			INTERNATIO	INAL CONST			
JOB No:	Frontier Energy					PREPRD.BY: FGL CHECKD.BY:	DATE: 04-Feb-16 SHEET:
	Alpha Crude Co				,	HECKD.BT:	SHEET
		urden Load Calcula	tions - Regency	Line at Truck U	nloading		
DATA	INPUT:	For further deta	ils or explanat	tions on the in	puts below, refer to	API 1102.	
2	=	Type 1 for natura					
60,000	S =	(psi) yield streng			assumed)		
1	Lap=	Lap weld pipe =	2 ; welded pipe	=1			
ERW		Type of Pipe					
16.000	D =	(inch) outside di		oorrooion if it is	non oil ningling (or	eumed)	
0.250 0.016	tw = tw/D=	wall thickness ov		COFFOSION IF IT IS	s non-oil pipeline (as	sumed)	
0.010	P =			re(in event no	internal pressure, o	an pipe withstand result	ing stresses from overburden and
1,000	p=	(psig) maximum	operating press	sure (assumed)			
loose sand	P-	Soil Type (text de					
0.72	F=	Design Factor					
1	E=	Longitudinal joint	t factor				
120	den=	<u> </u>		aterial [range fr	om 85-125] (API 11	02 recommends using 1	20 unless the value is known to be
0.069	V=	• •	tht of Soil (Geot	technical Repo	rt or Soils Informatio	n)	
5.00	H, depth=				pth of horizontal dire		
30,000,000	Es =						own, use table A1 in table workbool
1.25	Fs =	Factor of Safety	(1.25 = 25% tvr)	pical for $d > 3'$	1.5 = 50% is used fo	rd < 3')	
1.20	Ps=					is 12: per API 1102)	
10	Pt=					ue is 10: per API 1102)	
flexible						sphalt)Refer to API 11	02)
85	T1=	(degrees F) Insta	<u>.</u>				
50	T2=	Maximum or Min					
N/A (liquids)	T=	Temperature De					
45	API=	(degrees) API gr					
0.0000065	α _{T=}			rmal expansion	of steel (Recomme	nded 6.5 X 10-6)	
16.000	Bd=					unkown then this is typi	ically D+2 inches)
					al Directional Drill 1		
0.31	H/Bd=	depth over bored	diameter		al Directional Drill, li	unkown then this is typ	
0.31	H/Bd= Bd/D=	depth over bored			al Directional Drill, li		
1.00	Bd/D=	bored diameter of	over diameter o	f pipe			
1.00 0.2	Bd/D= E'=	bored diameter of (ksi)Modulus of	over diameter o Soil Reaction (I	f pipe Recommended	0.5 ksi if unknown)		
1.00	Bd/D=	bored diameter of (ksi)Modulus of (ksi) Resilient Mo	over diameter o Soil Reaction (I odulus (Refer to	f pipe Recommended o API 1102; use	0.5 ksi if unknown) table A1in table wo	rkbook)	
1.00 0.2 5	Bd/D= E'= Er=	bored diameter of (ksi)Modulus of (ksi) Resilient Mo	over diameter o Soil Reaction (I odulus (Refer to	f pipe Recommended o API 1102; use	0.5 ksi if unknown) table A1in table wo		
1.00 0.2 5 0.25	Bd/D= E'= Er=	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of	over diameter o Soil Reaction (I odulus (Refer to	f pipe Recommended o API 1102; use	0.5 ksi if unknown) table A1in table wo	rkbook)	
1.00 0.2 5 0.25 STEP B: Bark	Bd/D= E'= Er= vs=	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of	over diameter o Soil Reaction (I odulus (Refer to of pipe material	f pipe Recommended o API 1102; use (from pipe MTI	0.5 ksi if unknown) table A1in table wc R's or QA report) (if	rkbook)	
1.00 0.2 5 0.25 STEP B: Barlo TEP B: Barlow St	Bd/D= E'= Er= vs= low Stress vers	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio o sus Allowable	over diameter o Soil Reaction (I odulus (Refer to of pipe material ss that results	f pipe Recommended o API 1102; use (from pipe MTI	0.5 ksi if unknown) table A1in table wc R's or QA report) (if	rkbook)	
1.00 0.2 5 0.25 TEP B: Barlo TEP B: Barlow St	Bd/D= E'= Er= vs= ow Stress vers tress is the cir the following	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stree	over diameter o Soil Reaction (I odulus (Refer to of pipe material ss that results	f pipe Recommended API 1102; use (from pipe MTI from internal	0.5 ksi if unknown) table A1in table wc R's or QA report) (if pressure.	rkbook)	unknown, use .25)
