PROGRAM	TRDP v1.1	**Sheet no.**	1 of 1
PROJECT	70/71 6R	**Date**	6/22/2020
LOCATION	Columbus, OH		
DESIGNED BY			
CHECKED BY			
COMPANY	ms Consultants		
DESCRIPTION	11.25 horizontal + up		

Pipeline Information

Pipe Type (ECP, LCP, BWP, RCP)	LCP		Cylinder Outside Diameter, D_y	40.5	in.
Internal Diameter, ID	36	in.	Minimum Cylinder Thickness	0.1046	in.
Core Thickness, h'_c	2.25	in.	Bend Angle, Δ	11.2	deg
Mortar Coating Thickness, h_m	1	in.	Centerline Length of Fitting, L_b	0.8	ft
Core Outside Diameter, OD	40.5	in.	Pipe Laying Length (First Pipe), L_{p1}	20	ft
Pipe Outside Diameter, D_o	42.5	in.	Pipe Laying Length (Typical Pipe), L_p	20	ft

Joint Properties

Joint Type (Welded or Harnessed)	Harness	
Joint Diameter, D_j	41	in.
Joint Slack	0.0625	in.

Material Properties

Concrete Strength, f'_c	4500	psi
Steel Cylinder Yield Strength, f_{yy}	36000	psi

Pressures

Working Pressure, P_w	150	psi
Transient Pressure, P_t	100	psi
Field Test Pressure, P_{ft}	150	psi
$P_{weff} = \max(P_w, P_{ft}/1.25, (P_w + P_t)/1.4)$	179	psi

Soil Information (Table 9-1 - Soil Type Selection Guide)

Soil Type (I through V)	V	
Soil Stiffness, k	425	psi
Soil Unit Weight, γ	110	pcf
Pipe to Soil Friction Coefficient, μ	0.3	in.
Soil Cover, H	6	ft
Angle of Internal Friction, Φ	20	deg

Bend Angle (deg)	Centerline Length of Fitting (ft)	Thrust (kip)	Total Footage Required (one side)	Total Heavy Gage Footage (one side)
11.2	0.8	58	14	14

Required Lengths for One Side

Cylinder Thickness (in.)	0.5	0.4375	0.375	0.3125	0.25	0.1875	0.1644 (8 GA)	0.1345 (10 GA)	0.1046 (12 GA)	0.0747 (14 GA)	0.0598 (16 GA)
Length Needed (ft)	0	0	0	0	0	0	0	0	13.9	0	0
Number of Pipes	0	0	0	0	0	0	0	0	1	0	0

PROGRAM	TRDP v1.1	**Sheet no.**	1 of 1
PROJECT	70/71 6R	**Date**	6/22/2020
LOCATION	Columbus, OH		
DESIGNED BY			
CHECKED BY			
COMPANY	ms Consultants		
DESCRIPTION	22.5 horizontal + up		

Pipeline Information

Pipe Type (ECP, LCP, BWP, RCP)	LCP		Cylinder Outside Diameter, D_y	40.5	in.
Internal Diameter, ID	36	in.	Minimum Cylinder Thickness	0.1046	in.
Core Thickness, h'_c	2.25	in.	Bend Angle, Δ	22.5	deg
Mortar Coating Thickness, h_m	1	in.	Centerline Length of Fitting, L_b	1.1	ft
Core Outside Diameter, OD	40.5	in.	Pipe Laying Length (First Pipe), L_{p1}	20	ft
Pipe Outside Diameter, D_o	42.5	in.	Pipe Laying Length (Typical Pipe), L_p	20	ft

Joint Properties

Joint Type (Welded or Harnessed)	Harness	
Joint Diameter, D_j	41	in.
Joint Slack	0.0625	in.

Material Properties

Concrete Strength, f'_c	4500	psi
Steel Cylinder Yield Strength, f_{yy}	36000	psi

Pressures

Working Pressure, P_w	150	psi
Transient Pressure, P_t	100	psi
Field Test Pressure, P_{ft}	150	psi
$P_{weff} = \max(P_w, P_{ft}/1.25, (P_w + P_t)/1.4)$	179	psi

Soil Information (Table 9-1 - Soil Type Selection Guide)

Soil Type (I through V)	V	
Soil Stiffness, k	425	psi
Soil Unit Weight, γ	110	pcf
Pipe to Soil Friction Coefficient, μ	0.3	in.
Soil Cover, H	6	ft
Angle of Internal Friction, Φ	20	deg

Bend Angle (deg)	Centerline Length of Fitting (ft)	Thrust (kip)	Total Footage Required (one side)	Total Heavy Gage Footage (one side)
22.5	1.1	115	41	41

Required Lengths for One Side

Cylinder Thickness (in.)	0.5	0.4375	0.375	0.3125	0.25	0.1875	0.1644 (8 GA)	0.1345 (10 GA)	0.1046 (12 GA)	0.0747 (14 GA)	0.0598 (16 GA)
Length Needed (ft)	0	0	0	0	0	0	0	0	40.9	0	0
Number of Pipes	0	0	0	0	0	0	0	0	3	0	0

