending Stress Due to Pressure, psi		20,535	N/A
S3+S4	Meridional Mem. + Bending Stress Due to Pressure, psi		21,140	57,300
S5	Meridional Membrane Stress Due to Deflection, psi		511	N/A
S6	Meridional Bending Stress Due to Deflection, psi		70,230	N/A
	Maximum Design Pressure Based Upon Squirm, psig		292	
	Fatigue Characteristics			
	Total Stress Range for All Movements (St), psi			85,539
	Fatigue Life (cycles to failure)	EJMA		1,000,000
	Expansion Joint Spring Rates			
	Axial Spring Rate (lbs./in.)			343
	Lateral Spring Rate (lbs./in.)			336
	Angular Spring Rate (in.-lbs./deg.)			87
	Torsional Spring Rate (in.-lbs./deg.)			275,779
		(Maximum Allowed Torsion = 0.163 deg.)		
	Pressure Thrust at Design Pressure (lbs.)			-9,093

** Un-reinforced bellows, reinforcing rings not utilized — Bellows P/N 0

CONTECH ENGINEERED SOLUTIONS

Contech Engineered Solutions LLC
8301 State Hwy 29 N
Alexandria, MN 56308
Phone: 800-328-2047
Fax: (320) 852-7067
www.ContechES.com

July 25, 2014

Mr. Mark D. Wood, P. E.
Process Pipeline Services
1600 Providence Hwy
Walpole, MA 02081

Subject: Dover Landfill Pedestrian Bridge-Dover NH
Contech Job No. 425653

Dear Mr. Wood:

We have analyzed the 140' x 5' bridge that we supplied for the subject project with the addition of an 8" diameter Natural Gas Pipe. The pipe is located 10" from the inside of one truss. We placed a 300 lb load at that location on each of the internal floor beams.

We checked all of the members and connections in the bridge in accordance with ASCE 7-10 Factored Load Combinations and they are all adequate to resist this additional load.

Attached for your review are the calculations of the bridge with the increase in load for the Natural Gas Pipe. If you have any questions or you need some additional information, do not hesitate to contact me.

Very truly yours,

Craig B. Thorstad, P. E.
Truss Engineering Manager

AISC LRFD	TOP CHORD	JOB # ##

Location : City, State

Engineer : ENG

HSS8X6X3/8		
Properties		
Area =	8.97	in^2
S_x =	19.80	in^3
S_y =	16.90	in^3
I_x =	79.10	in^4
I_y =	50.60	in^4
r_x =	2.97	in.
r_y =	2.38	in.
Z_x =	24.10	in^3
Z_y =	19.80	in^3

The critical combined axial and bending loads in the top chord, as taken from the computer analysis are:

Axial load (P_u) =	256.95	kips
In-plane bending moment (M_{uy}) =	5.17	ft-kips
Out-of-plane bending moment (M_{ux}) =	2.22	ft-kips
Member # (from analysis) =	TC6-0	
Load combination =	1.2DL + 1.6LL	

Slenderness

K_x = 1.00 $\quad \frac{K_x l}{r_x} =$ 40.40 $\quad \frac{K_y l}{r_y} =$ 65.55

K_y = 1.30

l = 120 in $\quad$ Max = 65.55 ≤ 200 GOOD $\quad$ AISC E2

Compressive Resistance

$P_n = F_{cr} A_g$ $\quad$ AISC E3-1

$$\frac{K\,l}{r} \le 4.71\sqrt{E/F_y} \quad \left(or\ F_y/F_e \le 2.25\right) \quad F_{cr} = \left[0.658^{F_y/F_e}\right]F_y$$

36.521 ksi $\quad$ AISC E3-2

$$\frac{K\,l}{r} > 4.71\sqrt{E/F_y} \quad \left(or\ F_y/F_e > 2.25\right) \quad F_{cr} = 0.877F_e$$

NA $\quad$ AISC E3-3

Where: $F_e = \pi^2 E \Big/ \left(\frac{K\,l}{r}\right)^2 =$ 66.62 ksi $\quad$ AISC E3-4

$4.71\sqrt{E/F_y} =$ 113.43 $\quad \left(or\ F_y/F_e \le 2.25\right) =$ 0.7505

$P_n = F_{cr} A_g$ $\quad P_n$ = 327.59 kips

$P_r = \Phi_c P_n$ $\quad \Phi_c$ = 0.9 $\quad P_r$ = 294.83 kips

Flexural Resistance $\quad$ AISC F7

Yielding:

$M_n = M_p = F_y Z$ $\quad Z_x$ = 24.10 in^3 $\quad Z_y$ = 19.80 in^3 $\quad$ AISC F7-1

$M_{nx}=M_{px}$= 1205 k-in $\quad M_{ny}=M_{py}$= 990 k-in

Local Flange Buckling: $\quad$ AISC Table B4.1b

If $\lambda_f > \lambda_{pf}$, then:

$\lambda_{fx} = b_{xfc}/t_{xfc}$ = 19.92 $\quad \lambda_{fy} = b_{yfc}/t_{yfc}$ = 14.19

b_{xfc} = 6.953 in $\quad b_{yfc}$ = 4.953 in

λ_{pf} (compact flange) = $1.12\sqrt{\frac{E}{F_y}} =$ 26.97 (AISC Table B4.1b - 17)

λ_{rf} (non-compact flange) = $1.40\sqrt{\frac{E}{F_y}} =$ 33.72 (AISC Table B4.1b - 17)

If $\lambda_f \le \lambda_{rf}$, then, $M_n = M_p - (M_p - F_y S_x)\left\{3.57\frac{b_{fc}}{t_{fc}}\sqrt{\frac{F_y}{E}} - 4.0\right\} \le M_p$ AISC F7-2 NA

