Moving Loads on a Simple Span: Absolute Maximum Moment and Shear

Absolute maximum bending moment and maximum end shear of a simply supported span under a train of up to four moving point loads, with the critical position.

Method: Influence lines and the absolute maximum moment rule

Input parameters

Unit system: SI

Parameter	Value	Unit
Span	20.000	m
Number of axle loads	3.0000	
Load 1 (leading)	35.000	kN
Load 2	145.00	kN
Load 3	145.00	kN
Load 4	0	kN
Spacing load 1 to 2	4.3000	m
Spacing load 2 to 3	4.3000	m
Spacing load 3 to 4	0	m

Calculated results

Parameter	Value	Unit
Absolute maximum bending moment	1,246.6	kN·m
Position of the critical load from the left support	10.728	m
Critical load number	2.0000	
Maximum end shear (reaction)	278.77	kN

Notes for this case

• For a train of moving point loads the bending moment at a point is greatest with a load at that point, and the absolute maximum occurs under one load when the span's centre line lies midway between that load and the resultant of the loads then on the span. The calculator tries every load and every group of loads that can be on the span, and also each load at midspan. Maximum end shear occurs with a load at the support and the rest of the train on the span. The loads move in either direction; spacings are fixed. Dynamic allowance and lane factors are not included.

Formula and method

$$\bar{x}_c = \frac{L}{2} + \frac{\bar{x}_R - x_k}{2}, \quad M = R_A x_k - \sum_{i<k} P_i (x_k - x_i)$$

Variables

L	Span	m
n	Number of axle loads	-
P_1	Load 1 (leading)	N
P_2	Load 2	N
P_3	Load 3	N
P_4	Load 4	N
a_{12}	Spacing load 1 to 2	m
a_{23}	Spacing load 2 to 3	m

a_{34}	Spacing load 3 to 4	m
M_{max}	Absolute maximum bending moment	N·m
x_c	Position of the critical load from the left support	m
k	Critical load number	-
V_{max}	Maximum end shear (reaction)	N

Method and standards

Moving loads.

Assumptions and limits

- Simply supported span; point loads of fixed spacing; static loads.

References

Influence lines and the absolute maximum moment rule

Report details

Report reference	FCC-DDNF-P9M9 (the same inputs always give the same reference)
Generated	23 November 2026, 18:09 UTC
Calculator	Moving Loads on a Simple Span: Absolute Maximum Moment and Shear
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/civil/steel/influence-line-moving-loads

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.