PROGRAM	TRDP v1.1	**Sheet no.**	1 of 1
PROJECT	70/71 6R	**Date**	6/22/2020
LOCATION	Columbus, OH		
DESIGNED BY			
CHECKED BY			
COMPANY	ms Consultants		
DESCRIPTION	45 horizontal + up		

Pipeline Information

Pipe Type (ECP, LCP, BWP, RCP)	LCP		Cylinder Outside Diameter, D_y	40.5	in.
Internal Diameter, ID	36	in.	Minimum Cylinder Thickness	0.1046	in.
Core Thickness, h'_c	2.25	in.	Bend Angle, Δ	45	deg
Mortar Coating Thickness, h_m	1	in.	Centerline Length of Fitting, L_b	1.75	ft
Core Outside Diameter, OD	40.5	in.	Pipe Laying Length (First Pipe), L_{p1}	20	ft
Pipe Outside Diameter, D_o	42.5	in.	Pipe Laying Length (Typical Pipe), L_p	20	ft

Joint Properties

Joint Type (Welded or Harnessed)	Harness	
Joint Diameter, D_j	41	in.
Joint Slack	0.0625	in.

Material Properties

Concrete Strength, f'_c	4500	psi
Steel Cylinder Yield Strength, f_{yy}	36000	psi

Pressures

Working Pressure, P_w	150	psi
Transient Pressure, P_t	100	psi
Field Test Pressure, P_{ft}	150	psi
$P_{weff} = \max(P_w, P_{ft}/1.25, (P_w + P_t)/1.4)$	179	psi

Soil Information (Table 9-1 - Soil Type Selection Guide)

Soil Type (I through V)	V	
Soil Stiffness, k	425	psi
Soil Unit Weight, γ	110	pcf
Pipe to Soil Friction Coefficient, μ	0.3	in.
Soil Cover, H	6	ft
Angle of Internal Friction, Φ	20	deg

Bend Angle (deg)	Centerline Length of Fitting (ft)	Thrust (kip)	Total Footage Required (one side)	Total Heavy Gage Footage (one side)
45	1.75	226	89	89

Required Lengths for One Side

Cylinder Thickness (in.)	0.5	0.4375	0.375	0.3125	0.25	0.1875	0.1644 (8 GA)	0.1345 (10 GA)	0.1046 (12 GA)	0.0747 (14 GA)	0.0598 (16 GA)
Length Needed (ft)	0	0	0	0	0	0	0	15.5	73.1	0	0
Number of Pipes	0	0	0	0	0	0	0	1	4	0	0

PROGRAM	TRDP v1.1	**Sheet no.**	1 of 1
PROJECT	70/71 6R	**Date**	6/22/2020
LOCATION	Columbus, OH		
DESIGNED BY			
CHECKED BY			
COMPANY	ms Consultants		
DESCRIPTION	bulkhead/tee/dead end		

Pipeline Information

Pipe Type (ECP, LCP, BWP, RCP)	LCP		Cylinder Outside Diameter, D_y	40.5	in.
Internal Diameter, ID	36	in.	Minimum Cylinder Thickness	0.1046	in.
Core Thickness, h'_c	2.25	in.	Bend Angle, Δ	0	deg
Mortar Coating Thickness, h_m	1	in.	Centerline Length of Fitting, L_b	1	ft
Core Outside Diameter, OD	40.5	in.	Pipe Laying Length (First Pipe), L_{p1}	20	ft
Pipe Outside Diameter, D_o	42.5	in.	Pipe Laying Length (Typical Pipe), L_p	20	ft

Joint Properties

Joint Type (Welded or Harnessed)	Harness	
Joint Diameter, D_j	41	in.
Joint Slack	0.0625	in.

Material Properties

Concrete Strength, f'_c	4500	psi
Steel Cylinder Yield Strength, f_{yy}	36000	psi

Pressures

Working Pressure, P_w	150	psi
Transient Pressure, P_t	100	psi
Field Test Pressure, P_{ft}	150	psi
$P_{weff} = \max(P_w, P_{ft}/1.25, (P_w + P_t)/1.4)$	179	psi

Soil Information (Table 9-1 - Soil Type Selection Guide)

Soil Type (I through V)	V	
Soil Stiffness, k	425	psi
Soil Unit Weight, γ	110	pcf
Pipe to Soil Friction Coefficient, μ	0.3	in.
Soil Cover, H	6	ft
Angle of Internal Friction, Φ	20	deg

Bend Angle (deg)	Centerline Length of Fitting (ft)	Thrust (kip)	Total Footage Required (one side)	Total Heavy Gage Footage (one side)
0	1	236	186	186

Required Lengths for One Side

Cylinder Thickness (in.)	0.5	0.4375	0.375	0.3125	0.25	0.1875	0.1644 (8 GA)	0.1345 (10 GA)	0.1046 (12 GA)	0.0747 (14 GA)	0.0598 (16 GA)
Length Needed (ft)	0	0	0	0	0	0	0	0	185.8	0	0
Number of Pipes	0	0	0	0	0	0	0	0	10	0	0