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1.00 0.2 5 0.25 TEP B: Barlo he Barlow Str is based on Barlow Stress	Bd/D= E'= Er= vs= ow Stress vers tress is the cir the following s	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stres equation 8b (API	over diameter o Soil Reaction (i odulus (Refer to of pipe material ss that results 1102):	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=}	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS	rkbook) preliminary design and u NPI 1102/ASME B31.4/3 for natural gas	unknown, use .25)
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1.00 0.2 5 0.25 CTEP B: Barlow St t is based on Barlow Stress Shi= /alues as liste	Bd/D= E'= Er= vs= low Stress vers tress is the cir the following s p*D/2*tw ed from above p= D= tw= F= E= T=	bored diameter c (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio o sus Allowable cumferential stree equation 8b (API for natural gas a : 1000 16 0.25 0.72 1 N/A (liquids) 60000	over diameter o Soil Reaction (I odulus (Refer to of pipe material ss that results 1102): nd liquids	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=}	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS	rkbook) preliminary design and u NPI 1102/ASME B31.4/3 for natural gas	unknown, use .25)
1.00 0.2 5 0.25 STEP B: Barlow St t is based on Barlow Stress Shi= /alues as liste	Bd/D= E'= Er= vs= low Stress vers tress is the cir the following s p*D/2*tw ed from above p= D= tw= F= E= T=	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stree equation 8b (API for natural gas at for natural gas at 1000 16 0.25 0.72 1 N/A (liquids) 60000 32,000	over diameter o Soil Reaction (i odulus (Refer to of pipe material ss that results 1102): nd liquids	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=}	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS	rkbook) preliminary design and u NPI 1102/ASME B31.4/3 for natural gas	unknown, use .25)
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1.00 0.2 5 0.25 0.12	Bd/D= E'= Er= vs= bow Stress vers tress is the cir the following s p*D/2*tw ed from above p= D= tw= F= E= T= SMYS= OK, I umferential Str rential Stress from K _{He} ·B _e ·E _e ·y·D	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stree equation 8b (API for natural gas at for natural gas at 1000 16 0.25 0.72 1 N/A (liquids) 60000 32,000 43,200 Barlow stress m ress due to Earth due to Earth Load	pyer diameter o Soil Reaction (i odulus (Refer to of pipe material ss that results 1102): and liquids psig psig eets code Load i is the stress of 102):	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=} S _{hi=} the pipe feels	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS F*E*SMYS	rkbook) preliminary design and u API 1102/ASME B31.4/3 for natural gas for liquids	unknown, use .25)
1.00 0.2 5 0.25	Bd/D= E'= Er= vs= bow Stress vers tress is the cir the following s p*D/2*tw ed from above p= D= tw= F= E= T= SMYS= OK, I umferential Str rential Stress from K _{He} ·B _e ·E _e ·y·D	bored diameter of (ksi)Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stree equation 8b (API for natural gas at for natural gas at 1000 16 0.25 0.72 1 N/A (liquids) 60000 32,000 43,200 Barlow stress m ress due to Earth due to Earth Load	pyer diameter o Soil Reaction (i odulus (Refer to of pipe material ss that results 1102): and liquids psig psig eets code Load i is the stress of 102):	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=} S _{hi=} the pipe feels	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS F*E*SMYS	rkbook) preliminary design and u NPI 1102/ASME B31.4/3 for natural gas for liquids	unknown, use .25)
