STATE OF VERMONT PUBLIC UTILITY COMMISSION

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Petition of Vermont Gas Systems,
Inc., for a certificate of public good,
pursuant to 20V.S.A. §248,
authorizing the construction of the
"Addison Natural Gas Project"
consisting of approximately 41 miles
of new natural gas transmission
pipeline in Chittenden and Addison
Counties, approximately 5 miles of
new distribution mainlines in Addison
County, together with three new
stations in Williston, New Haven and
Middlebury, Vermont.

Case No. 17-3550-INV

PREFILED TESTIMONY OF LAWRENCE SHELTON

July 10, 2020

Summary: Mr. Shelton testifies about his direct personal knowledge of the depth of the pipeline in one part of the New Haven Swamp. When measured by Mr. Byrd by a probe inserted into the earth during the site visit, the pipeline was no more than 2.5 feet deep in three locations, and a total of 6 locations were less than 3 feet deep. The testing with the probe showed that the GPS readings, which VGS reported to the Commission, were wrong. In another section of the New Haven Swamp, which inspectors reported had the same conditions as the first section, Mr. Byrd did not measure the depth.

[Corrected 9-3-20 to replace "1641+75 by "1645+26" on page 3, line 11]

Exhibits:

[1]

- 49 CFR 192.327
- [2] Video September 19, 2016
- [3] Photographs A & B September 19, 2016
- [4] VELCO & VGS e-mail & attachments September 21, 2016
- [5] September 28, 2016 Inspection Report
- [6] September 29, 2016 Inspection Report

1	Q.	1. Please identify yourself.
2	A.	1. My name is Lawrence Shelton. I am a highly experienced project manager. I
3		began my career as a mason over 40 years ago, and for the past 30 years have worked as
4		a masonry project manager and estimator. My experience includes project estimation and
5		management of construction of what at the time was advertised as the largest brick
6		building in the world NIH Building 50, a hospital on the campus of the National Institute
7		of Health in Bethesda, Maryland.
8	Q.	2. What is the purpose of your testimony?
9	А.	2. I testify about my direct personal knowledge of the depth of the pipeline in the
10		"Clay Plains" section of the New Haven swamp. When measured by Mr Byrd by means
11		of a probe inserted into the earth, the pipeline was buried about 26 or 27 inches deep (as I
12		determined) or about 28 or 29 inches deep (as Mr. Byrd determined). Either way, several
13		were no more than 2.5 feet deep, and six were less than 3 feet deep. The testing with the
14		probe showed that the GPS readings, which VGS reported to the Commission, were
15		wrong. In the other section of the New Haven Swamp that inspectors reported had the
16		same conditions as the Clay Plains section, Mr. Byrd did not measure the depth. His
17		report continues to rely on the GPS data.
18	Q.	3. What was your role leading up to in Mr. Byrd's site visit?
19	A.	3. According to the Board's Final Order and the specifications and evidence
20		provided to the Board, among other specifications, all installation within the VELCO

1	Right of Way were required to have at least 4 feet of depth of cover and the entire 41-
2	miles of the pipeline were required to meet PHMSA Class 3 standards. (Docket No.
3	7970, Order issued 12/23/13, Finding No. 26). Class 3 standards require 36 inches of
4	burial. (49 C.F.R. section 192.327, attached as Shelton Exhibit 1). In what has come to
5	be called the Clay Plains Swamp and the New Haven Swamp, located approximately at
6	station numbers 1640+00 through 1666+50 and 1944+80 through 1951+80 respectively,
7	the exhibits filed with the Commission, and also the specifications used by VGS during
8	construction, called for depth of cover of 4 feet, but VGS's engineers have determined it
9	can safely bear loads if it is 3 feet deep. Docket No. 7970, Order issued 12/23/13,
10	Findings No. 26, 62(d), 62(e); McClain letter to Commission June 2, 2017 (stating that
11	Commission order required 4 feet of depth within VELCO Right of Way, that the
12	pipeline satisfies engineering standards if it is at least 3 feet deep, that PHMSA standards
13	for Class 3 require 3 feet of depth, and the pipeline is at least 3 feet deep).
14	On September 19, 2016, in the evening, I took photographs and a video of the
15	construction process at the Clay Plains Swamp site. The photographs and video showed
16	the pipeline, in a ditch and awaiting cover. The top of the pipeline was less than two feet
17	from the surface of the surrounding land, as I explained in affidavits I submitted to the
18	Commission. Obviously, this would be a violation of the PUC Order and PHMSA
19	regulations. The photographs and video, which have already been filed with the
20	Commission, are attached as Shelton Exhibit 2 and Shelton Exhibit 3.
21	Protect Geprags, a group of which I am a member, submitted my photographs,

showing the depth of burial below the required amount, to the federal Pipeline and
Hazardous Materials Safety Administration (PHMSA) in October of 2016, and sought an
investigation of a number of issues. PHMSA subsequently shared my information
regarding the burial of the pipeline with VGS. In a public meeting held on February 22,
2017, I shared directly with the Department and with VGS my concerns about the depth of
pipe burial in New Haven, including the Clay Plains Swamp.

7 On March 3, 2017, Mr. G.C. Morris, the inspector for the Department of Public 8 Service, and I visited the area shown in my video and photographs. (the Clay Plains 9 Swamp). We found a marker, created by VGS, or VGS's contractor, directly over the 10 buried pipeline. The wooden marker indicated that the pipeline was buried 3.5 feet at that 11 location, approximate station number 1645+26. During that visit with Mr. Morris, told me 12 that the pipeline that I had observed in September had been reburied by VGS to a deeper 13 depth. During this same visit, Mr. Morris told me that VGS used an excavator to press 14 down on the pipe with enough force to push it down through the soil. However, Mr. Morris' 15 only apparent source of information was VGS, since Mr. Morris made clear he had not 16 been present. This is also the area in which the excavator had been mired and stuck in, 17 according to Carl Bubolz's deposition (which I have read), this was on September 15, 2016.

During the meeting that was held at Attorney Dumont's office on February 27, 2019, I showed the video to Mr. Byrd on a laptop which was passed around the table, so that all present could view it. I also showed my photographs, some of which had been enlarged to poster size. I gave the posters to Mr. Byrd as well. Mr. Byrd asked me

- 1 questions about the video, the photographs and what I recalled from that visit. The video 2 and photos were given to him on a flash drive.
- When Mr. Byrd scheduled his visit to the Clay Plains Swamp, I accompanied him. Originally, Mr. Byrd had emailed to us that no one other than VGS employees and himself would be allowed to participate in the Clay Plains site visit. However, after our attorney protested that at least I should attend, Mr. Byrd backed down and agreed that I could accompany him. I did so, on August 27, 2019.
- 8 Q. 4. State the depth of cover that you and Mr. Byrd determined during the visit to the
 9 swamp in New Haven called the Clay Plains Swamp, and explain how it was
 10 determined.
- A. 4. The plan that was shared with me by Mr. Byrd was for VGS technicians to find the
 above-ground pedestals to disconnect the zinc ribbon, so that an electronic measuring
 device could function. However, the technicians were unable to do so. Accordingly we
 could not utilize the intended electronic equipment to detect the burial depth.
- 15 One of VGS technicians was able to locate the pipeline with a fiberglass probe. The 16 only problem: no one had a measuring tape to measure the depth of the probe.
- I had an 8.5" x 11" line notepad I had brought to take notes. Mr. Byrd borrowed a sheet of my paper and suggested that this page was 8.5" wide and that we would measure the burial depth of the pipeline by probing around until we hit what we thought was the pipeline, hold a thumb at ground level, extract the probe, and 'measure' it with the piece of notepaper.

1	In several locations I personally observed that, when my notepad was used as the
2	ruler, the probe measured no more than, and probably less than, 3 page-widths deep (3 x
3	8.5" = 25.5"). In other words, the pipeline was, at most an inch and a half more than 2 feet
4	deep. Mr. Byrd, after measuring the depth to be three page widths, declared "We'll call
5	that 30 inches."

6

7

Mr. Byrd's Attachment 9 is difficult to read, but if you turn to pages 8 and 9 you will see how Mr. Byrd reported these crude measurements. They are reproduced here:



8

VGS Addison Natural Gas Project, Case No. 17-3550-INV Prefiled Testimony of Lawrence Shelton July 10, 2020 Page 6 of 10





1

I disagree with his reported numbers. As stated, in several locations the depth was
just barely more than three page widths, which is 25.5 inches, so the pipe was at most 2'3"
or 2'4" deep. Each of my observations, and Mr. Byrd's observations, were made in the
presence of VGS staff.

I know I don't have to remind the Commission that its order was based upon plans
and exhibits stating that within the VELCO Right of Way depth of burial would be 4 feet.

1I also am sure that the Commission is aware that VGS has justified its deviation from that2standard by reference to an engineering report from Hatch Mott MacDonald dated May 25,32016, already on file with the Commission, which states that burial less than 4 feet would4be adequate – so long as the minimum depth is 3 feet. I attach that report, and VELCO's5email adopting that standard on September 21, 2016, as Shelton Exhibit 4. VGS's6commitment to satisfy Class 3 also required at least 3 feet of cover.

In sum, my testimony is that Mr. Byrd and I both personally determined that the
ANGP was constructed less than 3 feet deep in the in the Clay Plains section of the New
Haven Swamp. Attachment 9 lists six locations. We disagree whether at its most shallow
point it is 25 or 26 inches deep, as I determined, or 30 or 31 inches deep, as he determined.

Q. 5. Did you and/or Mr. Byrd use the probe to measure depth of cover in the other swamp in New Haven, sometimes referred to as the "New Haven Swamp?"

13 A. 5. No. The measurements Mr. Byrd and I made in the Clay Plains Swamp demonstrated 14 that the GPS data reported by Mr. St. Hilaire to the Commission were wrong. The VGS 15 inspections state that in the area referred to as the New Haven Swamp, further south, at 16 station numbers 1944+80- 1951+80, the same conditions were encountered and the same 17 construction method was used. The inspection reports dated September 28 and September 18 29 attached to this testimony as Shelton Exhibits 5 and 6 state that VELCO had approved 19 of "variance" allowing deviating from the 4-foot standard for this section of the pipeline. 20 I had to leave the August 27, 2019 site visit before it was over. Upon reading Mr. Byrd's 21 report, Attachment 9, I discovered that he did not use the probe to measure actual depth of VGS Addison Natural Gas Project, Case No. 17-3550-INV Prefiled Testimony of Lawrence Shelton July 10, 2020 Page 8 of 10

- 1 cover at station numbers 1944+80 to 1951+80.
- 2

The following page of his Attachment show that he did not use the probe to

3 determine depth of burial at these station numbers:





9 A. 6. No. He determined depth of burial to be under 4 feet, in fact under 3 feet at station
10 numbers 1645+80 to 1648+40, in the Clay Plains section of the swamp in New Haven. He
11 did not use the probe for the other section of the swamp in New Haven, station numbers
12 1944+80 to 1951+80, instead accepting VGS's self-certification of the depth. He did not

1 propose a survey for the remainder of the 41-mile length of the pipeline.

Q. 7. As the representative of the Intervenors who participated in the site visit and discussed with Mr. Byrd during the site visit what the probing revealed, were you surprised to read Mr. Byrd's report?

A. 7. Yes, for several reasons. On page 69 of his report he acknowledges that the Depth of
Cover required by the CPG for the VELCO Right of Way is 4 feet, and that "technically"
this was not honored. He explains that the Commission could not have intended that VGS
would have to comply with this standard so long as VELCO accepted a lesser standard.

9 This explanation surprised me. I am an Intervenor. I had read the Commission's 10 12/23/13 order and the Hearing Officer's orders opening and broadening the scope of this 11 investigation, and also the Commission's contract with Mr. Byrd and RCP. The 12 Commission's 12/23/13 Order does not say a party that entered into a MOU with VGS, 13 whether it was VELCO, a state agency, a town or a landowner, has the authority to 14 unilaterally approve of a deviation from a standard in the Commission's order on the basis 15 that their MOU was a source of the standard. I am not a lawyer (nor is Mr. Byrd), but his 16 reading seemed tortured.

