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60x142'f

## P I P E C A R

A Microcomputer Program for the Analysis and Design of Circular  
and Horizontal Elliptical Reinforced Concrete Pipe Culverts

Version 4.0 for windows  
11/22/2004 3:43:36 PM

Version 4.0 incorporates the loading system and design method  
of the ASCE, "Standard Practice for Direct Design of  
Buried Precast Concrete Pipe Using Standard Installations  
(SIDD)." See the User Manual for Details.

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## WARNING

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The successful application and use of this software product is dependent  
on the application of skilled engineering judgement and is the  
responsibility of the user. The user must select input values suitable  
to his specific installation. The information presented in the computer  
output is for review, interpretation, application and approval by a  
qualified engineer  
\*\*\*\*\*

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PROGRAM USER MANUAL INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR  
FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

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ASSOCIATION, THE FEDERAL HIGHWAY ADMINISTRATION AND GIFFELS ASSOCIATES  
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INDIRECT OR OTHER SIMILAR DAMAGES ARISING FROM BREACH OF WARRANTY,  
BREACH OF CONTRACT OR OTHER LEGAL THEORY EVEN IF SUCH PARTIES HAVE  
BEEN ADVISED OF SUCH DAMAGES.  
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DATE: 06-11-2024  
TIME: 14:00:44

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Filename:  
C:\Program Files\PIPECAR\Data\60x142'f.out  
Job Description  
60" Diameter w/142' fill

## GEOMETRY: CIRCULAR PIPE ANALYSIS AND DESIGN

Pipe Inside Diameter	60 in.
Pipe Wall Thickness	10.25 in.

## INSTALLATION CONDITIONS - SIDD Soil Pressures

Depth of Fill	142 ft
Standard Installation Type	2
Vertical Arching Factor	1.4
Horizontal Arching Factor	0.4

## MATERIAL PROPERTIES

Steel Reinforcing Yield Stress	65 ksi
Reinforcing Type	2
Design Concrete Strength	7 ksi
Concrete Density	150 pcf

## LOAD FACTORS

Dead Load Factor (Shear and Moment)	1.3
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	60x142'f	
Dead Load Factor (Thrust)		1
Live Load Factor (Shear and Moment)		1.75
Live Load Factor (Thrust)		1
Internal Pressure Factor (Thrust)		1

PHI FACTORS

Flexure	1
Diagonal Tension	0.9
Radial Tension	0.9
Limiting Crack Width Factor	1

PROCESS FACTORS

Radial Tension Process Factor	1
Shear Process Factor	1

Design based on the SIDD METHOD

SOIL LOAD DATA

soil Unit Weight	120 pcf
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FLUID LOAD DATA

Depth of Fluid	60 in.
Fluid Unit Weight	62.4 pcf
Pressure Head	0 ft

LIVE LOAD DATA

Live Load Type	NONE
Live Load	0

CAGE REINFORCING TYPE

DOUBLE CIRCULAR

CONCRETE COVERS

Inside Face	1 in.
Outside Face	1 in.

REINFORCING DIAMETERS

Inside Circular Reinforcing Diameter, Asi	0.82 in.
Outside Circular Reinforcing Diameter, Aso	0.82 in.

MAXIMUM REINFORCING SPACING

Inside Reinforcing Spacing, Asi	4 in.
Outside Reinforcing Spacing, Aso	4 in.

\*\*\*\*\*TOTAL APPLIED SERVICE LOADS ON PIPE\*\*\*\*\*

PIPE UNIT WT=	2.3557 KIPS/FT
SOIL UNIT WT=	160.8430 KIPS/FT
FLUID UNIT WT=	1.2248 KIPS/FT
WHEEL UNIT LOAD =	.0000 KIPS/FT

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 \*  
 \* WARNING \*  
 \* STIRRUPS REQUIRED AT INVERT \*  
 \* TO RESIST RADIAL TENSION \*  
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*          WARNING          *
*      STIRRUPS REQUIRED AT CROWN      *
*      TO RESIST RADIAL TENSION      *
*****

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*****
*          WARNING          *
*      STIRRUPS REQUIRED AT INVERT      *
*      TO RESIST DIAGONAL TENSION      *
*****

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*****
*          WARNING          *
*      STIRRUPS REQUIRED AT CROWN      *
*      TO RESIST DIAGONAL TENSION      *
*****

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*****
*          WARNING          *
*      STIRRUPS REQUIRED IN NEGATIVE MOMENT      *
*      REGION TO RESIST DIAGONAL TENSION      *
*****

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TABLE OF ULTIMATE FORCES

LOCATION DESIGN	MOMENT	THRUST	SHEAR
DEG FROM INVERT	IN.KIPS/FT	KIPS/FT	KIPS/FT
.00	930.448	26.813	.000
9.00	826.333	31.540	35.009
90.00	-676.723	80.850	.654
165.75	613.401	23.773	-19.504
180.00	700.983	19.839	.000

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\*\*\*\*\*REINFORCING DESIGN TABLE\*\*\*\*\*

DESIGN LOCATION	REINF. DESIG.	DEPTH TO REINF.	FLEXURAL REINFORCING	DESIGN INDICES NOT REINF. AREAS		
DEG FROM INVERT		IN.	SQ.IN./FT	0.01 INCH	RAD. TENS.	DIAG.TENS.
.00	ASI	8.84	1.586	1.530	2.520	
9.00	ASI	8.84				1.540*
90.00	ASO	8.84	.639	.000	.000	
165.75	ASC	8.84				1.228*
180.00	ASC	8.84	1.152	1.432	1.903	

NOTES:

1. REINFORCING REQUIRED FOR 0.01 INCH CRACK IS DETERMINED BY MULTIPLYING THE DESIGN INDEX BY THE FLEXURAL REINFORCEMENT.
2. IF THE DIAGONAL TENSION INDEX IS GREATER THAN 1.0, THE REINFORCEMENT REQUIRED FOR DIAGONAL TENSION IS GREATER THAN THE FLEXURAL AND CRACKING REINFORCEMENT. IF THE DIAGONAL TENSION INDEX IS GREATER THAN 1.0 AND THE REQUIRED REINFORCING RATIO IS GREATER THAN 0.02 THEN STIRRUPS MUST BE USED. THIS IS INDICATED BY A "\*" AFTER THE DIAGONAL TENSION INDEX.
3. IF THE RADIAL TENSION INDEX IS GREATER THAN 1, STIRRUPS MUST BE

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USED.