1.00 0.2 5 0.25	Bd/D= E'= Er= vs= bow Stress vers tress is the cir the following s p*D/2*tw ed from above p= D= tw= F= E= T= SMYS= OK, I umferential Str rential Stress from K _{He} ·B _e ·E _e ·y·D	bored diameter of (ksi) Modulus of (ksi) Resilient Mo Poisson's Ratio of sus Allowable cumferential stree equation 8b (API for natural gas at for natural gas at 1000 16 0.25 0.72 1 N/A (liquids) 60000 32,000 43,200 Barlow stress m ress due to Earth due to Earth Load equation 1 (API 1) Earth Load	pyer diameter o Soil Reaction (i odulus (Refer to of pipe material ss that results 1102): and liquids psig psig eets code Load i is the stress of 102):	f pipe Recommended API 1102; use (from pipe MTI from internal Allowab S _{hi=} S _{hi=} the pipe feels	0.5 ksi if unknown) table A1in table wo R's or QA report) (if pressure. le Barlow Stress (/ F*e*T*SMYS F*E*SMYS	rkbook) preliminary design and u API 1102/ASME B31.4/3 for natural gas for liquids	unknown, use .25)

			INTERNATIONAL	CONSTRUCTION CONSULTING, LLC	
	Frontier Energy /			PREPRD.BY: FGL CHECKD.BY:	DATE: 04-Feb-16
	Alpha Crude Con API 1102 Overbu		ions - Regency Line a	t Truck Unloading	
Values as lis	ted from above:				
valuee de lie	tw/D=	0.016			
	E'=	0.2			
	K _{He}	=	2500		
Finding Duri	al Factor, Be:				
	,	om the list below	and the figure 4 fro	om tables workbook, select and input Be be	elow:
j	j			······································	
Values as lis	ted from above:				
	H/Bd=	0.313			
	Soil Type= Be	loose sand =	1.5		
	De	=	1.5		
Finding Exca	avation Factor, E	e:			
Using the re	sulting values fro	om the list below	and the figure 5 from	m tables workbook, select and input Be be	elow:
Values as lis	ted from above:				
	Bd/D=	1.000			
	Ee	=	0.83		
	tial Stress from				
Using the val	D=	he stress is calcul 16.000			
	V=	0.0694			
She(calculated)=	2	3458.33			
			-		
			n Surface Pressur		
Step D is find	ding the critical of	case for live load	ing over the roadw	iy.	
Finding Imp	act Factor, Fi:				
	-	in the input sect	ion and Figure 7 fro	m tables workbook, select and input the In	npact Factor, Fi:
Ū	· · ·	•	Ū	· · ·	
	H=	5	ft		
	Fi=	1.50			
Einding Ann	ind Docign Surf	ace Pressure, w:			
• • • •	-		ok find the critical	case of live loading (axles), select and inpu	t Critical Case. Pt and w below:
-		2.2.2.1 for more in		5(11),	,
	Section 4.7.2.2.				
· ·		,	· · · ·	ace of the crossing. It is recommended that C	ooper E-80 loading of w=13.9 psi be used, is over an area 20 feet by 8 feet. If the load is
				ing cases should be used. Use Table 1 and f	
			ucks) are listed belo		5
Ps=	12	kips	(when critical case is	s single axle)	
Pt=	10	kps	(when critical case is	s tandem axle)	
The line and a			where the end of the ends	d at the surface of the sea durate. For dealers	
	• •			, , , , , , , , , , , , , , , , , , , ,	nly the load from one of the wheel sets needs s, or the maximum wheel load from the truck's
tandem axle	•			an whee load for the track's single axie, i's	, of the maximum wheel load norm the truck's
			pavement refers to		
Since w= P//	Ap (API 1102 form	nula) where P= d	esign wheel load (if	s) and Ap=area of contact of which wheel	load is appliedusually 144 in^2
W=	83.3	psi for single axle	loading		
w=		psi for tandem a	-		
	Critical Case	tandem	(tandem or single)		
	Pt=	10	kips		
	W=	69.40	psi		
	lia Stranger Cu		tial Strees ASUL a	nd Cyclic Longitudinal Strees ASL h	
				<u>nd Cyclic Longitudinal Stress, ∆SLh</u> ress that results from the highway vehicula	ar loading.
-	(API 1102) is list				· · · · · · · · · · · · · · · · · · ·
	,				
∆SHh=	K _{Hh*} G _{Hh*} R*L∗F _{i*} v	v	psi		
The events t			a alterational action of the		
i ne cyclic lo	ngitudinal stress	s, Δ SLN, is the lo	ngitudinal stress th	at results from the highway vehicular loadi	ng.

