# Buried Pipe Trench Load (Marston Formula)

Earth load on a pipe laid in a trench by the Marston formula, for rigid and flexible pipes, compared with the weight of the soil prism above the pipe.

**Method:** Marston–Spangler trench-condition load theory

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Unit weight of the backfill | 18.800 | kN/m³ |
| Cover depth to the top of the pipe | 3.0000 | m |
| Trench width at the top of the pipe | 1.2000 | m |
| Pipe outside diameter | 600.00 | mm |
| Backfill type (product of Rankine ratio and friction) | Sand and gravel (0.165) | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Load coefficient | 1.7023 | |
| Load on a rigid pipe | 46.085 | kN/m |
| Load on a flexible pipe (soil well compacted at the sides) | 23.043 | kN/m |
| Weight of the soil prism over the pipe | 33.840 | kN/m |

### Notes for this case

• Backfill settling in a trench is held up by friction on the trench walls, so a pipe carries less than the full weight of soil above the trench: W = C_d w B_d², with C_d = (1 − e^(−2Kμ′H/B_d))/(2Kμ′). A rigid pipe takes the load over the trench width; a flexible pipe, with well-compacted soil at its sides sharing the load, takes it over its own diameter. Keep the trench narrow at the top of the pipe: the load grows with the square of the trench width up to the embankment (positive projection) condition.

## Formula and method

The formula is shown on the calculator page: https://calc.firecad.com/mechanical/piping/marston-buried-pipe-load

### Variables

| | | |
|---|---|---|
| $w$ | Unit weight of the backfill | N/m³ |
| $H$ | Cover depth to the top of the pipe | m |
| $B_d$ | Trench width at the top of the pipe | m |
| $B_c$ | Pipe outside diameter | m |
| K\mu' | Backfill type (product of Rankine ratio and friction) | - |
| $C_d$ | Load coefficient | - |
| $W_r$ | Load on a rigid pipe | N/m |
| $W_f$ | Load on a flexible pipe (soil well compacted at the sides) | N/m |
| $W_p$ | Weight of the soil prism over the pipe | N/m |

### Method and standards

Marston load.

### Assumptions and limits

- Trench condition; no live load or surcharge; settled backfill.

### References

Marston–Spangler trench-condition load theory

## Report details

| | |
|---|---|
| Report reference | FCC-PM1A-4ANM (the same inputs always give the same reference) |
| Generated | 23 November 2026, 17:50 UTC |
| Calculator | Buried Pipe Trench Load (Marston Formula) |
| Method last reviewed | 17 November 2026 |
| Software release | FireCAD Calc, release of 22 November 2026 |
| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/mechanical/piping/marston-buried-pipe-load

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.