

API RP 1102 Analysis Report

Steel Pipelines Crossing Railroads and Highways

PROJECT NAME

Demo - Case #1

CLIENT

ABC Pipeline

CALCULATED BY

John Smith, PE

DATE

June 29, 2026

API RP 1102 PIPELINE CROSSING ANALYSIS

Railroad Crossing

Generated: June 29, 2026 at 09:07 PM

1. EXECUTIVE SUMMARY

OVERALL COMPLIANCE STATUS

PASS

All four design checks satisfied per API RP 1102

1.1 Design Check Summary

Design Check	Actual	Allowable	Unit	Status
1. Barlow Hoop Stress	26,666.67	37,440.00	psi	PASS
2. Von Mises Effective Stress	31,837.19	37,440.00	psi	PASS
3. Girth Weld Fatigue	6,643.28	8,640.00	psi	PASS
4. Longitudinal Weld Fatigue	6,482.61	15,120.00	psi	PASS

1.2 Pipeline Overview

Pipe Specification

OD x WT:	20.000 x 0.375 in
Grade:	X52
SMYS:	52,000 psi
Design Pressure:	1,000 psi

Installation

Crossing Type:	Railroad Crossing
Pipeline Depth:	4.00 ft
Class Location:	Class 1
Design Factor:	0.72

2. INPUT PARAMETERS

2.1 Pipe Properties

Parameter	Symbol	Value	Unit
External Diameter	D	20.000	in
Wall Thickness	t_w	0.375	in
Pipe Grade	-	X52	-
Specified Min. Yield Strength	$SMYS$	52,000	psi
Design Pressure	P	1,000	psig
Class Location	-	Class 1	-
Design Factor	F	0.72	-
Longitudinal Joint Factor	E	1.00	-
Poisson's Ratio	ν	0.30	-

2.2 Earth Load Parameters

Parameter	Symbol	Value	Unit
Pipeline Depth	H	4.00	ft
Bored Diameter	B_d	22.00	in
Soil Type (Fig 4)	-	A - Loose/Soft	-
Unit Weight of Soil	γ	120.0	lbm/ft ³
Modulus of Soil Reaction	E'	0.50	ksi
Soil Resilient Modulus	E_r	10.0	ksi
Stiffness Factor (Fig 3)	K_{he}	3,168	-
Burial Factor (Fig 4)	B_c	0.69	-
Excavation Factor (Fig 5)	E_e	1.00	-

2.3 Railroad Live Load Parameters

Parameter	Symbol	Value	Unit
Design Surface Pressure	w	13.9	psi
Number of Tracks	-	Single Track	-
Impact Factor (Fig 7)	F_i	1.75	-

2.4 Railroad Cyclic Stress Factors

Parameter	Symbol	Value	Unit
Stiffness Factor - Circ. (Fig 8)	K_{Hr}	325	-
Geometry Factor - Circ. (Fig 9)	G_{Hr}	0.82	-
Double Track Factor (Fig 10)	N	1.00	-
Stiffness Factor - Long. (Fig 11)	K_{Lr}	321	-
Geometry Factor - Long. (Fig 12)	G_{Lr}	0.85	-

2.5 Fatigue Endurance Limits

Parameter	Symbol	Value	Unit
Girth Weld Endurance Limit	S_{FG}	12,000	psi
Longitudinal Weld Endurance Limit	S_{FL}	21,000	psi

3. CALCULATION RESULTS

3.1 Intermediate Calculated Values

Parameter	Formula	Value	Unit
Barlow Hoop Stress	$S_{hi} = P \cdot D / (2 \cdot t_w)$	26,667	psi
Allowable Hoop Stress	$S_a = F \cdot E \cdot SMYS$	37,440	psi
Earth Load Circ. Stress	$S_{he} = K_{he} \cdot B_c \cdot E_e \cdot \gamma \cdot D$	3044.80	psi
Surface Pressure	w (Cooper E-80)	13.90	psi
Thin-Wall Hoop Stress	$S_{hi} = P \cdot (D - t_w) / (2 \cdot t_w)$	26,167	psi
Cyclic Circ. Stress	ΔS_{Hr}	6482.61	psi
Cyclic Long. Stress	ΔS_{Lr}	6643.28	psi