			INTERNATIONAL			
JOB No:		(PREPRD.BY: FGL	DATE: 04-Feb-1
	Frontier Energy				CHECKD.BY:	SHEET:
	Alpha Crude Co API 1102 Overb		tions - Regency Line	at Truck Unloading		
e formula ((API 1102) is lis	sted below:				
-						
SLh=	K _{Lh*} GL _{h*} R*L∗F	i∗W	psi			
alculating Δ						
	way Stiffness		rom tablos workbo	ook, select and input h		
sing the var	ues listeu beit	wanu Figure 141		ok, select and input r	Ann below.	
	tw/D=	0.0156				
	Er= KHh=	5 20				
	N III-	20				
	way Geometry					
sing the val	ues listed belo	ow and Figure 15 f	rom tables workbo	ok, select and input (Hh below:	
I	D=	16.00	in	7		
	H=	5]		
	GHh=	1.4		J		
nding R and ing Table 2						
anig rable 2						
	flexible	pavement]		
	tandem	axles	•	4		
	H= D=	5		_		
	D= Fi=	1.5	in	-		
	R=	1.1				
	N=			-		
	L=	1.10		-		
	L=	1.10				
SHh (calcula	L=		psi]		
	L= ated) =	1.10	psi]		
alculating Δ	L= ated) = . <u>SLh</u>	1.10 3,527	psi			
alculating ∆ nding High	L= ated) = . <u>SLh</u> way Stiffness I	1.10 3,527 Factor,KLh:		bok, select and input P	(Lh below:	
alculating ∆ nding High	L= ated) = .SLh way Stiffness I ues listed belo	3,527 Factor,KLh: bw and Figure 16 f		bok, select and input P	(Lh below:	
alculating ∆ nding High	L= ated) = SLh way Stiffness I ues listed belo tw/D=	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156		bok, select and input P	(Lh below:	
alculating ∆ nding High	L= ated) = .SLh way Stiffness I ues listed belo	3,527 Factor,KLh: bw and Figure 16 f		bok, select and input P	(Lh below:	
alculating ∆ nding Highv sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh=	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12		bok, select and input P	(Lh below:	
alculating ∆ nding Highr sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 Factor, GLh:	rom tables workbo			
alculating ∆ nding Highr sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 Factor, GLh:	rom tables workbo	bok, select and input P		
alculating ∆ nding Highr sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f	rom tables workbo			
alculating ∆ nding Highv sing the val nding Highv sing the val	L= ated) = <u>SLh</u> way Stiffness ues listed belo tw/D= Er= KLh= way Geometry ues listed belo	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 Factor, GLh:	rom tables workbo rom tables workbo			
alculating ∆ nding Highv sing the val nding Highv sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000	rom tables workbo rom tables workbo			
alculating ∆ nding Highv sing the val nding Highv sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2	rom tables workbo rom tables workbo			
alculating ∆ nding Highv sing the val nding Highv sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2	rom tables workbo rom tables workbo			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with:	rom tables workbo rom tables workbo			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2	rom tables workbo rom tables workbo			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 * Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5	rom tables workbo rom tables workbo in ft			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 * Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5 16	rom tables workbo rom tables workbo in ft			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5 16 1.5	rom tables workbo rom tables workbo in ft			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement 1.5 16	rom tables workbo rom tables workbo in ft			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5 16 1.5	rom tables workbo rom tables workbo in ft			
alculating ∆ nding Highy sing the val nding Highy sing the val	L= ated) = SLh way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement 1.5 16	rom tables workbo rom tables workbo in ft			
alculating ∆ nding High sing the val nding High sing the val nding R and	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) =	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 Factor, GLh: bw and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 16 1.1 1.10 3,325	rom tables workbo	ook, select and input C		
alculating ∆ nding Highy sing the val nding Highy sing the val nding R and SLh (calcula	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) =	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 Factor, GLh: bw and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 1.1 1.10 3,325	rom tables workbo	ook, select and input C	3Lh below:	