I was also surprised because the orders pertaining to the investigation, and the
contract, both called upon Mr. Byrd to determine whether the plans and evidence
submitted to the Commission had been complied with, not whether the signer of an MOU
had the authority to allow VGS to depart from those plans and evidence.

21

What really surprised me -- even if VELCO did have the authority that Mr. Byrd

1		claims – is that Mr. Byrd knows that VELCO did not approve of depth of burial less than
2		3 feet. VGS's own engineers, Hatch Mott MacDonald, stated in their report that 3 feet was
3		the minimum necessary for safety. Based on Hatch Mott MacDonald report, which VELCO
4		relied upon and which Mr. Byrd states he read, VELCO accepted less than 4 feet. Class 3
5		also requires at least 3 feet. Mr. Byrd himself determined that the depth of the pipeline is
6		less than 3 feet in fact, little more than half the depth required by the Commission's
7		order.
8	Q.	7. You have been referring to Attachment 9 of Mr. Byrd's report, which shows
9		depth of burial less than 3 feet at six locations within the VELCO Right of Way in
10		New Haven. In the body of his Report, does he address his determination that in six
11		locations within the VELCO Right of Way the pipeline is buried less than 3 feet
12		deep, and that VELCO accepted the departure from 4-foot depth on the basis that
13		there would be at least 3-foot depth?
14	A.	No. The only discussion I could find that might justify ignoring the measurements we
15		took is his statement that when one steps in the swamp one's foot sometimes sinks 6
16		inches deep in the muck (p.69). This suggests that perhaps the measurements we took we
17		made in a footprint. When we measured the depth of cover using the probe, we did not
18		measure it within a footprint where someone had sunk into the muck.
19		This concludes my testimony.

20

49 CFR 192.327

This document is current through the July 8, 2020 issue of the Federal Register with the exception of the amendment appearing at 85 FR 41100. Title 3 is current through July 2, 2020.

Code of Federal Regulations > TITLE 49 -- TRANSPORTATION > SUBTITLE B -- OTHER REGULATIONS RELATING TO TRANSPORTATION > CHAPTER I -- PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION > SUBCHAPTER D -- PIPELINE SAFETY > PART 192--TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE: MINIMUM FEDERAL SAFETY STANDARDS > SUBPART G -- GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS

§ 192.327 Cover.

(a)Except as provided in paragraphs (c), (e), (f), and (g) of this section, each buried transmission line must be installed with a minimum cover as follows:

Location	Normal	Consolidated	
	soil	rock	
		Inches (Millimeters)	
Class 1 locations	30 (762)	18 (457)	
Class 2, 3, and 4 locations	36 (914)	24 (610)	
Drainage ditches of public roads			
and railroad crossings	36 (914)	24 (610)	

(b)Except as provided in paragraphs (c) and (d) of this section, each buried main must be installed with at least 24 inches (610 millimeters) of cover.

(c)Where an underground structure prevents the installation of a transmission line or main with the minimum cover, the transmission line or main may be installed with less cover if it is provided with additional protection to withstand anticipated external loads.

(d)A main may be installed with less than 24 inches (610 millimeters) of cover if the law of the State or municipality:

(1)Establishes a minimum cover of less than 24 inches (610 millimeters);

(2)Requires that mains be installed in a common trench with other utility lines; and

(3) Provides adequately for prevention of damage to the pipe by external forces.

(e)Except as provided in paragraph (c) of this section, all pipe installed in a navigable river, stream, or harbor must be installed with a minimum cover of 48 inches (1,219 millimeters) in soil or 24 inches (610 millimeters) in consolidated rock between the top of the pipe and the underwater natural bottom (as determined by recognized and generally accepted practices).

(f)All pipe installed offshore, except in the Gulf of Mexico and its inlets, under water not more than 200 feet (60 meters) deep, as measured from the mean low tide, must be installed as follows:

(1)Except as provided in paragraph (c) of this section, pipe under water less than 12 feet (3.66 meters) deep, must be installed with a minimum cover of 36 inches (914 millimeters) in soil or 18 inches (457 millimeters) in consolidated rock between the top of the pipe and the natural bottom.

(2)Pipe under water at least 12 feet (3.66 meters) deep must be installed so that the top of the pipe is below the natural bottom, unless the pipe is supported by stanchions, held in place by anchors or heavy concrete coating, or protected by an equivalent means.

(g)All pipelines installed under water in the Gulf of Mexico and its inlets, as defined in § 192.3, must be installed in accordance with § 192.612(b)(3).

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STATE OF VERMONT PUBLIC UTILITY COMMISSION

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Petition of Vermont Gas Systems,
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Case No. 17-3550-INV

PREFILED TESTIMONY OF LAWRENCE SHELTON

July 10, 2020

EXHIBIT 2 CLAY PLAINS SWAMP VIDEO SEPTEMBER 19, 2016



Shelton PFT Exhibit 3



Docket 7970 δth Non-Substantial Change Determination Response 6/23/17 Attachment #17 From: Peter W. Lind [mailto:PLIND@velco.com]

Sent: Wednesday, September 21, 2016 5:21 AM

To: John St.Hilaire < isthilaire@vermontgas.com>

Cc: John Stamatov (US - Advisory) (john.r.stamatov@pwc.com) <john.r.stamatov@pwc.com>; Reagan, Michael J (<u>Michael.Reagan@mottmac.com</u>) <<u>Michael.Reagan@mottmac.com</u>>; Brian Connaughton <<u>BCONNAUGHTON@velco.com</u>>; Mike Fiske <<u>MFISKE@velco.com</u>>; Mark Sciarrotta <<u>MSCIARROTTA@velco.com</u>>; Eric Frazer (<u>efrazer@ececnh.com</u>) <<u>efrazer@ececnh.com</u>> Subject: Vermont Gas Project - Clay Plains Issue - VELCO K43 Structures 262 - 263

Good morning John.

Thank you for the follow-up responses and information on the issues you are having in obtaining the 4' foot burial depth of the gas pipeline in the Clay Plains area along VELCO's K43 transmission line between structures 262 and 263. Based upon this information and our discussions yesterday afternoon; VELCO agrees for you to move forward with the installation of the gas pipeline at less than the agreed upon 4' depth in this area with the following conditions as we discussed:

- VGS to document the specific area where the pipe is not going to be installed at the agreed upon 4' depth (Survey, pictures, as-built drawings, etc.).
- VGS will use all reasonable measures to maximize and maintain the loading factor to the HS-20 &15% as possible with concrete coatings and other measures, etc.
- VGS to confirm with PE engineering analysis that the HS-20 & 15% loading factor will be obtained and maintained at this location with the diminished burial depth.
- Additional VGS standard yellow location markers will be installed over the pipeline every 50 feet at this Clay Plains area for the estimated 300 feet section such that it is visibly marked.
- VELCO and VGS will memorialize this specific variance from our established agreement for the standard installation of the gas pipeline at four feet along the VELCO ROW and access roads.

I trust that this correctly represents the issues we addressed and agreed to in our discussion. Please review and confirm. Thanks John.

Best regards,

Peter

Peter W. Lind Senior Project Manager Vermont Electric Power Company 366 Pinnacle Ridge Road Rutland, VT 05701

Tel: (802) 770-6292

Mobile: (802) 353-0418 Fax: (802) 770-6449 plind@velco.com www.velco.com

From: John St.Hilaire [mailto:jsthilaire@vermontgas.com]
Sent: Tuesday, September 20, 2016 12:26 PM
To: Peter W. Lind
Cc: Brian Connaughton; john.r.stamatov@pwc.com; Reagan, Michael J (Michael.Reagan@mottmac.com)
Subject: FW: Draft VELCO compaction reply

Hi Peter.

Thanks for the call today. We appreciate your team working expeditiously to review this issue for us. You asked for documentation on compaction for this line. I am attaching a compaction report from Mott McDonald that indicates the compaction of HS20+15% can be met with our 12" pipe specifications with all soils at a depth of 3' or greater. The pipe in the affected area is concrete coated which will only increase the loading capacity of the pipe.

The details of the field conditions were conveyed by Mike Reagan via e-mail on 9/19/16.

We will plan to install line markers every 50'in the affected area if the 3' of cover is approved.

Should you have further questions, please let us know.

John St.Hilaire

Project Name: Vermont Gas Systems

Location: Burlington, VT

Prepared for: Vermont Gas Systems

Prepared by: Mott MacDonald

Purpose:

Mott MacDonald has prepared the stress calculations included herein for Vermont Gas Systems, to ensure the pipeline's integrity under loading without compaction of backfill. The stress calculations were performed per API 1102, using various combinations of soil type and depth of cover to confirm that 90% compaction will not be necessary.

Knowns:

- Class 3 Location, Design Factor of 0.5
- 12.75 inch OD
- 0.312 inch WT
- API-5L Electric Resistance Welded
- Grade X-65
- MAOP of 1440 psi
- Design Wheel Load HS-20 + 15%

Results:

A summary table has been provided below. The stress calculations show that under all soil types, paired with 3', 4', and 5' of cover, the pipeline passes all stress checks (Hoop, Effective, Girth Weld, and Longitudinal Weld). In conclusion, Mott MacDonald recommends a minimum depth of cover of 4 feet. Although 3 feet of cover is sufficient under the given loading, a one foot buffer would help ensure that even if settlement were to occur, the pipeline would remain safe and operational.

API 1102 STRESS CALCULATION RESULTS						
	Calculated Effective Stress (psi)					
Soil type	3' Cover	4' Cover	5' Cover			
Soft to medium clays and silts with high plasticities	31,239	31,437	31,234			
Soft to medium clays and silts with low/medium plasticities	31,180	31,370	31,159			
Loose sands and gravels	30,360	30,550	30,427			
Stiff to very stiff clays and silts	30,216	30,366	30,193			
Medium dense sands and gravels	30,278	30,453	30,318			
Dense to very dense sands and gravels	29,422	29,554	29,437			
ALLOWABLE EFFECTIVE STRESS (psi)		32,500				
Note:						

1. Calculated girth weld and longitudinal weld stress values were less than the allowable (Girth: 6,000 psi & Long. Welds: 11,500 psi).

