

Program: RFEM 5, RF-STEEL AISC

Category: Design Check

Verification Example: 1005 – AISC G.1A - W-Shape in Strong Axis Shear

1005 – AISC G.1A - W-Shape in Strong Axis Shear

Description

An ASTM A992 W 24×62 beam with end shears of 48.000 and 145.000 kips from dead and live load is shown in Figure 1. Verify the available shear strength of the beam selected based on LRFD and ASD, see [1].

Material		Modulus of Elasticity	E	29000.000	ksi
		Yield Strength	F_y	50.000	ksi
		Ultimate Strength	F_u	65.000	ksi
Geometry	Structure	Length	L	20.000	ft
		Depth	d	23.700	in
	Cross-section W 24×62	Web Thickness	t_w	0.430	in
Load		Dead	V_D	48.000	kips
		Live	V_L	145.000	kips

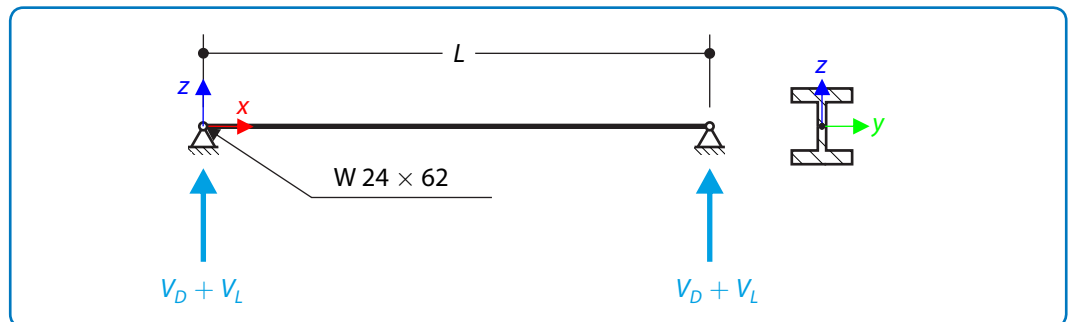


Figure 1: Connection Geometry

1 Nominal Shear Strength

Except for very few sections, which are listed in the User Note, AISC Specification Section G2.1(a) is applicable to the I-shaped beams published in [1] for $F_y = 50.000$ ksi. The W-shape sections that do not meet the criteria of AISC Specification Section G2.1(a) are indicated with subscript “v” in Tables 1-1, 3-2 and 6-2.

$$C_{v1} = 1$$

From AISC Specification Section G2.1, the area of the web A_w is determined as follows

Verification Example: 1005 – AISC G.1A - W-Shape in Strong Axis Shear

$$A_w = dt_w = 10.200 \text{ in}^2 \quad (1005 - 1)$$

From AISC Specification Section G2.1, the nominal shear strength is

$$V_n = 0.6 \cdot F_y \cdot A_w \cdot C_{v1} = 306.000 \text{ kips} \quad (1005 - 2)$$

2 Available Shear Strength

From AISC Specification Section G2.1, the available shear strength is

LRFD	ASD
$\phi_v = 1$ $\phi_v V_n = 306.000 \text{ kips}$	$\Omega_v = 1.5$ $V_n / \Omega_v = 204.000 \text{ kips}$

RFEM 5 Settings

- Modeled in RFEM 5.14.03
- Isotropic linear elastic model is used
- Shear stiffness of members is activated

Results

Design	AISC Solution [kip]	RFEM Solution [kip]	Ratio [-]
LRFD	305.732	306.000	0.999
ASD	203.821	204.000	0.999

Available Shear Strength

Example (Shape)	Design	RFEM Solution [kip]	Analytical Solution [kip]	Ratio [-]
G.1B (W 24×62)	LRFD	305.732	306.000	0.999
	ASD	203.821	204.000	0.999
G.2A (C 15×33.9)	LRFD	116.641	117.000	0.997
	ASD	77.605	77.600	1.000
G.2B (C 15×33.9)	LRFD	116.641	117.000	0.997
	ASD	77.605	77.800	0.998
G.5 (HSS 16×0.375)	LRFD	213.625	213	1.003
	ASD	142.133	142	1.001
G.6 (W 21×48)	LRFD	189.012	189.000	1.000
	ASD	125.757	126.000	0.9981
G.7 (C 9×20)	LRFD	42.553	42.600	0.999
	ASD	28.312	28.300	1.000
*G.8A (Built-up Girder)	LRFD	149.417	149.000	1.003
	ASD	99.412	99.400	1.000

Remark

*Note: The values being verified from Problem G.8A are only the available shear strengths of the beam without stiffeners.

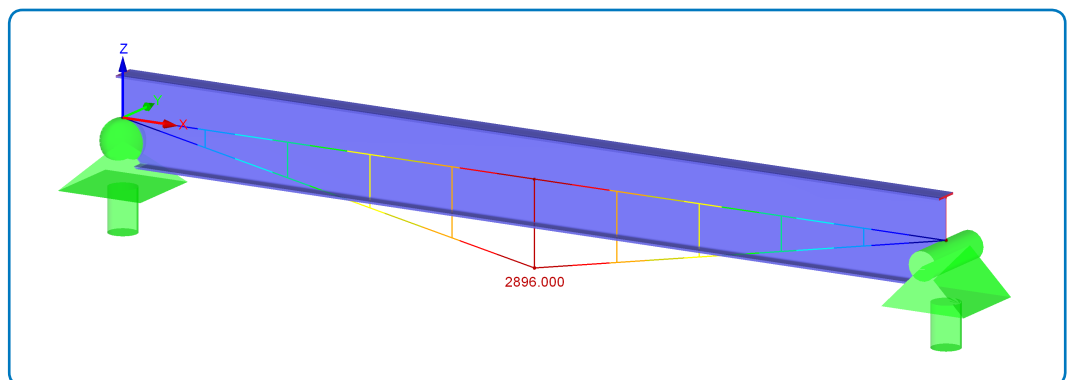


Figure 2: Results - Moment M_y about the y-axis (LRFD)

References

- [1] AMERICAN INSTITUTE OF STEEL CONSTRUCTION, *Specification for Structural Steel Buildings*. 2015.