M_{nx}= NA k-in M_{ny}= NA k-in

If $\lambda_f > \lambda_{rf}$, then, $M_n = F_y S_{eff}$ $b_e = 1.92\, t_{fc}\sqrt{\frac{E}{F_y}}\left\{1 - \frac{0.38}{b_{fc}/t_{fc}}\sqrt{\frac{E}{F_y}}\right\} \le b_{fc}$ AISC F7-3,4 NA

b_{xe} = NA in b_{ye} = NA in

S_{effx} = NA in^3 S_{effy} = NA in^3

M_{nx}= NA k-in M_{ny}= NA k-in

Web Local Buckling:
If $D/t_w > \lambda_{pw}$, then: $M_n = M_p - (M_p - F_y S)\left\{0.305\frac{D}{t_w}\sqrt{\frac{F_y}{E}} - 0.738\right\} \le M_p$ AISC F7-5 NA

λ_{pw} (compact web) = $2.42\sqrt{\frac{E}{F_y}} =$ 58.28 (AISC Table B4.1b - 19)

Dx/t_w = 19.92 Dy/t_w = 14.19

M_{nx}= NA k-in M_{ny}= NA k-in

M_{nx}min= 1205.00 k-in M_{ny}min = 990.00 k-in

Φ_f = 0.9 $M_{rx} = \Phi_f M_{nx}$ $M_{ry} = \Phi_f M_{ny}$

M_{rx} = 1084.50 k-in M_{ry} = 891.00 k-in

Check Combined Axial Compression and Flexure

M_{ux} = 62.04 k-in
M_{uy} = 26.64 k-in

$$If\ \frac{P_u}{P_r} < 0.2,\ then\ \frac{P_u}{2.0P_r} + \left(\frac{M_{ux}}{M_{rx}} + \frac{M_{uy}}{M_{ry}}\right) \le 1.0$$ AISC H1-1a

$$If\ \frac{P_u}{P_r} \ge 0.2,\ then\ \frac{P_u}{P_r} + \frac{8.0}{9.0}\left(\frac{M_{ux}}{M_{rx}} + \frac{M_{uy}}{M_{ry}}\right) \le 1.0$$ AISC H1-1b

$\frac{P_u}{P_r} =$ 0.872

Unity Check

0.95 ≤ 1.0 GOOD

425653-Dover Landfill

VisualAnalysis 4.00 Report
Company: CONTECH Bridge Solutions, Inc. **Engineer: Craig B. Thorstad**
File: C:\Program Files\IES\IESCommonFiles\425653-Dover Landfill-Rev C.vap

Member End Reactions

Member	Load Case	Offset ft	Fx K	Vy K	Vz K	Mx K-ft	My K-ft	Mz K-ft
TC7-0	0.6DL + .7IL + .7WL	0.0000	-82.654	0.3311	0.1001	0.3083	-0.8588	1.8342
"	"	10.0000	-82.654	-0.4729	0.1001	0.3083	0.1427	1.1252
"	1.2D + 1.0W + 0.5LL + IL	0.0000	-213.40	0.7549	0.2365	**0.6032**	**-1.3284**	4.1298
"	"	10.0000	-213.40	**-0.8531**	0.2365	0.6032	1.0371	3.6386
"	1.2D + 1.6L + .2IL + .5SL	0.0000	**-256.95**	**0.9454**	**0.2511**	0.4472	-0.2870	3.7587
"	"	10.0000	-256.95	-0.6626	0.2511	0.4472	**2.2235**	**5.1731**
"	DL + 0.7IL + 0.7WL + SL	0.0000	-174.06	0.6493	0.1896	0.4666	-0.9596	3.2017
"	"	10.0000	-174.06	-0.6907	0.1896	0.4666	0.9359	2.9951
"	DL + .75LL + .75SL	0.0000	-178.95	0.7690	0.1743	0.3165	-0.2079	2.4329
"	"	10.0000	-178.95	-0.5710	0.1743	0.3165	1.5351	3.4228
"	DL + .75WL + .75LL + .75S	0.0000	-173.89	0.6409	0.1908	0.4776	-1.0135	3.2601
"	"	10.0000	-173.89	-0.6991	0.1908	0.4776	0.8947	2.9690
"	DL + 0.85LL + 0.7IL	0.0000	-183.36	0.7714	0.1787	0.3235	-0.2118	2.5205
"	"	10.0000	-183.36	-0.5686	0.1787	0.3235	1.5749	3.5341
"	DL + WL	0.0000	-67.316	0.5419	0.0922	0.3637	-1.1887	1.4500
"	"	10.0000	-67.316	-0.7981	0.0922	0.3637	-0.2666	0.1689
"	Dead Load	0.0000	-74.063	0.7127	0.0702	0.1489	-0.1146	0.3470
"	"	10.0000	-74.063	-0.6273	0.0702	0.1489	0.5872	0.7740
"	Ice Load	0.0000	-61.342	0.0329	0.0609	**0.0980**	-0.0546	1.2198
"	"	10.0000	-61.342	0.0329	0.0609	0.0980	0.5543	1.5490
"	Live Load	0.0000	-78.072	0.0419	0.0775	0.1247	-0.0694	1.5525
"	"	10.0000	-78.072	0.0419	0.0775	0.1247	0.7055	1.9715
"	Snow Load	0.0000	-61.788	0.0332	0.0613	0.0987	-0.0550	1.2287
"	"	10.0000	-61.788	0.0332	0.0613	0.0987	0.5583	1.5603
"	Wind Load	0.0000	**6.7470**	-0.1708	**0.0220**	0.2148	-1.0741	1.1031
"	"	10.0000	6.7470	-0.1708	0.0220	0.2148	-0.8539	**-0.6051**