PIPELINE PLANNING TOOLBOX

Uncased Pipeline Crossing Report

Pipeline Crossing Design Analysis

PROJECT NAME
Demo - Case #1

CLIENT
ABC Pipeline

CALCULATED BY
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DATE
June 29, 2026

UNCASED PIPELINE CROSSING ANALYSIS

Spangler/GPTC Combined Stress Method

Generated: June 29, 2026 at 09:08 PM

1. EXECUTIVE SUMMARY

TOTAL COMBINED STRESS (% SMYS)

57.5%

Total Stress: 29,916 psi | SMYS: 52,000 psi

Pipe Properties

OD:	**12.750 in**
Wall Thickness:	**0.250 in**
Grade:	**X52**
SMYS:	**52,000 psi**

Installation

Condition:	**Bored**
Cover Height:	**5.0 ft**
Bore Diameter:	**24.0 in**

Soil Type:

Clays and Silt - Medium with Low to Medium Plasticities

1.1 Input Parameters

Parameter	Symbol	Value	Unit
Pipe OD	D	12.750	in
Wall Thickness	t	0.250	in
SMYS	S	52,000	psi
Internal Pressure	P	1,000	psig
Soil Unit Weight	δ	120	lb/ft³
Bore Diameter	B_D	24.0	in
Cover Height	H	5.0	ft
Wheel Load	L	16,000	lbs
Impact Factor	I	1.50	-
Load Coefficient	C_a	1.600	-
Bending Parameter	K_b	0.157	-
Deflection Parameter	K_z	0.096	-

2. STRESS CALCULATIONS

2.1 Calculated Results

Parameter	Value	Unit
Dead Load (W_{dead})	63.974	lb/in
Live Load (W_{live})	40.520	lb/in
Total External Load (W)	104.494	lb/in
Internal Hoop Stress (S_I)	25,500	psi
External Hoop Stress (S_E)	4,416	psi
Total Combined Stress (S_T)	**29,916**	**psi**
% of SMYS	**57.5**	**%**

2.2 Compliance Check

Check	Actual	Limit	Status
Combined Stress vs 72% SMYS	57.5%	72%	PASS

3. CONCLUSIONS AND RECOMMENDATIONS

Design Verification

Combined stress is within the 72% SMYS limit

- Total combined stress: 29,916 psi (57.5% SMYS)
- The uncased crossing design is acceptable

Construction Recommendations

1. Verify pipe material meets Grade X52 through MTRs
2. Ensure minimum cover height of 5.0 ft is maintained
3. Confirm soil conditions match assumed type during installation
4. Monitor crossing for settlement after construction
5. Document as-built conditions for records

3.1 References & Standards

Methodology combines public-domain buried-pipe load theory (Marston/Spangler) with the combined-stress procedure as presented in the GPTC Guide. Equations are implemented independently; standards are cited rather than reproduced.

1. Marston, A. (1930). The Theory of External Loads on Closed Conduits. Iowa Eng. Experiment Station, Bulletin No. 96 — load coefficient (Ca).
2. Spangler, M. G. (1941). The Structural Design of Flexible Pipe Culverts. Iowa Eng. Experiment Station, Bulletin No. 153 — external bending stress (SE), Kb and Kz.
3. GPTC, Guide for Gas Transmission, Distribution, and Gathering Piping Systems (ANSI GPTC Z380) — combined-stress procedure, dead/live load expressions, impact-factor curves.
4. ASME B31.8, Gas Transmission and Distribution Piping Systems — internal hoop stress (SI) and class-location design factors (Table 841.114B).
5. AASHTO, Standard Specifications for Highway Bridges / LRFD Bridge Design Specifications — wheel-load designations and live-load impact factors.