Parameter	Specification
Beam Specifications	
Total Length	16' (192 inches)
Effective Span	14' 6.25" (174.25 inches)
Beam Dimensions	6" x 12" (width x depth)
Material	Glulam (Glued Laminated Timber)
Material Properties	
Modulus of Elasticity (E)	1.8 x 10^6 psi
Moment of Inertia (I)	1,728 in^4
Load Calculation (psf/plf)	
Live Load (Sun Room)	20 psf / 290 plf
Dead Load (Furniture, Roof)	15 psf / 217.5 plf
Snow Load	30 psf / 435 plf
Total Uniform Load (w)	65 psf / 942.5 plf
Deflection Calculation	
Maximum Deflection (Δ)	0.40 inches

Parameter	Specification
Allowable Deflection	0.48 inches
Conclusion	Beam meets allowable deflection criteria.

GLULAM BEAM DEFLECTION ANALYSIS

1. Beam Specifications:
- **Total Length**: 16' (192 inches)
- **Effective Span**: 14' 6.25" (174.25 inches) - This accounts for the beam being supported on each end by four 2x8 studs.
- **Beam Dimensions**: 6" x 12" (width x depth)
- **Material**: Glulam (Glued Laminated Timber)

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2. Material Properties:
- **Modulus of Elasticity (E)**: 1.8 x 10^6 psi (Typical for glulam, but varies based on grade and manufacturer)
- **Moment of Inertia (I)**: Using the formula $I = \frac{b \times h^3}{12}$, where b is the width (6 inches) and h is the height (12 inches):
$$I = \frac{6 \times 12^3}{12} = 1,728 in^4$$

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3. Load Calculation:
Assuming a relatively low live load for a little-used sunroom, and combining it with the known snow load and estimated dead loads:

Load Type	Value (psf)	Calculated Load (plf)
Live Load (Sun Room)	20 psf (estimated)	290 plf
Dead Load (Furniture, Roof)	15 psf	217.5 plf
Snow Load	30 psf	435 plf
Total Uniform Load (w)	65 psf	**942.5 plf**

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4. Deflection Calculation:

Using the formula for maximum deflection Δ of a simply supported beam with a uniformly distributed load:

$$ \Delta = \frac{5wL^4}{384EI} $$

Substituting in:
$$ \Delta = \frac{5(942.5)(174.25^4)}{384(1.8 x 10^6)(1,728)} $$
Result:
$$ \Delta \approx 0.40 inches $$

Allowable Deflection:
For residential applications, typically L/360:
$$ Allowable \ Delta = \frac{174.25}{360} = 0.48 inches $$

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5. Conclusion:

The calculated deflection of 0.40 inches is within the allowable deflection of 0.48 inches for the glulam beam under the given loads, even when considering the support from the four 2x8 studs on each end. This suggests that the beam should be suitable for the given application.

Shear Capacity:

For glulam beams, the average allowable shear stress, V_{allow}, is approximately $90 psi$ (though this can vary based on wood species, grade, and other factors).

$$ V = V_{allow} \times A $$
Where $ A $ is the cross-sectional area of the beam.

For the glulam beam section (6” x 12”):
$$ A = 6" \times 12" = 72 in^2 $$
$$ V = 90 psi \times 72 in^2 = 6480 lbs $$

This value represents the total shear force the beam can support at its ends when uniformly loaded.

Bending Capacity:

For glulam, an average allowable bending stress, $F_{b, allow}$, might be in the range of $2400 psi$.

$$ M = F_{b, allow} \times S $$
Where $ S $ is the section modulus.

$$ S = \frac{b \times h^2}{6} $$
For the glulam beam:

$$ S = \frac{6" \times (12")^2}{6} = 144 in^3 $$
$$ M = 2400 psi \times 144 in^3 = 345,600 in-lbs or 28,800 ft-lbs $$

Now, let's evaluate if the beam is adequate:

Load Calculation (from previous calculations):
Total Load: 888 plf

1. **Maximum Shear** (at beam supports):
$$ V_{max} = \frac{w \times L}{2} = \frac{888 plf \times 14.52 ft}{2} = 6459.36 lbs $$

2. **Maximum Moment** (at mid-span of beam):
$$ M_{max} = \frac{w \times L^2}{8} = \frac{888 plf \times (14.52 ft)^2}{8} = 18,785.05 ft-lbs $$

Comparison:

Shear:
Given capacity: 6480 lbs
Actual: 6459.36 lbs
The shear is very close to the limit.

Bending:
Given capacity: 28,800 ft-lbs
Actual: 18,785.05 ft-lbs
The beam is adequate for bending.

Summary:

Parameter	Capacity	Actual Load
Shear Capacity (lbs)	6480	6459.36
Bending Capacity (ft-lbs)	28,800	18,785.05

The beam appears to be adequate for bending, but the shear is very close to its capacity.