5/25/2016

Rev. 1



Calculation cover sheet

Project Title:	VERMONT GAS SYSTEMS	Project No:	351481KKØ1
File No:		No. of Sheets:	18
Section:		Subject:	•
Calc No:			
Project Manager:		Designer:	
Design Phase:	A - Concept or preliminary	C - Design verifica	ition
	B - Analysis and detailed design	D - Other (specify)	

Computer Applications Used:				
Title:	Version Date:			
PIPELINE TOOLBOX	2013			
(i)				

Scopes for Checking Manual and Computer Generated Calculations:

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ALT 1102 IN CONTRACTOR							
b) Identify documents/technical records where output will be used:							
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Distribution: Origina

Original to project file



Vermont Gas Systems				
Location		Date		
Burlington, VI		5/24/20	16	
API 1102 - Gas Pipeline	Crossing High	way		
PIPE AND OPERATIONAL DATA:		SITE A	ND INSTALLATION DATA:	
Operating Pressure [psi]	1440	Soil Ty	pe: Soft to medium clays and silts	s with high
Location Class:	3	E' - Mo	plasticities dulus of Soil Reaction [ksi]	0.2
Operating Temperature [°F]	60.0	Er - Re	silient Modulus [ksi]	5.0
Pipe Outside Diameter [in]	12.75	Averad	e Unit Weight of Soil [lb/ft³]	120.00
🥪 Pipe Wall Thickness [in]	0.312	Pipe De	epth [ft]	3
Pipe Grade: X65		Bored I	Diameter [in]	12.75
Specified Minimum Yield Stress	65,000	Installa	tionTemperature [°F]	60.0
Design Factor	0.50	Design	Wheel Load from Single Axle [kips]	18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load from Tandem Axles [k	ips] 18.4
Temperature Derating Factor	1.000	Pavem	ent Type: None	
Pipe Class: API 5L Electric Res	sistance Welded	Impact	Factor Method: ASCE - Highway	
Young's Modulus for Steel [ksi]	30,000		0.1	
Poisson's Ratio for Steel	0.30			
Coefficient of Thermal Expansion [per°F] 0.0000065	Safety	Factor Applied: API 1102 Procedu	Ire
RESULTS				
Hoop Stress [psi]		29,423	Maximum Circumferential Stress [osi] 34,305
Allowable Hoop Stress [psi]		32,500	Maximum Longitudinal Stress [psi]	12,239
Stiffness Factor for Earth Load Circ	cumferential Stress	2,196	Maximum Radial Stress [psi]	-1,440
Burial Factor for Earth Load Circum	nferential Stress	0.83	Total Effective Stress [psi]	31,239
Excavation Factor for Earth Load C	Circumferential Stress	0.83	Allowable Effective Stress [psi]	32,500
Circumferential Stress from Earth L	_oad [psi]	1,331		
Impact Factor		1.50	Stress [psi] Calculated Allowable	PASS/FAIL
Highway Stiffness Factor for Cyclic	Circumferential	16.60	Hoop 29,423 32,500	PASS
Highway Geometry Factor for Cycli	c Circumferential	1.22	Girth Welds 3,229 6,000	PASS
Cyclic Circumferential Stress [psi]		4,271	Long. Welds 4,271 11,500	PASS
Highway Stiffness Factor for Cyclic	Longitudinal Stress	13.20		
Highway Geometry Factor for Cycli	c Longitudinal Stress	1.16		
Cyclic Longitudinal Stress [psi]		3,229		
Notes: Open cut construction, calcu	ulations run using HS-	20 loading	g + 15%	
	olinos Crossina Poilra	ade and l	Highwove"	

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1
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Burlington, VT		Date 5/24/20	16	
API 1102 - Gas Pipelin	e Crossing High	way		
PIPE AND OPERATIONAL DATA	:	SITE A	ND INSTALLATION DATA:	
Operating Pressure [psi]	1440	Soil Ty	pe: Soft to medium clays and	silts with high
Location Class:	3	E' - Mc	plasticities dulus of Soil Reaction [ksi]	0.2
Operating Temperature [°F]	60.0	Er - Re	esilient Modulus [ksi]	5.0
Pipe Outside Diameter [in]	12.75	Averac	e Unit Weight of Soil [lb/ft³]	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]	4
Pipe Grade: X65		Bored	Diameter [in]	12.75
Specified Minimum Yield Stress	65,000	Installa	ationTemperature [°F]	60.0
Design Factor	0.50	Desigr	Wheel Load from Single Axle [k	(ips] 18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load from Tandem Axle	s [kips] 18.4
Temperature Derating Factor	1.000	Pavem	ent Type: None	
Pipe Class: API 5L Electric Re	esistance Welded	Impact	; Factor Method: ASCE - Highwa	ıy
Young's Modulus for Steel [ksi]	30,000		Ū	•
Poisson's Ratio for Steel	0.30			
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied: API 1102 Proc	edure
RESULTS				
Hoop Stress [psi]		29,423	Maximum Circumferential Stre	ss [psi] 34,5
Allowable Hoop Stress [psi]		32,500	Maximum Longitudinal Stress	[psi] 12,3
Stiffness Factor for Earth Load Ci	rcumferential Stress	2,196	Maximum Radial Stress [psi]	-1,4
Burial Eactor for Earth Load Circu	mferential Stress	0.97	Total Effective Stress [psi]	31,4
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effective Stress [psi]	32,5
Excavation Factor for Earth Load Circumferential Stress from Earth	Circumferential Stress Load [psi]	0.83 1,555	Allowable Effective Stress [psi]	32,5
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	Circumferential Stress Load [psi]	0.83 1,555 1.50	Stress [psi] Calculated Allow	32,5
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl	Circumferential Stress Load [psi] ic Circumferential	0.83 1,555 1.50 16.60	Allowable Effective Stress [psi] Stress [psi] Calculated Allow Hoop 29,423 32,50 Effective 31,437 32,50	32,5 able PASS/F/ 00 PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cyc	Circumferential Stress Load [psi] ic Circumferential clic Circumferential	0.83 1,555 1.50 16.60 1.22	Allowable Effective Stress [psi]Stress [psi]Calculated AllowHoop29,42332,50Effective31,43732,50Girth Welds3,2296,000	32,5 able PASS/F/ 00 PASS 00 PASS 0 PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cyc Cyclic Circumferential Stress [psi]	Circumferential Stress Load [psi] ic Circumferential clic Circumferential	0.83 1,555 1.50 16.60 1.22 4,271	Allowable Effective Stress [psi]Stress [psi]Calculated AllowHoop29,42332,50Effective31,43732,50Girth Welds3,2296,000Long. Welds4,27111,50	32,5 able PASS/F/ 00 PASS 00 PASS 00 PASS 00 PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cyc Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycl	Circumferential Stress Load [psi] ic Circumferential clic Circumferential clic Circumferential	0.83 1,555 1.50 16.60 1.22 4,271 13.20	Stress [psi]Calculated AllowHoop29,42332,50Effective31,43732,50Girth Welds3,2296,000Long. Welds4,27111,50	32,5 able PASS/F/ 00 PASS 00 PASS 00 PASS 00 PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl	Circumferential Stress Load [psi] ic Circumferential clic Circumferential ic Longitudinal Stress clic Longitudinal Stress	0.83 1,555 1.50 16.60 1.22 4,271 13.20 1.16	Stress [psi]Calculated AllowHoop29,42332,50Effective31,43732,50Girth Welds3,2296,000Long. Welds4,27111,50	32,5 able PASS/F/ 00 PASS 00 PASS 00 PASS 00 PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Cyclic Longitudinal Stress [psi]	Circumferential Stress Load [psi] ic Circumferential clic Circumferential ic Longitudinal Stress clic Longitudinal Stress	0.83 1,555 1.50 16.60 1.22 4,271 13.20 1.16 3,229	Allowable Effective Stress [psi] Stress [psi] Calculated Allow Hoop 29,423 32,50 Effective 31,437 32,50 Girth Welds 3,229 6,000 Long. Welds 4,271 11,50	32,5 able PASS/F/ 00 PASS 00 PASS 00 PASS 00 PASS

Project Vermont Gas Systems								
Location		Date)					
Burlington, VT		5/24	4/2016					
API 1102 - Gas Pipeline	e Crossing High	way	/					
PIPE AND OPERATIONAL DATA:		SI	TE AND INS	TALLA		A:		
Operating Pressure [psi]	1440	So	il Type:	Soft to r	nedium clay	/s and	d silts	with high
Location Class:	3	E'	ا Modulus c -	f Soil R	es leaction [ksi	i]		0.2
Operating Temperature [°F]	60.0	Er	- Resilient I	Aodulus	s [ksi]	-		5.0
Pipe Outside Diameter [in]	12.75	Av	erage Unit	Neight	of Soil [lb/ft	3]		120.00
Pipe Wall Thickness [in]	0.312	Pip	be Depth [ft]					5
Pipe Grade: X65		Во	ored Diamet	er [in]				12.75
Specified Minimum Yield Stress	65,000	Ins	stallationTer	nperatu	ıre [°F]			60.0
Design Factor	0.50	De	sign Wheel	Load f	rom Single /	Axle	[kips]	18.4
Longitudinal Joint Factor	1.0	De	sign Wheel	Load f	rom Tander	n Axl	es [kij	os] 18.4
Temperature Derating Factor	1.000	Pa	vement Typ	e: Non	e			
Pipe Class: API 5L Electric Res	sistance Welded	lm	pact Factor	Method	d: ASCE - ⊢	lighw	ay	
Young's Modulus for Steel [ksi]	30,000							4
Poisson's Ratio for Steel	0.30	0						
Coefficient of Thermal Expansion [per°F] 0.0000065	Sa	itety Factor	Applied	: API 110	2 Pro	cedur	e
RESULTS								
Hoop Stress [psi]		29,4	23 Maxin	num Cir	cumferentia	al Stre	ess [p	si] 34,285
Allowable Hoop Stress [psi]		32,5	00 Maxin	num Lo	ngitudinal S	tress	[psi]	12,136
Stiffness Factor for Earth Load Circ	cumferential Stress	2,19	6 Maxin	num Ra	dial Stress	[psi]		-1,440
Burial Factor for Earth Load Circun	nferential Stress	1.08	Total	Effectiv	e Stress [ps	si]		31,234
Excavation Factor for Earth Load C	Circumferential Stress	0.83	Allowa	able Eff	ective Stres	s [ps	i]	32,500
Circumferential Stress from Earth I	Load [psi]	1,73	2		#C			
Impact Factor		1.50	Stress	[psi]	Calculated	Allo	vable	PASS/FAIL
Highway Stiffness Factor for Cyclic	Circumferential	16.6	0 Hoop Effect	ve	29,423	32,5	00 00	PASS
Highway Geometry Factor for Cycli	ic Circumferential	1.10	Girth	Velds	3,006	6,00	00	PASS
Cyclic Circumferential Stress [psi]		3,85	0 Long.	Welds	3,850	11,5	00	PASS
Highway Stiffness Factor for Cyclic	Longitudinal Stress	13.2	0					
Highway Geometry Factor for Cycli	ic Longitudinal Stress	1.08						
Cyclic Longitudinal Stress [psi]		3,00	6					
Notes: Open cut construction, calc	ulations run using HS-	-20 lo	ading + 15%	, D				
Reference: API RP 1102 "Steel Pip	pelines Crossing Railro	oads a	and Highwa	ys"				
Prepared By Kelsey Kibbe			Approved By				Revi	sion: 13.0.1

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Location Burlington, VT		Date 5/24/2	2016				
API 1102 - Gas Pipeline	e Crossing High	way					
PIPE AND OPERATIONAL DATA		SITE	AND INST	ALLA		A:	
Operating Pressure [psi]	1440	Soil ⁻	Type: So	oft to m	edium clay	s and silts	with
Location Class:	3	F' - N	lov Vodulus of 3	v/medi Soil Re	um plastici	ties 1	0.5
Operating Temperature [°F]	60.0	Fr-I	Resilient Mo	odulus	[ksi]	1	5.0
Pipe Outside Diameter [in]	12.75	Aver	age Unit W	eiaht a	of Soil [lb/ft ^s	5 1	120.00
Pipe Wall Thickness [in]	0.312	Pipe	Depth [ft]				3
Pipe Grade: X65		Bore	d Diameter	[in]			12.75
Specified Minimum Yield Stress	65,000	Insta	allationTem	beratu	re [°F]		60.0
Design Factor	0.50	Desi	gn Wheel L	oad fr	om Single /	Axle [kips]	18.4
Longitudinal Joint Factor	1.0	Desi	an Wheel L	oad fr	om Tanden	n Axles [kij	os] 18.4
Temperature Derating Factor	1.000	Pave	ement Type	: None	е	-	-
Pipe Class: API 5L Electric Re	esistance Welded	Impa	act Factor M	lethod	: ASCE - H	lighway	
Young's Modulus for Steel [ksi]	30,000					•	
Poisson's Ratio for Steel	0.30						
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safe	ety Factor A	pplied:	API 110	2 Procedui	e
RESULTS							
Hoop Stress [psi]		29,423	3 Maximu	ım Ciro	cumferentia	al Stress [p	si] 34,239
Allowable Hoop Stress [psi]		32,500) Maximu	ım Lor	igitudinal S	tress [psi]	12,219
Stiffness Factor for Earth Load Cit	rcumferential Stress	2,088	Maximu	ım Rad	dial Stress	[psi]	-1,440
Burial Factor for Earth Load Circu	mferential Stress	0.83	Total Ef	ffective	e Stress [ps	si]	31,180
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowab	le Effe	ective Stres	s [psi]	32,500
Circumferential Stress from Earth	Load [psi]	1,265					
Impact Factor		1.50	Stress [psi]	Calculated	Allowable	PASS/FAIL
Highway Stiffness Factor for Cycli	c Circumferential	16.60	Hoop	0	29,423	32,500	PASS
Highway Geometry Factor for Cyc	lic Circumferential	1.22	Girth W	e Ields	3,229	6,000	PASS
Cyclic Circumferential Stress [psi]		4,271	Long: V	Velds	4,271	11,500	PASS
Highway Stiffness Factor for Cycli	c Longitudinal Stress	13.20					
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.16					
Cyclic Longitudinal Stress [psi]		3,229					
Notes: Open cut construction, cal	culations run using HS-	-20 load	ding + 15%				
Reference: API RP 1102 "Steel P	ipelines Crossing Railro	nads ar	nd Highway	s"			
				-			

