Inline Design

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MATERIAL PROPERTY:

Stainless Steel 316 (S31600)	Yield Strength 30,000 psi

POSTS PROPERTIES:

Outside Dimension (in)	Inside Dimension (in)	Gauge	S (in^3)
1.57	1.41	14	0.22539
1.57	1.37	12	0.27102
1.57	1.33	11	0.31282
1.57	1.29	10	0.35101

DEFINITION:

Yield strength is defined as the stress at which a material begins to deform plastically.

CALCULATION STRUCTURE:

Handrail, wall rail and guardrail assemblies and attachments shall withstand a minimum concentrated load of 200 pounds applied horizontally or vertically down at any point on the top rail. Infill area of guardrail system shall be capable of withstanding a horizontal concentrated load of 200 pounds applied to one square foot at any point in the system. Applied load is not to act concurrently with loads on top rail of system in determining stress on guardrail. Handrail assemblies and guards shall be designed to resist a load of 50 pounds per linear foot (pound per foot) (0.73 kN/m) applied in any direction at the top, and to transfer this load through the supports to the structure.

In this document, we will apply a uniform load (50 lbs) to the rail, or a concentrated load (200 lbs) to the top of the post itself.

LOAD PROPORTION FACTOR, Pf or D:

End Post	2-Span railing	85%
	3 or more spans	82%
Intermediate Post	2-Span railing	65%
	3 or more spans	60%

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RESULT:

After the calculation, the bending stress should be less than the allowable yield strength of the material. Otherwise, the system is failed.

Symbols on the formulas:

M	Bending Moment
w	Uniform Loading
P	Concentrated Loading
h	Height of Post
L	Post Spacing or Horizontal Span Rail
D	Load Proportion Factor

I. CONCENTRATED LOADING ON END POST:

We applied the concentrated load at a critical point: 42" in height on a two spans railing, using our standard commercial gauge.

Bending Moment:

$$M = D \times P \times h$$

with	D	Load Proportion Factor	85%
	P	Concentrate Load	200 lbs
	h	Post Height	42 in

$$M = 0.85 \times 200 \times 42 = 7140\ lbs - in$$

Bending Stress:

$$\sigma = \frac{M}{S}$$

with	S	Section Modulus	0.35101 in^3

$$\sigma = \frac{7140}{0.35101} = 20341\ psi$$

Comparison:

$$\sigma = 20341\ psi\ < 30000\ (allowable)$$

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II. UNIFORM LOAD ON AN INTERMEDIATE POST:

We recommend 4' max span for 36", and 5' max span for 42"
We applied the uniform load at a critical point: 36" in height on a two spans railing, 5' each span, using our standard commercial gauge.

Bending Moment:

$$M = w \times L \times h$$

with	w	Uniform Load	50 lbs/ft
	L	Post Spacing	5 ft
	h	Post Height	36 in

$$M = 50 \times 5 \times 36 = 9000\ lbs - in$$

Bending Stress:

$$\sigma = \frac{M}{S}$$

with	S	Section Modulus	0.35101 in^3

$$\sigma = \frac{9000}{0.35101} = 25640\ psi$$

Comparison:

$$\sigma = 25640\ psi\ < 30000\ (allowable)$$

CONCLUSION:

The result shows that the bending stress is below the yield strength of the material, in this case stainless steel 316. The posts should be able to handle a concentrated load of 200 lbs or a uniform load of 50 lbs/ft. Testing with our commercial gauge.