alculating ∆ nding High sing the val nding High sing the val nding R and <u>SLh (calcula</u> <u>FEP F: Circ</u> ne circumfer	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) = cumferential Stress du	1.10 3,527 Factor,KLh: bw and Figure 16 f 0.0156 5 12 * Factor, GLh: bw and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5 16 1.5 1.6 1.1 1.10 3,325 tress due to Internal pressure	rom tables workbo rom tables workbo in ft ft in psi al Pressurization, s	ook, select and input C	3Lh below:	
alculating ∆ nding High sing the val nding High sing the val nding R and <u>SLh (calcula</u> <u>FEP F: Circ</u> ne circumfer	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) = cumferential Stress du p=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 * Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ble 2 with: pavement axles 5 16 1.5 1.6 1.1 1.10 3,325 tress due to Interme 1000	rom tables workbo	ook, select and input C	3Lh below:	
alculating ∆ nding Highy sing the val nding Highy sing the val nding R and <u>SLh (calcula</u> <u>FEP F: Circ</u> e circumfer	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) = umferential Stress du p= D=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ole 2 with: pavement axles 5 16 1.5 16 1.5 1.1 1.10 3,325 tress due to Interme 1000 16	rom tables workbo rom tables workbo in ft ft in psi al Pressurization, 1 rization is the stress psi inches	ook, select and input C	3Lh below:	
alculating ∆ nding Highy sing the val nding Highy sing the val nding R and <u>SLh (calcula</u> <u>FEP F: Circ</u> e circumfer	L= ated) = <u>SLh</u> way Stiffness I ues listed belo tw/D= Er= KLh= way Geometry ues listed belo D= H= GLh= d L; Using Tab flexible tandem H= D= Fi= R= L= ated) = cumferential Stress du p=	1.10 3,527 Factor,KLh: ow and Figure 16 f 0.0156 5 12 Factor, GLh: ow and Figure 17 f 16.0000 5 2.2 ole 2 with: pavement axles 5 16 1.5 16 1.5 1.1 1.10 3,325 tress due to Interme 1000 16	rom tables workbo	ook, select and input C	3Lh below:	

Op No: PREPRD BY: FOL DATE: 04-Fab-15 ULBN: CHECKD.BY: DATE: 04-Fab-15 SUBJECT: APIato Crute Connector SHEET: SHEET: SUBJECT: APIato Crute Connector SHEET: SHEET: SUBJECT: APIato Crute Connector SHEET: SHEET: Subject: API table Crute Connector SHEET: SHEET: Subject: API table Shieted below, the calculated stress is shown: SHEET: SHEET: Stratement: Stratesses are the stresses that act in the circumferential, longitudinal, and radial directions. Circumfarential Stress Strate Shr45NH-ASHh pit Shr45NH-ASHh pit Shr45NH-ASHh pit Strate Shr45NH-ASH pit Shr45NH-ASH pit Shr45NH-ASH pit					INTERNATIONAL	CONSTRUCTION CONSULTING, LLC		
PROJECT: Alpha Crude Connector SUBJECT: Alpha Crude Connector	JOB No:					PREPRD.BY: FGL	DATE: 04-Feb-16	
SUBJECT: API 1102 Overburden Laad Cakulations - Regency Line at Truck Unloading Using the values listed below, the calculated stress is shown: Site C - Principal Stresses, S1 S2, and S3 The principal stresses and the attresses that act in the circumferential, longitudinal, and radial directions. Circumferential Stress Site C - Principal Stresses, S1 S2, and S3 The principal Stresses are the attresses that act in the circumferential, longitudinal, and radial directions. Circumferential Stress Site Stress <td co<="" th=""><th></th><td></td><td></td><td></td><td></td><td>CHECKD.BY:</td><td>SHEET:</td></td>	<th></th> <td></td> <td></td> <td></td> <td></td> <td>CHECKD.BY:</td> <td>SHEET:</td>						CHECKD.BY:	SHEET:
Strateging 31.00 psi Strep 0::::::::::::::::::::::::::::::::::::					tions - Regency Line a	t Truck Unloading		
31,000 psi Striperiodical Stresses. S1,32, and 53 The principal stresses are the stresses that act in the circumferential, longitudinal, and radial directions. Circumferential Stress Star Shot-Shith/Shith psi Longitudinal Stress Star Shot-Shith/Shith psi Calibreat Star Star P or -MAOP or -MOP Star Star Star P or -MAOP or -MOP Star Star Star P or -MAOP or -MOP Star Star St						-		
Strateging 31.00 psi Strep 0::::::::::::::::::::::::::::::::::::	llsing the val	luos liste	ad helov	v the calculated	stress is shown.			