REINF.	DEPTH IN.	GOVERNING DESIGN			
		REQUIRED AREA (SQ.IN./FT)	REINF. RATIO	STIRRUPS REQUIRED?	GOVERNING MODE
ASI	8.84	2.426	.0229	YES	RAD. TEN. + 0.01 IN. CR.
ASO	8.84	.639	.0060	YES	FLEXURE
ASC	8.84	1.651	.0156	YES	RAD. TEN. + 0.01 IN. CR.

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PIPECAR PIPE CULVERT DESIGN SUMMARY  
60.0 INCH DIAMETER REINFORCED CONCRETE CIRCULAR PIPE

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## I N S T A L L A T I O N   D A T A

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HEIGHT OF FILL ABOVE CROWN, FT	142.00
SOIL UNIT WEIGHT, PCF	120.00
LOAD SYSTEM	SIDD LOAD SYSTEM
INSTALLATION TYPE	2
VERTICAL ARCHING FACTOR	1.40
HORIZONTAL ARCHING FACTOR	.40

## M A T E R I A L   P R O P E R T I E S

REINFORCING - MINIMUM SPECIFIED YIELD STRENGTH, KSI	65.00
REINFORCING TYPE	SMOOTH WELDED WIRE FABRIC
NO. OF LAYERS OF REINFORCING	1
CONCRETE - SPECIFIED COMPRESSIVE STRENGTH, KSI	7.0

## D E S I G N   A N D   L O A D I N G   D A T A

BASIS FOR DESIGN	SIDD METHOD
DEAD LOAD FACTOR - MOMENT AND SHEAR	1.30
DEAD LOAD FACTOR - THRUST	1.00
LIVE LOAD FACTOR - MOMENT AND SHEAR	1.75
LIVE LOAD FACTOR - THRUST	1.00
INTERNAL PRESSURE FACTOR - THRUST	1.00
STRENGTH REDUCTION FACTOR-FLEXURE	1.00
STRENGTH REDUCTION FACTOR-DIAGONAL TENSION	.90
STRENGTH REDUCTION FACTOR-RADIAL TENSION	.90
LIMITING CRACK WIDTH FACTOR	1.00
RADIAL TENSION PROCESS FACTOR	1.00
DIAGONAL TENSION PROCESS FACTOR	1.00
LIVE LOAD TYPE	NONE

## P I P E   D A T A

WALL THICKNESS, IN.	10.25
INSIDE CONCRETE COVER OVER REINFORCING, IN.	1.00
OUTSIDE CONCRETE COVER OVER REINFORCING, IN.	1.00

## F L U I D   D A T A

FLUID UNIT WEIGHT, PCF.	62.40
DEPTH OF FLUID, INCHES ABOVE INVERT	60.00
PRESSURE HEAD, FT	.00

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## R E I N F O R C I N G   D A T A

REINFORCING CAGE TYPE	DOUBLE CIRCULAR		
	d *	MAXIMUM REINFORCING SPACING(IN.)	REINFORCING AREA (SQ.IN./FT)
	(IN.)		
INVERT- INSIDE REINFORCING	8.840	4.000	2.426
SPRINGLINE- OUTSIDE REINFORCING	8.840	4.000	.639
CROWN- INSIDE REINFORCING	8.840	4.000	1.651

\*\*\* STIRRUP REINFORCING IS REQUIRED \*\*\*

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>>> IF THIS PIPE IS MANUFACTURED WITH ANY REINFORCING SCHEME OTHER THAN A SINGLE OR DOUBLE CIRCULAR CAGE, THE MANUFACTURER MUST CLEARLY MARK THE PIPE TO INDICATE THE PROPER ORIENTATION IN THE GROUND. REINFORCING DESIGNS SHOULD ALLOW FOR SOME TOLERANCE IN LOCATION OF PIPE INVERT IN THE FIELD INSTALLATION.

\* d IS THE DISTANCE FROM THE COMPRESSION FACE TO THE CENTROID OF THE TENSION REINFORCEMENT AND IS USED TO DETERMINE THE REQUIRED REINFORCEMENT. IF SELECTION OF REINFORCEMENT RESULTS IN A SMALLER d THAN THIS VALUE, THE DESIGN SHOULD BE REEVALUATED.

STIRRUP REINFORCING DATA

STIRRUPS CENTERED ON	AREA SQ.IN./FT/LINE	NUMBER OF LINES AND SPACING
INVERT	.589	18 AT 5.5 in. O.C.
CROWN	.467	18 AT 5.5 in. O.C.

SHEAR REINFORCEMENT IS CALCULATED USING A DEVELOPABLE STIRRUP  
YIELD STRESS OF 60. ksi

NOTE : SHEAR REINFORCEMENT IS REQUIRED AROUND THE FULL  
CIRCUMFERENCE OF THE PIPE.