Location Burlington, VT		Date 5/24/20	16	
API 1102 - Gas Pipelin	e Crossing High	way	l	
PIPE AND OPERATIONAL DATA		SITE A	ND INSTALLATION DATA:	
Operating Pressure [psi]	1440	Soil Ty	pe: Soft to medium clays and s	silts with
Location Class:	3	E' - Mo	low/medium plasticities	0.5
Operating Temperature [°F]	60.0	Er - Re	esilient Modulus [ksi]	5.0
Pipe Outside Diameter [in]	12.75	Avera	ae Unit Weight of Soil [lb/ft³]	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]	4
Pipe Grade: X65		Bored	Diameter [in]	12.75
Specified Minimum Yield Stress	65,000	Installa	ationTemperature [°F]	60.0
Design Factor	0.50	Desigr	Wheel Load from Single Axle [ki	ps] 18.4
Longitudinal Joint Factor	1.0	Desigr	Wheel Load from Tandem Axles	[kips] 18.4
Temperature Derating Factor	1.000	Paver	nent Type: None	
Pipe Class: API 5L Electric Re	esistance Welded	Impac	Factor Method: ASCE - Highway	1
Young's Modulus for Steel [ksi]	30,000			
Poisson's Ratio for Steel	0.30			
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied: API 1102 Proce	edure
RESULTS				
Hoop Stress [psi]		29,423	Maximum Circumferential Stres	s [psi] 34,4
Allowable Hoop Stress [psi]		32,500	Maximum Longitudinal Stress [p	osi] 12,28
Stiffness Factor for Earth Load Ci	rcumferential Stress	2,088	Maximum Radial Stress [psi]	-1,44
Burial Factor for Earth Load Circu	mferential Stress	0.97	Total Effective Stress [psi]	31,37
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effective Stress [psi]	32,50
Circumferential Stress from Earth	Load [psi]	1,479		
Impact Factor		1.50	Stress [psi] Calculated Allowa	ble PASS/FA
Highway Stiffness Factor for Cycli	c Circumferential	16.60	Hoop 29,423 32,500	D PASS
Highway Geometry Factor for Cyc	lic Circumferential	1.22	Girth Welds 3,229 6,000	PASS
Cyclic Circumferential Stress [psi]		4,271	Long. Welds 4,271 11,500) PASS
Highway Stiffness Factor for Cycli	c Longitudinal Stress	13.20		
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.16		
		2 220		
Cyclic Longitudinal Stress [psi]		3,229		

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1
repared by Keisey Kibbe	Approved By	Revision: 13.0.1

Location		Date				
Burlington, VT		5/24/20	16			
API 1102 - Gas Pipeline	e Crossing High	way				
PIPE AND OPERATIONAL DATA		SITE A	ND INSTALLA	TION DAT	A:	
Operating Pressure [psi]	1440	Soil Ty	pe: Soft to n	nedium cla	ys and silts	with
Location Class:	3	E' - Mo	low/med dulus of Soil R	ium plastic eaction [ks	aties ai]	0.5
Operating Temperature [°F]	60.0	Er - Re	silient Modulus	[ksi]		5.0
Pipe Outside Diameter [in]	12.75	Averag	e Unit Weight	of Soil [lb/fl	t ³]	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]			5
Pipe Grade: X65		Bored	Diameter [in]			12.75
Specified Minimum Yield Stress	65,000	Installa	tionTemperatu	re [°F]		60.0
Design Factor	0.50	Design	Wheel Load fr	om Single	Axle [kips]	18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load fr	om Tande	m Axles [ki	ps] 18.4
Temperature Derating Factor	1.000	Pavem	ent Type: Non	е		
Pipe Class: API 5L Electric Re	esistance Welded	Impact	Factor Method	I: ASCE - I	Highway	
Young's Modulus for Steel [ksi]	30,000	·				
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied	: API 110	2 Procedu	re
RESULTS						
Hoop Stress [psi]		29,423	Maximum Cir	cumferenti	al Stress [p	si] 34,200
Allowable Hoop Stress [psi]		32,500	Maximum Lor	ngitudinal S	Stress [psi]	12,11 [.]
Stiffness Factor for Earth Load Cir	rcumferential Stress	2,088	Maximum Ra	dial Stress	[psi]	-1,440
Burial Factor for Earth Load Circu	mferential Stress	1.08	Total Effective	e Stress [p	si]	31,159
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effe	ective Stres	ss [psi]	32,500
Circumferential Stress from Earth	Load [psi]	1,647				
Impact Factor		1.50	Stress [psi]	Calculated	d Allowable	PASS/FAI
Highway Stiffness Factor for Cycli	c Circumferential	16.60	Hoop	29,423	32,500	PASS
Highway Geometry Factor for Cyc	lic Circumferential	1.10	Girth Welds	31,159	6.000	PASS
Cyclic Circumferential Stress [psi]		3,850	Long. Welds	3,850	11,500	PASS
Highway Stiffness Factor for Cycli	c Longitudinal Stress	13.20		· · · · · · · · · · · · · · · · · · ·	2	
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.08				
		3.006				
Cyclic Longitudinal Stress [psi]		-,				

Prepared By Kelsey Kibbe Approved By Revision: 13.0.1

	Project	
	Vermont Gas Systems	
	Location	Date
	Burlington, VT	5/24/2016
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API 1102 - Gas Pipeline Crossing Highway

PIPE AND OPERATIONAL DATA:					
Operating Pressure [psi]	1440				
Location Class:	3				
Operating Temperature [°F]	60.0				
Pipe Outside Diameter [in]	12.75				
Pipe Wall Thickness [in]	0.312				
Pipe Grade: X65					
Specified Minimum Yield Stress	65,000				
Design Factor	0.50				
Longitudinal Joint Factor	1.0				
Temperature Derating Factor	1.000				
Pipe Class: API 5L Electric Res	istance Welded				
Young's Modulus for Steel [ksi]	30,000				
Poisson's Ratio for Steel	0.30				
Coefficient of Thermal Expansion [per°F] 0.0000065					

SITE AND INSTALLATION DATA:	
Soil Type: Loose sands and gravels	
E' - Modulus of Soil Reaction [ksi]	0.5
Er - Resilient Modulus [ksi]	10.0
Average Unit Weight of Soil [lb/ft³]	120.00
Pipe Depth [ft]	3
Bored Diameter [in]	12.75
InstallationTemperature [°F]	60.0
Design Wheel Load from Single Axle [kips	s] 18.4
Design Wheel Load from Tandem Axles [kips] 18.4
Pavement Type: None	
Impact Factor Method: ASCE - Highway	

Maximum Circumferential Stress [psi]

Maximum Longitudinal Stress [psi]

Maximum Radial Stress [psi]

Allowable Effective Stress [psi]

29,423

30,360

2,275

Total Effective Stress [psi]

Stress [psi]

Effective

Girth Welds

Long. Welds 3,241

Ноор

33,209

11,265

-1,440

30,360

32,500

PASS

PASS

PASS

PASS

Calculated Allowable PASS/FAIL

32,500

32,500

6,000

11,500

Safety Factor Applied: API 1102 Procedure

RESULTS

Hoop Stress [psi]	29,423
Allowable Hoop Stress [psi]	32,500
Stiffness Factor for Earth Load Circumferential Stress	2,088
Burial Factor for Earth Load Circumferential Stress	0.83
Excavation Factor for Earth Load Circumferential Stress	0.83
Circumferential Stress from Earth Load [psi]	1,265
Impact Factor	1.50
Highway Stiffness Factor for Cyclic Circumferential	12.60
Highway Geometry Factor for Cyclic Circumferential	1.22
Cyclic Circumferential Stress [psi]	3,241
Highway Stiffness Factor for Cyclic Longitudinal Stress	9.30
Highway Geometry Factor for Cyclic Longitudinal Stress	1.16
Cyclic Longitudinal Stress [psi]	2,275

Notes: Open cut construction, calculations run using HS-20 loading + 15%

Reference: API RP 1102 "Steel Pipelines Crossing Railroads and Highways"

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1

Location Burlington, VT		Date 5/24/20	16				
API 1102 - Gas Pipeline	e Crossing High	way					
PIPE AND OPERATIONAL DATA	:	SITE A		ISTALLA [.]	TION DATA	. :	
Operating Pressure [psi]	1440	Soil Ty	vpe:	Loose sa	ands and gra	avels	
Location Class:	3	E' - Mo	odulus	of Soil Re	eaction [ksi]		0.5
Operating Temperature [°F]	60.0	Er - Re	silien	t Modulus	[ksi]		10.0
Pipe Outside Diameter [in]	12.75	Averac	ae Uni	t Weight o	of Soil [lb/ft ³	1	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]			4
Pipe Grade: X65		Bored	Diame	eter [in]			12.75
Specified Minimum Yield Stress	65,000	Installa	ationT	emperatu	re [°F]		60.0
Design Factor	0.50	Desigr	n Whe	el Load fr	om Sinale A	xle [kips]	18.4
Longitudinal Joint Factor	1.0	Desigr) Whe	el Load fr	om Tander	Axles [kir	osl 18.4
Temperature Derating Factor	1.000	Paver	ient T	vpe [.] Non	e	17 mao [14]	
Pipe Class: API 5L Electric Re	esistance Welded	Impact	t Facto	or Method	· ASCE - H	iahway	
Young's Modulus for Steel [ksi]	30,000	mpao				ignituj	
Poisson's Ratio for Steel	0.30						
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Facto	r Applied:	API 1102	2 Procedur	e
RESULTS						7	
Hoop Stress [psi]		29,423	Max	imum Cire	cumferentia	I Stress [p	si] 33,42
Allowable Hoop Stress [psi]		32,500	Max	imum Lor	ngitudinal St	ress [psi]	11,33
Stiffness Factor for Earth Load Ci	rcumferential Stress	2,088	Max	imum Ra	dial Stress [psi]	-1,44
Burial Factor for Earth Load Circu	mferential Stress	0.97	Tota	I Effective	e Stress [ps	i]	30,5
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allov	wable Effe	ective Stress	s [psi]	32,50
Circumferential Stress from Earth	Load [psi]	1,479					
Impact Factor		1.50	Stre	ss [psi]	Calculated	Allowable	PASS/FA
Highway Stiffness Factor for Cycli	c Circumferential	12.60	Hoo) otivo	29,423	32,500	PASS
Highway Geometry Factor for Cyc	lic Circumferential	1.22	Girt	n Welds	2,275	6.000	PASS
Cyclic Circumferential Stress [psi]		3,241	Long	g. Welds	3,241	11,500	PASS
Highway Stiffness Factor for Cycli	c Longitudinal Stress	9.30					
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.16					
Cyclic Longitudinal Stress [psi]		2,275					

Prepared By	Kelsey Kibbe	
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Approved By