3.2 Principal Stresses & Von Mises

Parameter	Formula	Value	Unit
Principal Stress 1	$S_1 = S_{he} + \Delta S_H + S_{hi}$	35,694	psi
Principal Stress 2	$S_2 = \Delta S_L + \nu \cdot (S_{he} + S_{hi})$	15,407	psi
Principal Stress 3	$S_3 = -P$	-1,000	psi
Von Mises Effective Stress	$S_{eff} = \sqrt{(S_1^2 - S_1 \cdot S_3 + S_3^2)}$	31,837	psi
Allowable Effective Stress	$S_a = F \cdot SMYS$	37,440	psi

3.3 Fatigue Stress Summary

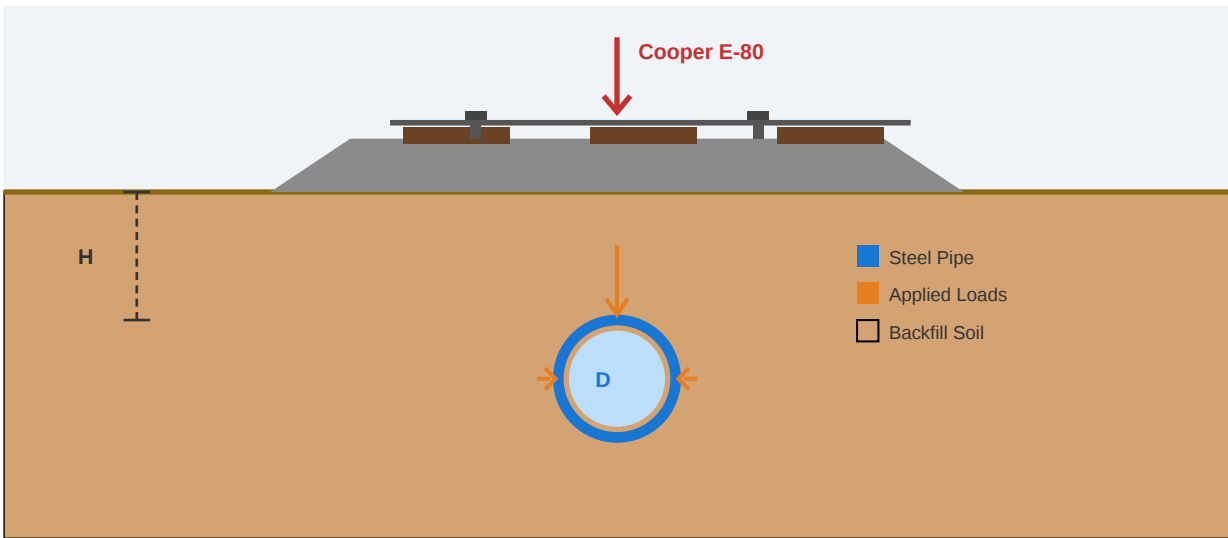
Parameter	Formula	Value	Unit
Girth Weld Cyclic Stress	$\Delta S_{Lr} / N$	6643.28	psi
Girth Weld Allowable	$S_{FG} \cdot F$	8,640	psi
Long. Weld Cyclic Stress	$\Delta S_{Hr} / N$	6482.61	psi
Long. Weld Allowable	$S_{FL} \cdot F$	15,120	psi

4. DESIGN CHECK VERIFICATION

4.1 Design Check Summary

Design Check	Acceptance Criterion	Actual (psi)	Allowable (psi)	Status
Barlow Hoop Stress	$S_{hi} = P \cdot D / (2 \cdot t_w) \leq F \cdot E \cdot \text{SMYS}$	26,667	37,440	PASS
Von Mises Effective Stress	$S_{eff} = \sqrt{(S_1^2 - S_1 \cdot S_3 + S_3^2)} \leq F \cdot \text{SMYS}$	31,837	37,440	PASS
Girth Weld Fatigue	$\Delta S_{Lr} / N \leq S_{FG} \cdot F$	6643.28	8,640	PASS
Longitudinal Weld Fatigue	$\Delta S_{Hr} / N \leq S_{FL} \cdot F$	6482.61	15,120	PASS
Overall Result				PASS

4.2 Cross-Section Diagram — Railroad Crossing



5. CONCLUSIONS AND RECOMMENDATIONS

API RP 1102 Railroad Crossing Analysis — COMPLIANT

All four design checks are satisfied. The pipeline design meets API RP 1102 requirements for railroad crossing.

Construction Recommendations

1. Maintain minimum cover depth of 4.0 ft during construction
2. Use proper backfill material and compaction procedures per API RP 1102
3. All girth welds shall be inspected per applicable standards
4. Monitor pipeline for settlement after construction
5. Conduct post-construction integrity verification