STEP 2: Principal Stresses. Si S2: and S3 The principal stresses. Si S2: and S3 The principal stresses. Si S2: and S3 Sta She+Shit-AShit psi Londitudinal Stress S2 Sa AShE-So T (12:T1)+vs(She+Shi psi Radial Stress S3 Sa - Por -MAOP or -MOP psi Using the values listed below and equations from API 1102, the calculated principal stresses are: The principal stresses S3 - Por -MAOP or -MOP Diag the values listed below and equations from API 1102, the calculated principal stresses are: The principal stresses strest stresses part of the stresses principal stresses are: Stress Stress stresses are stresses are and the stresses principal stresses are: Stress Stress stresses are are and the stresses (steff) The effective stress is the vectoral effect of all of the stresses (radia, circumferential, and radial). Seff (allowable)= 500 psi Seff (allowable)= 500 psi Seff (allowable)= 500 psi Seff (allowable)= 43200 psi Seff (allowable)= 500 psi Seff (allo	USING the Val			, the calculated	30033 13 3110WII.			
The principal stresses are the stresses that act in the circumferential, longitudinal, and radial directions. Circumferential Stress Stans Shres Strings (172-T1)+vs(ShretShips) Candiductial Stress Stans Port-MAOP or -MOP psi Stans Status Istad below and equations from API 1102, the calculated principal stresses are: $\frac{15}{12a} = 3000000000000000000000000000000000000$	Shi (calculated)=	31,	500	psi]			
The principal stresses are the stresses that act in the circumferential, longitudinal, and radial directions. Circumferential Stress Stans Shres Strings (172-T1)+vs(ShretShips) Candiductial Stress Stans Port-MAOP or -MOP psi Stans Status Istad below and equations from API 1102, the calculated principal stresses are: $\frac{15}{12a} = 3000000000000000000000000000000000000$		nainal St		S1 S2 and S2				
Circumferential Stress S1= Shar-Shi-ASHh pai Londitudial Stress S2= ASLN-Es of (12-T1)+vs(She+Shi pai Radial Stress S3= - P or -MAOP or -MOP S3= - P or -MAOP or -MOP S1=					act in the circumfere	ntial, longitudinal, and radial directions.		
St= She+Shi-ASHh psi Longtuinal Stress S2 ASULES off (T2-T1)+va(She+Shi psi Radial Stress S2 S2 -Por -MAOP or -MOP psi Using the values listed below and equations from API 1102, the calculated principal stresses are: S1 S2 <t< th=""><th></th><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
Longitudinal Stress 23 NSL-Es of T(72-T1)+vs(She+Shi psi Radial Stress 33 Por MAOP or -MOP psi Using the values listed below and equations from API 1102, the calculated principal stresses are: $\frac{1}{12} + \frac{1}{12} +$				noi				
S2e ASU-Es CI (T2-T1)+vs(She+Shi psi Radial Stress S3 - Por -MAOP or -MOP psi Using the values listed below and equations from API 1102, the calculated principal stresses are:			тдопп	psi				
Sa -P or -MAOP or -MOP psi Using the values listed below and equations from API 1102, the calculated principal stresses are:			s αT (T2	-T1)+vs(She+Shi	psi			
Using the values listed below and equations from API 1102, the calculated principal stresses are: $\frac{E^{s}}{12} = \frac{30000000.00}{12} \frac{psi}{12} = \frac{195}{12} \frac{195}$		-						
$\frac{Es}{12} = \frac{30000000 00}{12} \frac{1}{12} = \frac{1}{12} \frac{1}$	S3=	-P or -M	IAOP or	-MOP	psi			
$\frac{Es}{12} = \frac{30000000 00}{12} \frac{1}{12} = \frac{1}{12} \frac{1}$	Using the va	lues liste	ed belov	v and equations	from API 1102, the o	alculated principal stresses are:		
$\frac{T_1 = 85}{T_2 = 0.250000} \frac{4egree F}{1}$ $\frac{T_2 = 0.250000}{T_1 = 0.000065} per degree F$ $\frac{T_2 = 0.250000}{She = 3468.33} psi$ $\frac{T_2 = 0.250000}{She = 3468.33} psi$ $\frac{T_2 = 0.250000}{She = 3468.33} psi$ $\frac{T_2 = 0.250000}{She = 32000.00} psi$ $\frac{T_2 = 0.250000}{She = 320000} psi$ $\frac{T_2 = 0.25000}{She = 320000} psi$ \frac		-				· ·		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$								
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		ted)=		3325.3704	psi			
Result: OK, longitudinal weld stress meets code	∆SL (calculat	-						