Revision: 13.0.1

Burlington, VT		Date 5/24/20	16			
API 1102 - Gas Pipelin	e Crossing High	way				
PIPE AND OPERATIONAL DAT/	۹:	SITE A	ND INSTALLA	TION DATA	A:	
Operating Pressure [psi]	1440	Soil Ty	pe: Loose sa	ands and gr	avels	
Location Class:	3	F' - Mc	dulus of Soil Re	eaction [kei]	1	0.5
Operating Temperature [°F]	60.0		eilient Modulus	[kei]	1	10.0
Pipe Outside Diameter [in]	12.75		e Unit Weight o	t Sail [Ib/ft3	·1	120.00
Pipe Wall Thickness [in]	0.312	Pine D	enth [ft]		1	5
Pipe Grade: X65		Bored	Diameter [in]			12 75
Specified Minimum Yield Stress	65,000	Installa	ationTemperatu	re [°F]		60.0
Design Factor	0.50	Design	Wheel I oad fro	om Single A	Ayle [kins]	18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load fr	om Tander	n Axles [kir	18.4
Temperature Derating Factor	1.000	Paver	ent Type: None			50] 10.1
Pipe Class: API 5L Electric R	esistance Welded	Impaci	Eactor Method	· ASCE - H	lighway	
Young's Modulus for Steel [ksi]	30,000	mpac			ginicy	
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	1 [per°F] 0.0000065	Safety	Factor Applied:	API 1102	2 Procedur	e
RESULTS						
Hoop Stress [psi]		29,423	Maximum Circ	cumferentia	I Stress [p	si] 33,27
Hoop Stress [psi] Allowable Hoop Stress [psi]		29,423 32,500	Maximum Circ Maximum Lon	cumferentia igitudinal St	l Stress [p tress [psi]	si] 33,27 11,22
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C	ircumferential Stress	29,423 32,500 2,088	Maximum Ciro Maximum Lon Maximum Rao	cumferentia Igitudinal St dial Stress [l Stress [p tress [psi] [psi]	si] 33,27 11,22 -1,44
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load Ci Burial Factor for Earth Load Circu	ircumferential Stress umferential Stress	29,423 32,500 2,088 1.08	Maximum Circ Maximum Lon Maximum Rac Total Effective	cumferentia ngitudinal St dial Stress [Stress [ps	il Stress [p tress [psi] [psi] i]	si] 33,27 11,22 -1,44 30,42
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load	ircumferential Stress umferential Stress Circumferential Stress	29,423 32,500 2,088 1.08 0.83	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe	cumferentia ngitudinal St dial Stress [stress [ps ective Stress	il Stress [p tress [psi] ipsi] i] s [psi]	si] 33,27 11,22 -1,44 30,42 32,50
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth	ircumferential Stress umferential Stress Circumferential Stress 1 Load [psi]	29,423 32,500 2,088 1.08 0.83 1,647	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe	cumferentia ngitudinal St dial Stress [e Stress [psi ective Stress	I Stress [p tress [psi] psi] i] s [psi]	si] 33,27 11,22 -1,44 30,42 32,50
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	ircumferential Stress umferential Stress Circumferential Stress Load [psi]	29,423 32,500 2,088 1.08 0.83 1,647 1.50	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe	cumferentia Igitudinal St dial Stress [Stress [ps ective Stress Calculated	I Stress [p tress [psi] i] s [psi] Allowable	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] lic Circumferential	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective	cumferentia ngitudinal St dial Stress [ps ective Stress Calculated 29,423	I Stress [p tress [psi] i] s [psi] Allowable 32,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] lic Circumferential clic Circumferential	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Cyclic Circumferential Stress [psi]	ircumferential Stress umferential Stress Circumferential Stress Load [psi] lic Circumferential clic Circumferential	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA PASS PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Highway Stiffness Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress t Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923 9.30	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA PASS PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Highway Stiffness Factor for Cycl Highway Stiffness Factor for Cycl Highway Stiffness Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923 9.30 1.08	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS PASS PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Cyclic Circumferential Stress [psi] Highway Geometry Factor for Cycl Highway Geometry Factor for Cycl Cyclic Longitudinal Stress [psi]	ircumferential Stress umferential Stress Circumferential Stress n Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923 9.30 1.08 2,118	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS PASS PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Highway Stiffness Factor for Cycl Highway Stiffness Factor for Cycl Highway Stiffness Factor for Cycl Notes: Open cut construction, cal	ircumferential Stress umferential Stress Circumferential Stress n Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923 9.30 1.08 2,118	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [p tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,27 11,22 -1,44 30,42 32,50 PASS/FA PASS PASS PASS PASS
Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl Highway Stiffness Factor for Cycl Highway Stiffness Factor for Cycl Cyclic Circumferential Stress [psi] Highway Geometry Factor for Cycl Cyclic Longitudinal Stress [psi] Notes: Open cut construction, cal Reference: API RP 1102 "Steel F	ircumferential Stress umferential Stress Circumferential Stress Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress lculations run using HS-	29,423 32,500 2,088 1.08 0.83 1,647 1.50 12.60 1.10 2,923 9.30 1.08 2,118 -20 loadin	Maximum Circ Maximum Lon Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds dirth Welds	cumferentia agitudinal St dial Stress [ps ective Stress Calculated 29,423 30,427 2,118 2,923	I Stress [psi] tress [psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,21 11,22 -1,44 30,42 32,50 PASS PASS PASS PASS PASS

Vermont Gas Systems
Location Date
Burlington, VT 5/24/2016

API 1102 - Gas Pipeline Crossing Highway

PIPE AND OPERATIONAL DATA	x.	SITE AND INSTALLATION DATA:	
Operating Pressure [psi]	1440	Soil Type: Stiff to very stiff clays and silts	
Location Class:	3	E' - Modulus of Soil Reaction [ksi]	1.0
Operating Temperature [°F]	60.0	Er - Resilient Modulus [ksi]	10.0
Pipe Outside Diameter [in]	12.75	Average Unit Weight of Soil [lb/ft³]	120.00
Pipe Wall Thickness [in]	0.312	Pipe Depth [ft]	3
Pipe Grade: X65		Bored Diameter [in]	12.75
Specified Minimum Yield Stress	65,000	InstallationTemperature [°F]	60.0
Design Factor	0.50	Design Wheel Load from Single Axle [kips]	18.4
Longitudinal Joint Factor	1.0	Design Wheel Load from Tandem Axles [kip	s] 18.4
Temperature Derating Factor	1.000	Pavement Type: None	
Pipe Class: API 5L Electric Re	esistance Welded	Impact Factor Method: ASCE - Highway	
Young's Modulus for Steel [ksi]	30,000		
Poisson's Ratio for Steel	0.30		
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety Factor Applied: API 1102 Procedure	е

RESULTS

Hoop Stress [psi]	29,423
Allowable Hoop Stress [psi]	32,500
Stiffness Factor for Earth Load Circumferential Stress	1,934
Burial Factor for Earth Load Circumferential Stress	0.78
Excavation Factor for Earth Load Circumferential Stress	0.83
Circumferential Stress from Earth Load [psi]	1,102
Impact Factor	1.50
Highway Stiffness Factor for Cyclic Circumferential	12.60
Highway Geometry Factor for Cyclic Circumferential	1.22
Cyclic Circumferential Stress [psi]	3,241
Highway Stiffness Factor for Cyclic Longitudinal Stress	9.30
Highway Geometry Factor for Cyclic Longitudinal Stress	1.16
Cyclic Longitudinal Stress [psi]	2,275

Notes: Open cut construction, calculations run using HS-20 loading + 15%

Reference: API RP 1102 "Steel Pipelines Crossing Railroads and Highways"

	1,934	Maximum Rad	-1,440			
	0.78	Total Effective	30,216			
s	0.83	Allowable Effective Stress [psi]			32,500	
	1,102					
	1.50	Stress [psi]	PASS/FAIL			
	12.60 Hoop 29,423 32,500 F		PASS			
12.00		Effective	30,216	32,500	PASS	
	1.22	Girth Welds 2,275 6,000 PASS				

Long. Welds 3,241

Maximum Longitudinal Stress [psi]

Maximum Circumferential Stress [psi] 33,046

11,216

PASS

11,500

Prepared By Kelsey Kibbe Approved By Revision: 13.0.1

Pro	oject			
Vermont Gas Systems				
Lo	cation		Date	
Вι	urlington, VT		5/24/2016	
A	Pl 1102 - Gas Pipeline	Crossing High	way	
PI	PE AND OPERATIONAL DATA:		SITE AND I	NSTALLATION DATA:
O	perating Pressure [psi]	1440	Soil Type:	Stiff to very stiff clays and silts

Operating Pressure [psi]	1440
Location Class:	3
Operating Temperature [°F]	60.0
Pipe Outside Diameter [in]	12.75
Pipe Wall Thickness [in]	0.312
Pipe Grade: X65	
Specified Minimum Yield Stress	65,000
Design Factor	0.50
Longitudinal Joint Factor	1.0
Temperature Derating Factor	1.000
Pipe Class: API 5L Electric Res	sistance Welded
Young's Modulus for Steel [ksi]	30,000
Poisson's Ratio for Steel	0.30
Coefficient of Thermal Expansion [p	per°F] 0.0000065

Safety Factor Applied: API 1102 Procedure

Design Wheel Load from Single Axle [kips]

Impact Factor Method: ASCE - Highway

Design Wheel Load from Tandem Axles [kips] 18.4

E' - Modulus of Soil Reaction [ksi]

Average Unit Weight of Soil [lb/ft³]

Er - Resilient Modulus [ksi]

InstallationTemperature [°F]

Pipe Depth [ft]

Bored Diameter [in]

Pavement Type: None

1.0

10.0

4

120.00

12.75

60.0

18.4

RESULTS

Hoop Stress [psi]	29,423
Allowable Hoop Stress [psi]	32,500
Stiffness Factor for Earth Load Circumferential Stress	1,934
Burial Factor for Earth Load Circumferential Stress	0.90
Excavation Factor for Earth Load Circumferential Stress	0.83
Circumferential Stress from Earth Load [psi]	1,271
Impact Factor	1.50
Highway Stiffness Factor for Cyclic Circumferential	12.60
Highway Geometry Factor for Cyclic Circumferential	1.22
Cyclic Circumferential Stress [psi]	3,241
Highway Stiffness Factor for Cyclic Longitudinal Stress	9.30
Highway Geometry Factor for Cyclic Longitudinal Stress	1.16
Cyclic Longitudinal Stress [psi]	2,275

,423	Maximum Circumferential Stress [psi]	33,215
,500	Maximum Longitudinal Stress [psi]	11,267
934	Maximum Radial Stress [psi]	-1,440
9 0	Total Effective Stress [psi]	30,366
33	Allowable Effective Stress [psi]	32,500

Stress [psi]	Calculated	Allowable	PASS/FAIL
Ноор	29,423	32,500	PASS
Effective	30,366	32,500	PASS
Girth Welds	2,275	6,000	PASS
Long. Welds	3,241	11,500	PASS

Notes: Open cut construction, calculations run using HS-20 loading + 15%

Reference: API RP 1102 "Steel Pipelines Crossing Railroads and Highways"

