

Program: RFEM 6, Steel Design Add-on

Category: Design Check

Verification Example: 1033 – W-Shape Shear Design According to AISC

1033 – W-Shape Shear Design According to AISC

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

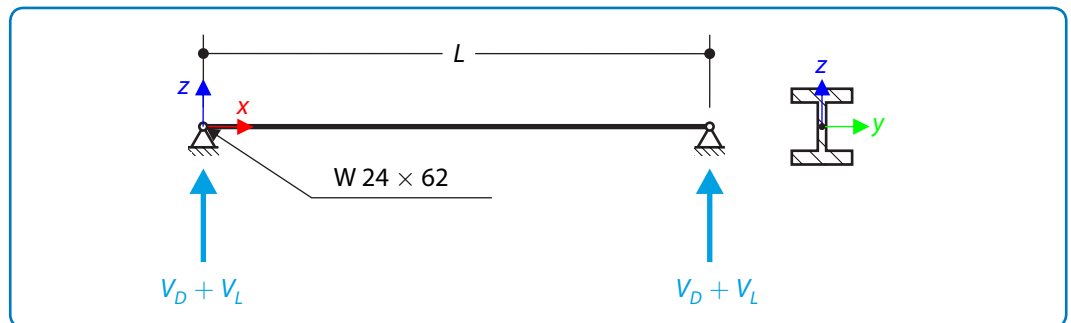


Figure 1: Connection Geometry

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 the AISC 2022 [2] 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.

$$C_{v1} = 1$$

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

$$A_w = dt_w = 10.200 \text{ in}^2 \quad (1033 - 1)$$

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

$$V_n = 0.6 \cdot F_y \cdot A_w \cdot C_{v1} = 306.000 \text{ kips} \quad (1033 - 2)$$

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 6 Settings

- Modeled in RFEM 6.08.0010
- Isotropic linear elastic model is used
- Shear stiffness of members is activated

Results

Design	RFEM Solution [kip]	AISC Solution [kip]	Ratio [-]
LRFD	305.730	306.000	0.999
ASD	203.820	204.000	0.999

Available Shear Strength

Example (Shape)	Design	RFEM Solution [kip]	AISC Solution [kip]	Ratio [-]
G.1B (W 24×62)	LRFD	305.730	306.000	0.999
	ASD	203.820	204.000	0.999
G.2B (C 15×33.9)	LRFD	162.000	162.000	1.000
	ASD	107.784	108.000	0.998
G.5 (HSS 16×0.375)	LRFD	232.200	232.000	0.999
	ASD	154.491	155.000	0.996
G.6 (W 21×48)	LRFD	189.011	189.000	1.000
	ASD	125.756	126.000	0.998
G.7 (C 9×20)	LRFD	59.100	59.100	0.999
	ASD	39.322	39.300	1.000
*G.8A (Built-up Girder)	LRFD	176.088	176.000	1.000
	ASD	117.157	117.000	1.000

Remark

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

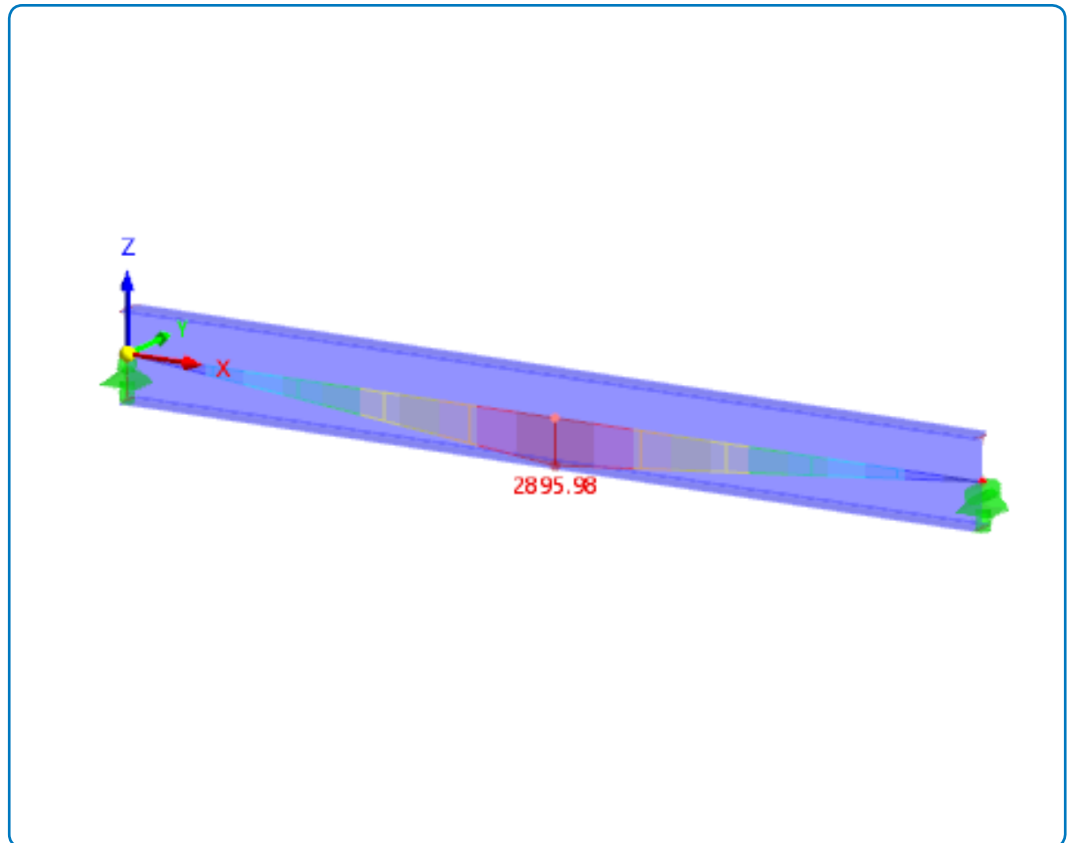


Figure 2: Results - Moment M_y about the y-axis (LRFD)

References

- [1] AMERICAN INSTITUTE OF STEEL CONSTRUCTION, *Design Examples V16 - Companion to the AISC Steel Construction Manual*.
- [2] AMERICAN INSTITUTE OF STEEL CONSTRUCTION, *Specification for Structural Steel Buildings*. 2022.