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1
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Location Burlington, VT		Date 5/24/20	16			
API 1102 - Gas Pipeline	e Crossing High	way				
PIPE AND OPERATIONAL DATA	:	SITE A	ND INSTALLATIO	N DATA	Λ:	
Operating Pressure [psi]	1440	Soil Ty	pe: Stiff to very	stiff clay	s and silts	
Location Class:	3	E' - Mo	dulus of Soil Read	tion [ksi]		1.0
Operating Temperature [°F]	60.0	Er - Re	silient Modulus [k	si]		10.0
Pipe Outside Diameter [in]	12.75	Averac	۔ Ie Unit Weight of S	- Soil [lb/ft³	1	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]	L		5
Pipe Grade: X65		Bored	Diameter [in]			12.75
Specified Minimum Yield Stress	65,000	Installa	itionTemperature	°F]		60.0
Design Factor	0.50	Design	Wheel Load from	Single A	xle [kips]	18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load from	Tandem	n Axles [kir	os] 18.4
Temperature Derating Factor	1.000	Pavem	ent Type: None			
Pipe Class: API 5L Electric Re	esistance Welded	Impact	Factor Method: A	SCE - H	ighway	
Young's Modulus for Steel [ksi]	30,000				0 ,	
Poisson's Ratio for Steel	0.30				5	
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied:	API 1102	2 Procedur	e
RESULTS						
Hoop Stress [psi]		29,423	Maximum Circur	nferentia	l Stress [p	si] 33,01
Allowable Hoop Stress [psi]		32,500	Maximum Longit	udinal St	tress [psi]	11,14
Stiffness Factor for Earth Load Ci	rcumferential Stress	1,934	Maximum Radia	Stress [psi]	-1,44
Burial Eactor for Earth Load Circumferential Stress		0.98	Total Effective S	tress [ps	i]	30,19
Burlai Factor for Earth Luau Circu	Excavation Factor for Earth Load Circumferential Stress		Allowable Effective Stress [psi] 3		32.50	
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effecti	ve Stress		02,00
Excavation Factor for Earth Load Circumferential Stress from Earth	Circumferential Stress Load [psi]	0.83 1,384	Allowable Effecti	ve Stress		02,00
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	Circumferential Stress Load [psi]	0.83 1,384 1.50	Allowable Effecti Stress [psi] Ca	ve Stress	Allowable	PASS/FA
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli	Circumferential Stress Load [psi] c Circumferential	0.83 1,384 1.50 12.60	Allowable Effecti Stress [psi] Ca Hoop 29 Effective 30	alculated	Allowable 32,500	PASS/FA PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli	Circumferential Stress Load [psi] c Circumferential lic Circumferential	0.83 1,384 1.50 12.60 1.10	Allowable EffectionStress [psi]CaHoop29Effective30Girth Welds2,	ve Stress alculated 0,423 0,193 118	Allowable 32,500 32,500 6,000	PASS/FA PASS PASS PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli Highway Geometry Factor for Cyc Cyclic Circumferential Stress [psi]	Circumferential Stress Load [psi] c Circumferential lic Circumferential	0.83 1,384 1.50 12.60 1.10 2,923	Stress [psi]CaHoop29Effective30Girth Welds2,Long. Welds2,	ve Stress alculated 0,423 0,193 118 923	Allowable 32,500 32,500 6,000 11,500	PASS/FA PASS PASS PASS PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli Highway Geometry Factor for Cycli Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycli	Circumferential Stress Load [psi] c Circumferential lic Circumferential c Longitudinal Stress	0.83 1,384 1.50 12.60 1.10 2,923 9.30	Stress [psi]CaHoop29Effective30Girth Welds2,Long. Welds2,	ve Stress alculated),423),193 118 923	Allowable 32,500 32,500 6,000 11,500	PASS/FA PASS PASS PASS PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli Gyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycli Highway Geometry Factor for Cycli	Circumferential Stress Load [psi] c Circumferential lic Circumferential c Longitudinal Stress	0.83 1,384 1.50 12.60 1.10 2,923 9.30 1.08	Stress [psi]CaHoop29Effective30Girth Welds2,Long. Welds2,	ve Stress alculated),423),193 118 923	Allowable 32,500 32,500 6,000 11,500	PASS/FA PASS PASS PASS PASS
Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycli Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cycli Highway Geometry Factor for Cycli Cyclic Longitudinal Stress [psi]	Circumferential Stress Load [psi] c Circumferential lic Circumferential c Longitudinal Stress lic Longitudinal Stress	0.83 1,384 1.50 12.60 1.10 2,923 9.30 1.08 2,118	Stress [psi]CaHoop29Effective30Girth Welds2,Long. Welds2,	ve Stress alculated 0,423 0,193 118 923	Allowable 32,500 32,500 6,000 11,500	PASS/FA PASS PASS PASS PASS

Approved By

Prepared By Kelsey Kibbe

Revision: 13.0.1

Location Burlington VT		Date 5/24/201	16			
API 1102 - Gas Pipelin	e Crossing High	way				
PIPE AND OPERATIONAL DATA	A:	SITE A	ND INSTALLA		A:	
Operating Pressure [psi]	1440	Soil Ty	pe: Medium	dense sand	ds and grav	vels
Location Class:	3	E' - Mo	Indulus of Soil P	eaction [kei]	1	10
Operating Temperature [°F]	60.0		eilient Modulus	e [kei]	1	1.0
Pipe Outside Diameter [in]	12.75		e Unit Weight	of Soil [Ib/ft³	31	120.00
Pipe Wall Thickness [in]	0.312		enth [ft]		1	3
Pipe Grade: X65		Bored	Diameter (in)			12 75
Specified Minimum Yield Stress	65,000	Instalia	utionTemperatu	Ine [°F]		60.0
Design Factor	0.50	Design	Wheel I oad fr	rom Single A	Avle [kins]	18.4
Longitudinal Joint Factor	1.0	Design	Wheel Load fr	om Tanden	n Avlee [kir	10.4 nel 187
Temperature Derating Factor	1.000	Pavement Type: None			05] 10.4	
Pipe Class: API 5L Electric R	esistance Welded	Impact	Eactor Methor		liabway	
Young's Modulus for Steel [ksi]	30,000	impact			ngnway	
Poisson's Ratio for Steel						
	0.30					
Coefficient of Thermal Expansion	0.30 [per°F] 0.0000065	Safety	Factor Applied	: API 1102	2 Procedur	е
Coefficient of Thermal Expansion RESULTS	0.30 [per°F] 0.0000065	Safety	Factor Applied	: API 1102	2 Procedur	e
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi]	0.30 [per°F] 0.0000065	Safety 29,423	Factor Applied Maximum Cir	: API 1102	2 Procedur al Stress [p	⁻ e si] 33,1
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi]	0.30 [per°F] 0.0000065	Safety 29,423 32,500	Factor Applied Maximum Cir Maximum Loi	: API 1102 cumferentia ngitudinal S	2 Procedur al Stress [p tress [psi]	re si] 33,1 11,2
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C	0.30 [per°F] 0.0000065 ircumferential Stress	Safety 29,423 32,500 1,934	Factor Applied Maximum Cir Maximum Lot Maximum Ra	: API 1102 cumferentia ngitudinal S dial Stress	2 Procedur al Stress [p tress [psi] [psi]	re si] 33,1 11,2 -1,44
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress	Safety 29,423 32,500 1,934 0.83	Factor Applied Maximum Cir Maximum Loi Maximum Ra Total Effective	: API 1102 cumferentia ngitudinal S dial Stress [e Stress [ps	2 Procedur al Stress [p tress [psi] [psi]	re si] 33,1 11,2 -1,44 30,2
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress	Safety 29,423 32,500 1,934 0.83 0.83	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe	: API 1102 cumferentia ngitudinal S dial Stress [e Stress [ps ective Stres	2 Procedur al Stress [p tress [psi] [psi] si] s [psi]	re si] 33,1 11,2 -1,44 30,2 32,5
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi]	Safety 29,423 32,500 1,934 0.83 0.83 1,172	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe	: API 1102 rcumferentia ngitudinal S dial Stress [e Stress [ps ective Stres	2 Procedur al Stress [p tress [psi] [psi] si] s [psi]	re si] 33,1 11,2 -1,44 30,2 32,5
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi]	Safety 29,423 32,500 1,934 0.83 0.83 1,172 1.50	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effective Stress [psi]	: API 1102 cumferentia ngitudinal S dial Stress [e Stress [ps ective Stres Calculated	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi]	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential	Safety 29,423 32,500 1,934 0.83 0.83 1,172 1.50 12.60	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective	: API 1102 cumferentia ngitudinal S dial Stress [ps ective Stres Calculated 29,423 30 278	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA PASS
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential clic Circumferential	Safety 29,423 32,500 1,934 0.83 0.83 1,172 1.50 12.60 1.22	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds	: API 1102 cumferentia ngitudinal S dial Stress [e Stress [ps ective Stres Calculated 29,423 30,278 2,275	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500 32,500 6,000	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA PASS PASS PASS
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential clic Circumferential]	Safety 29,423 32,500 1,934 0.83 0.83 1,172 1.50 12.60 1.22 3,241	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	: API 1102 cumferentia ngitudinal S dial Stress [e Stress [ps ective Stres Calculated 29,423 30,278 2,275 3,241	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500 32,500 6,000 11,500	re si] 33,1 11,2 -1,44 30,2 32,5 PASS PASS PASS PASS PASS
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi Highway Stiffness Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress	Safety 29,423 32,500 1,934 0.83 0.83 1,172 1.50 12.60 1.22 3,241 9.30	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	: API 1102 rcumferentia ngitudinal S dial Stress [ps ective Stress Calculated 29,423 30,278 2,275 3,241	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500 32,500 6,000 11,500	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA PASS PASS PASS PASS PASS
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	Safety 29,423 32,500 1,934 0.83 1,172 1.50 12.60 1.22 3,241 9.30 1.16	Factor Applied Maximum Cir Maximum Lor Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	: API 1102 cumferentia ngitudinal S dial Stress [ps ective Stres Calculated 29,423 30,278 2,275 3,241	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500 32,500 6,000 11,500	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA PASS PASS PASS PASS PASS
Coefficient of Thermal Expansion RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc	0.30 [per°F] 0.0000065 ircumferential Stress umferential Stress Circumferential Stress h Load [psi] lic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	Safety 29,423 32,500 1,934 0.83 1,172 1.50 12.60 1.22 3,241 9.30 1.16 2,275	Factor Applied Maximum Cir Maximum Lou Maximum Ra Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	: API 1102 roumferentia ngitudinal S dial Stress [ps ective Stress Calculated 29,423 30,278 2,275 3,241	2 Procedur al Stress [p tress [psi] [psi] s [psi] s [psi] Allowable 32,500 32,500 6,000 11,500	re si] 33,1 11,2 -1,44 30,2 32,5 PASS/FA PASS PASS PASS PASS PASS

Location Burlington, VT	20 20	Date 5/24/201	6			
API 1102 - Gas Pipelin	e Crossing High	way				
PIPE AND OPERATIONAL DATA	X	SITE A	ND INSTALLA	TION DATA	:	
Operating Pressure [psi]	1440	Soil Typ	be: Medium	dense sand	s and grav	vels
Location Class:	3		dulus of Soil D	action [kci]	·	1.0
Operating Temperature [°F]	60.0		silient Modulus			10.0
Pipe Outside Diameter [in]	12.75		a Unit Moiabt d	[NSI] Af Sail [Ib/f#3]	1	120.00
Pipe Wall Thickness [in]	0.312		e Unit Weight (120.00
Pipe Grade: X65		Pipe De	pur [ir]			4 10 75
Specified Minimum Yield Stress	65,000	Installer	tionTomporatu	ro [°E]		60.0
Design Factor	0.50	Design	Wheel Lood fr	el Fl	vla [kina]	10.0
Longitudinal Joint Factor	1.0	Design	Wheel Load In	om Single A		10.4
Temperature Derating Factor	1.000	Design	gn Wheel Load from Tandem Axles [kips] 18.4			05] 10.4
Pipe Class: API 5L Electric R	esistance Welded	Pavenn	Ent Type. Non Fostor Mothod		abwov	
Young's Modulus for Steel [ksi]	30,000	Impact	racion method	. ASCE - H	ignway	
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied:	API 1102	Procedur	е
					•	
RESULTS		00.400		u Facada tina	``	-11 00 044
RESULTS Hoop Stress [psi]		29,423	Maximum Ciro	cumferentia	l Stress [p	si] 33,314
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi]		29,423 32,500	Maximum Ciro Maximum Lor	cumferentia ngitudinal St	l Stress [p ress [psi]	si] 33,314 11,297
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C	ircumferential Stress	29,423 32,500 1,934	Maximum Cire Maximum Lor Maximum Rae	cumferentia ngitudinal St dial Stress [l Stress [p ress [psi] psi]	si] 33,314 11,297 -1,440
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu	ircumferential Stress	29,423 32,500 1,934 0.97	Maximum Cire Maximum Lor Maximum Rae Total Effective	cumferentia ngitudinal St dial Stress [e Stress [psi	l Stress [p ress [psi] psi]]	si] 33,314 11,297 -1,440 30,453
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load	ircumferential Stress Imferential Stress Circumferential Stress	29,423 32,500 1,934 0.97 0.83	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe	cumferentia ngitudinal St dial Stress [e Stress [psi ective Stress) Stress [p ress [psi] psi]] s [psi]	si] 33,314 11,297 -1,440 30,453 32,500
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth	ircumferential Stress umferential Stress Circumferential Stress n Load [psi]	29,423 32,500 1,934 0.97 0.83 1,370	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe	cumferentia ngitudinal St dial Stress [e Stress [psi ective Stress	I Stress [p ress [psi] psi] s [psi]	si] 33,314 11,297 -1,440 30,453 32,500
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	ircumferential Stress Imferential Stress Circumferential Stress Load [psi]	29,423 32,500 1,934 0.97 0.83 1,370 1.50	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi]	cumferentia ngitudinal St dial Stress [e Stress [psi ective Stress Calculated 29 423	I Stress [p ress [psi] psi]] 6 [psi] Allowable 32 500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective	cumferentia ngitudinal St dial Stress [psi ective Stress Calculated 29,423 30,453	I Stress [p ress [psi]] 3 [psi] Allowable 32,500 32,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds	cumferentia ngitudinal St dial Stress [psi ective Stress Calculated 29,423 30,453 2,275	I Stress [p ress [psi] psi]] s [psi] Allowable 32,500 32,500 6,000	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Highway Geometry Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia ngitudinal St dial Stress [e Stress [psi ective Stress Calculated 29,423 30,453 2,275 3,241	I Stress [p ress [psi]] 3 [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cycl Cyclic Circumferential Stress [psi Highway Stiffness Factor for Cycl	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential] ic Longitudinal Stress	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241 9.30	Maximum Cire Maximum Lor Maximum Rad Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia ngitudinal St dial Stress [psi e Stress [psi ective Stress Calculated 29,423 30,453 2,275 3,241	I Stress [p ress [psi]] 3 [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi Highway Stiffness Factor for Cyc	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential] ic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241 9.30 1.16	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia ngitudinal St dial Stress [psi ective Stress Calculated 29,423 30,453 2,275 3,241	I Stress [p ress [psi] psi]] & [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi] Highway Geometry Factor for Cyc	ircumferential Stress umferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential] ic Ļongitudinal Stress clic Longitudinal Stress	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241 9.30 1.16 2,275	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia ngitudinal St dial Stress [psi ective Stress 29,423 30,453 2,275 3,241	I Stress [p ress [psi]] 5 [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi] Highway Geometry Factor for Cyc Cyclic Longitudinal Stress [psi] Notes: Open cut construction, ca	ircumferential Stress Imferential Stress Circumferential Stress I Load [psi] ic Circumferential clic Circumferential] lic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241 9.30 1.16 2,275 -20 loading	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds Long. Welds	cumferentia ngitudinal St dial Stress [psi ective Stress 29,423 30,453 2,275 3,241	I Stress [p ress [psi]] 5 [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAIL PASS PASS PASS PASS
RESULTS Hoop Stress [psi] Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi] Highway Geometry Factor for Cyc Highway Geometry Factor for Cyc Cyclic Longitudinal Stress [psi] Notes: Open cut construction, ca	ircumferential Stress Imferential Stress Circumferential Stress Load [psi] ic Circumferential clic Circumferential] ic Longitudinal Stress clic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 1,934 0.97 0.83 1,370 1.50 12.60 1.22 3,241 9.30 1.16 2,275 -20 loading	Maximum Cire Maximum Lor Maximum Rae Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds Long. Welds	cumferentia ngitudinal St dial Stress [psi ective Stress Calculated 29,423 30,453 2,275 3,241	I Stress [p ress [psi]] 5 [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,314 11,297 -1,440 30,453 32,500 PASS/FAII PASS PASS PASS PASS

Burlington, VT		Date 5/24/20	16			
API 1102 - Gas Pipelin	e Crossing High	way				
PIPE AND OPERATIONAL DAT	۹:	SITE A	ND INSTALLA	ΓΙΟΝ DATA	:	
Operating Pressure [psi]	1440	Soil Ty	pe: Medium	dense sand	s and grav	vels
Location Class:	3	E' - Mo	dulus of Soil Re	action [ksi]		10
Operating Temperature [°F]	60.0	E - Mo	silient Modulus	íksi)		10.0
Pipe Outside Diameter [in]	12.75	Averag	e Unit Weight o	of Soil [lb/ft³]	I	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	eoth [ft]			5
Pipe Grade: X65		Bored	Diameter [in]			12.75
Specified Minimum Yield Stress	65,000	Installa	tionTemperatur	e [°F]		60.0
Design Factor	0.50	Desian	Wheel Load fro	om Sinale A	xle (kips)	18.4
Longitudinal Joint Factor	1.0	Desian	Wheel Load fro	om Tandem	n Axles [kip	osl 18.4
Temperature Derating Factor	1.000	Pavem	ent Type: None	9		-
Pipe Class: API 5L Electric R	esistance Welded	Impact	Factor Method	: ASCE - Hi	iqhway	
Young's Modulus for Steel [ksi]	30,000				<u>.</u>	
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	ו [per°F] 0.0000065	Safety	Factor Applied:	API 1102	Procedur	e
RESULTS	2		W:			
Hoop Stress [psi]		20 422	Movimum Cir			
1 1 2		23,423	waximum Circ	cumferentia	I Stress [p:	si] 33,15
Allowable Hoop Stress [psi]		32,500	Maximum Lor	cumferentia Igitudinal St	l Stress [p: ress [psi]	si] 33,15 11,18
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C	ircumferential Stress	32,500 1,934	Maximum Circ Maximum Lor Maximum Rad	cumferentia igitudinal St dial Stress [l Stress [p: ress [psi] psi]	si] 33,15 11,18 -1,440
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu	Fircumferential Stress	32,500 1,934 1.08	Maximum Circ Maximum Lor Maximum Rac Total Effective	cumferentia Igitudinal St dial Stress [Stress [psi	l Stress [p: ress [psi] psi] i]	si] 33,15 11,18 -1,44(30,31
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load	Circumferential Stress umferential Stress I Circumferential Stress	32,500 1,934 1.08 0.83	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe	cumferentia Igitudinal St dial Stress [Stress [psi ective Stress	l Stress [p: ress [psi] psi] i] s [psi]	si] 33,15 11,18 -1,440 30,31 32,50
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth	Fircumferential Stress umferential Stress I Circumferential Stress n Load [psi]	29,423 32,500 1,934 1.08 0.83 1,525	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe	cumferentia Igitudinal St dial Stress [Stress [psi ective Stress	l Stress [p: ress [psi] psi] i] s [psi]	si] 33,15 11,18 -1,440 30,31 32,50
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor	Fircumferential Stress umferential Stress I Circumferential Stress h Load [psi]	32,500 1,934 1.08 0.83 1,525 1.50	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe	cumferentia ggitudinal St dial Stress [e Stress [psi ective Stress Calculated	l Stress [p: ress [psi] psi] i] s [psi] Allowable	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] lic Circumferential	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop	cumferentia gitudinal St dial Stress [e Stress [psi ective Stress Calculated 29,423	I Stress [p: ress [psi] psi] i] s [psi] Allowable 32,500	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] lic Circumferential rclic Circumferential	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds	cumferentia gitudinal St dial Stress [e Stress [psi ective Stress Calculated 29,423 30,318 2,118	I Stress [p: ress [psi] psi] i] s [psi] Allowable 32,500 32,500 6.000	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress In Load [psi] Lic Circumferential Inclic Circumferential	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923	Maximum Circ Maximum Lor Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia gitudinal St dial Stress [psi e Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	I Stress [p: ress [psi] psi] [] [] [] [] [] [] [] [] [] [] [] [] []	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [ps Highway Stiffness Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] lic Circumferential rclic Circumferential i] lic Longitudinal Stress	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923 9.30	Maximum Circ Maximum Circ Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia gitudinal St dial Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	l Stress [p: ress [psi] psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] lic Circumferential colic Circumferential i] lic Longitudinal Stress colic Longitudinal Stress	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923 9.30 1.08	Maximum Circ Maximum Circ Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia gitudinal St dial Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	l Stress [p: ress [psi] psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] lic Circumferential rclic Circumferential i] lic Longitudinal Stress rclic Longitudinal Stress	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923 9.30 1.08 2,118	Maximum Circ Maximum Circ Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia gitudinal St dial Stress [e Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	l Stress [p: ress [psi] psi]] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,15 11,18 -1,440 30,31 32,50 PASS/FAI PASS PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circu Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Cyclic Circumferential Stress [psi] Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] Clic Circumferential clic Circumferential i] Clic Longitudinal Stress clic Longitudinal Stress	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923 9.30 1.08 2,118 -20 loadin	Maximum Circ Maximum Circ Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds	cumferentia gitudinal St dial Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	l Stress [p: ress [psi] psi] i] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,15 11,18 -1,44(30,31 32,50 PASS PASS PASS PASS PASS
Allowable Hoop Stress [psi] Stiffness Factor for Earth Load C Burial Factor for Earth Load Circle Excavation Factor for Earth Load Circumferential Stress from Earth Impact Factor Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc Highway Stiffness Factor for Cyc Highway Stiffness Factor for Cyc Highway Geometry Factor for Cyc Cyclic Longitudinal Stress [psi] Notes: Open cut construction, ca Reference: API RP 1102 "Steel F	Circumferential Stress umferential Stress I Circumferential Stress h Load [psi] clic Circumferential rclic Circumferential i] clic Longitudinal Stress rclic Longitudinal Stress alculations run using HS	29,423 32,500 1,934 1.08 0.83 1,525 1.50 12.60 1.10 2,923 9.30 1.08 2,118 -20 loadin	Maximum Circ Maximum Circ Maximum Rac Total Effective Allowable Effe Stress [psi] Hoop Effective Girth Welds Long. Welds g + 15% Highways''	cumferentia gitudinal St dial Stress [psi ective Stress Calculated 29,423 30,318 2,118 2,923	l Stress [p: ress [psi] psi]] s [psi] Allowable 32,500 32,500 6,000 11,500	si] 33,15 11,18 -1,44 30,31 32,50 PASS/FA PASS PASS PASS PASS

Date 5/24/2016 WAY SITE AND INS Soil Type: E E' - Modulus o Er - Resilient M Average Unit V Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	STALLA Dense to of Soil Re Vlodulus Weight o er [in] nperatur Load fre	TION DATA o very dens eaction [ksi [ksi] of Soil [lb/ft ³ re [°F]	A: e sands an] ']	nd gravels 2.0 20.0 120.00
SITE AND INS Soil Type: E E' - Modulus o Er - Resilient M Average Unit V Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	STALLA Dense to of Soil Re Vlodulus Weight o er [in] nperatur Load fre	TION DAT/ o very dens eaction [ksi [ksi] of Soil [lb/ft ³ re [°F]	A: e sands an] ']	nd gravels 2.0 20.0 120.00
WAY SITE AND INS Soil Type: E E' - Modulus o Er - Resilient M Average Unit V Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	STALLA Dense to of Soil Re Modulus Weight o er [in] nperatur Load fre	TION DAT/ o very dens eaction [ksi [ksi] of Soil [lb/ft ³ re [°F]	۹: e sands an] ']	nd gravels 2.0 20.0 120.00
SITE AND INS Soil Type: E E' - Modulus o Er - Resilient M Average Unit M Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel	STALLA Dense to of Soil Re Modulus Weight o er [in] nperatur Load fr	TION DAT/ o very dens eaction [ksi [ksi] of Soil [lb/ft ³ re [°F]	A: e sands an] ']	nd gravels 2.0 20.0 120.00
Soil Type: [E' - Modulus o Er - Resilient M Average Unit M Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	Dense to of Soil Re Weight o er [in] nperatur Load fre	o very dens eaction [ksi [ksi] of Soil [lb/ft ⁴ re [°F]	e sands ar] ']	nd gravels 2.0 20.0 120.00
E' - Modulus o Er - Resilient M Average Unit M Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	of Soil Re Weight o er [in] nperatur Load fre	eaction [ksi [ksi] of Soil [lb/ft [:] re [°F] om Single 4] ³]	2.0 20.0 120.00
Er - Resilient M Average Unit M Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	Modulus Weight o er [in] nperatur Load fro	s [ksi] of Soil [lb/ft [:] re [°F] om Single 4	3]	20.0 120.00
Average Unit N Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	Weight o er [in] nperatur Load fro	of Soil [Ib/ft re [°F]	3]	120.00
Pipe Depth [ft] Bored Diamete InstallationTer Design Wheel Design Wheel	er [in] nperatur Load fro	re [°F] om Single /		•
Bored Diameter InstallationTer Design Wheel Design Wheel	er [in] nperatur Load fr	re [°F] om Single 4		3
InstallationTer Design Wheel Design Wheel	nperatur Load fro	re [°F] om Single 4		12.75
Design Wheel Design Wheel	Load fr	om Single /		60.0
Design Wheel		en engle/	Axle [kips]	18.4
	Load fr	om Tander	n Axles [kij	os] 18.4
Pavement Type: None				
Impact Factor	Method	: ASCE - H	lighway	
Safety Factor	Applied:	API 1102	2 Procedur	e
29,423 Maxim	num Ciro	cumferentia	al Stress [p	si] 32,06
32,500 Maxim	num Lor	ngitudinal S	tress [psi]	10,41
1,693 Maxim	num Rad	dial Stress	[psi]	-1,44(
0.78 Total I	Effective	e Stress [ps	i]	29,42
0.83 Allowa	able Effe	ective Stres	s [psi]	32,50
964				
4.50	s [psi]	Calculated	Allowable	PASS/FAI
1.50 Stress	ive.	29,423	32,500	PASS
9.30 Stress	ive	1.517	6.000	PASS
9.30 Stress 9.30 Hoop 1.22 Girth	Welds	2,393	11,500	PASS
1.50 Stress 9.30 Hoop 1.22 Girth V 2,393 Long.	Welds Welds			
1.50 Stress 9.30 Hoop 1.22 Girth V 2,393 Long. 6.20 Stress	Welds Welds			
1.50 Stress 9.30 Hoop 1.22 Girth V 2,393 Long. 6.20 1.16	Welds Welds			
1.50 Stress 9.30 Hoop 1.22 Girth V 2,393 Long. 6.20 1.16 1,517 1.517	Welds Welds			
1.50 Stress 9.30 Hoop 1.22 Girth V 2,393 Long. 6.20 1.16 1,517 20 loading + 15%	Welds Welds			
	1.22 Girth 1 2,393 Long. 6.20 1.16 1,517	1.16 1,517	1,517	20 loading + 15%

Location		Date	2			
Burlington, VT		5/24/20	016			
API 1102 - Gas Pipeline	e Crossing High	way				
PIPE AND OPERATIONAL DATA	:	SITE	AND INSTALLATION DATA:			
Operating Pressure [psi]	1440	Soil Ty	pe: Dense to very dense sand	ls and gravels		
Location Class:	3	E' - M	odulus of Soil Reaction [ksi]	2.0		
Operating Temperature [°F]	60.0	Er - Re	esilient Modulus [ksi]	20.0		
Pipe Outside Diameter [in]	12.75	Avera	ge Unit Weight of Soil [lb/ft³]	120.00		
Pipe Wall Thickness [in]	0.312	Pipe D	Depth [ft]	4		
Pipe Grade: X65		Bored	Diameter [in]	12.75		
Specified Minimum Yield Stress	65,000	Installa	ationTemperature [°F]	60.0		
Design Factor	0.50	Desig	n Wheel Load from Single Axle [k	ips] 18.4		
Longitudinal Joint Factor	1.0	Design Wheel Load from Tandem Axles		s [kips] 18.4		
Temperature Derating Factor 1.000		Pavement Type: None				
Pipe Class: API 5L Electric Re	esistance Welded	Impac	t Factor Method: ASCE - Highwa	y		
Young's Modulus for Steel [ksi]	30,000		C C	-		
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied: API 1102 Proc	edure		
RESULTS						
Hoop Stress [psi]		29,423	Maximum Circumferential Stres	ss [psi] 32,2		
Allowable Hoop Stress [psi]		32,500	Maximum Longitudinal Stress [psi] 10,4		
Stiffness Factor for Earth Load Ci	rcumferential Stress	1,693	Maximum Radial Stress [psi]	-1,44		
Burial Factor for Earth Load Circu	mferential Stress	0.90	Total Effective Stress [psi]	29,5		
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effective Stress [psi]	32,5		
Circumferential Stress from Earth	Load [psi]	1,113				
Impact Factor		1.50	Stress [psi] Calculated Allow	able PASS/FA		
Highway Stiffness Factor for Cycli	c Circumferential	9.30	Hoop 29,423 32,50	0 PASS		
Highway Geometry Factor for Cyc	lic Circumferential	1.22	Effective 29,554 32,50 Girth Welds 1,517 6,000	PASS		
Cyclic Circumferential Stress [psi]		2,393	Long. Welds 2,393 11,50	0 PASS		
Highway Stiffness Factor for Cycli	c Longitudinal Stress	6.20				
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.16				
Cuelie Longitudinal Strees Incil		1.517				
Cyclic Longitudinal Stress [psi]		,				

e N

Reference: API RP 1102 "Steel Pipelines Crossing Kaliroads and Highways"

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1

Location		Date				
Burlington, VT		5/24/20	16			
API 1102 - Gas Pipeline	e Crossing High	way				
PIPE AND OPERATIONAL DATA	:	SITE A	AND INSTALLA	TION DATA	Α:	
Operating Pressure [psi]	1440	Soil Ty	vpe: Dense to	very dense	e sands ar	nd gravels
Location Class:	3	E' - Mo	odulus of Soil R	eaction [ksi]]	2.0
Operating Temperature [°F]	60.0	Er - Re	esilient Modulus	[ksi]		20.0
Pipe Outside Diameter [in]	12.75	Averag	ge Unit Weight o	of Soil [lb/ft ³]	120.00
Pipe Wall Thickness [in]	0.312	Pipe D	epth [ft]			5
Pipe Grade: X65		Bored	Diameter [in]			12.75
Specified Minimum Yield Stress	65,000	Installa	ationTemperatu	re [°F]		60.0
Design Factor	0.50	Desigr	Wheel Load fr	om Single A	Axle [kips]	18.4
Longitudinal Joint Factor	1.0	Desigr	Wheel Load fr	om Tanden	n Axles [ki	ps] 18.4
Temperature Derating Factor	1.000	Paver	nent Type: Non	е		-
Pipe Class: API 5L Electric Re	esistance Welded	Impac	t Factor Method	: ASCE - H	lighway	
Young's Modulus for Steel [ksi]	30,000				• •	
Poisson's Ratio for Steel	0.30					
Coefficient of Thermal Expansion	[per°F] 0.0000065	Safety	Factor Applied:	API 1102	2 Procedui	re
RESULTS						
Hoop Stress [psi]		29,423	Maximum Cire	cumferentia	l Stress [p	si] 32,0
Allowable Hoop Stress [psi]		32,500	Maximum Lor	ngitudinal S	tress [psi]	10,3
Stiffness Factor for Earth Load Ci	cumferential Stress	1,693	Maximum Ra	dial Stress	[psi]	-1,4
Burial Factor for Earth Load Circu	mferential Stress	0.98	Total Effective	e Stress [ps	i]	29,4
Excavation Factor for Earth Load	Circumferential Stress	0.83	Allowable Effe	ective Stres	s [psi]	32,5
Circumferential Stress from Earth	Load [psi]	1,211				
Impact Factor		1.50	Stress [psi]	Calculated	Allowable	PASS/F/
Highway Stiffness Factor for Cycli	c Circumferential	9.30	Hoop	29,423	32,500	PASS
Highway Geometry Factor for Cyc	lic Circumferential	1.10	Girth Welds	1.412	6.000	PASS
Cyclic Circumferential Stress [psi]		2,157	Long. Welds	2,157	11,500	PASS
Highway Stiffness Factor for Cycli	c Longitudinal Stress	6.20	1/ 1 1/			
Highway Geometry Factor for Cyc	lic Longitudinal Stress	1.08				
Cyclic Longitudinal Stress [psi]		1,412				

Prepared By Kelsey Kibbe	Approved By	Revision: 13.0.1



PROJECT NAME: Addison Natural Gas Project Phase 1			DATE: 9/28/16			
PROJECT JOB #: 28757			CONTRACTOR: Michels			
PROJECT LOCATION: New Haven swamp						
WEATHER CONDITIONS: Clear, 60s	<u>, , , , , , , , , , , , , , , , , , , </u>		<u> </u>			
LOWERED-IN:		FROM STA.		TO STA.	DAILY TOTAL	
		1944	+80	1947+80	300'	
	·					
PADDING:	EACH	FROM	I STA.	TO STA.	DAILY TOTAL	
SANDBAG SUPPORT						
BENTONITE						
PADDING BERM						
BACKFILL:		FROM	I STA.	TO STA.	DAILY TOTAL	
SAFETY:			REMARKS:			
ONE CALLS MADE	YES 🖌					
SAFETY MTG CONDUCTED	YES 🔽					
TRAFFIC CONTROL BARRIERS & SIGN	YES 🖌	NO 🔲				
PPE USE COMPLIANCE	YES 🖌	NO 🔲				
WORK-SITE HOUSEKEEPING	YES=🚺	NO======				
JOB SITE SECURED	YES 🔽	NO 🗌				
ENVIRONMENTAL CONCERNS:						
	20				NI-	
COMMENTS:					- Ard	
Cover on pipe in Lowering-in section is 3' Lower-in: 1944+80 to 1947+80. Final jee final jeep area.	per Darrel and e-mai p process done by B	l variance. ill Jackson a	nd M/L coati	ing crew, then they in	nstalled rockshield to	
INSPECTOR SIGNATURE						
INST LETON JIGHATORE:						



PROJECT NAME: Addison Natural Gas P		DATE: 9/29/16			
PROJECT JOB #: 28757			CONTRACTOR: Michels		
PROJECT LOCATION: New Haven swamp					
WEATHER CONDITIONS: Clear, 70s					
LOWERED-IN:	FROM STA.		TO STA.	DAILY TOTAL	
		1947+80		1951+80	400'
PADDING:	EACH	FROM STA.		TO STA.	DAILY TOTAL
SANDBAG SUPPORT					
BENTONITE					
PADDING BERM					
BACKFILL:		FROM STA.		TO STA.	DAILY TOTAL
		194	7+80	1951+80	400'
-					
SAFETY:		-	REMARKS	:	
ONE CALLS MADE	YES 🗸				
SAFETY MTG CONDUCTED	YES 🔽				
TRAFFIC CONTROL BARRIERS & SIGN	YES 🖌	NO 🗌			
PPE USE COMPLIANCE					
		NO 🛄			
JOB SITE SECURED YES 🖌					
ENVIRONMENTAL CONCERNS:					
COMMENTS:					
Lowering-in has cover of at least 3' (apr) e-mail variance. Final jeep process done by Bill Jackson	3' 6" of cover on section and M/L coating crew,	ion). Cover then they ir	on pipe in	Lowering-in section is kshield to final jeep are	3' per Darrel and
INSPECTOR NAME: Gary Gerlache					3

INSPECTOR SIGNATURE: Any Sulach

CHIEF INSPECTOR REVIEW: