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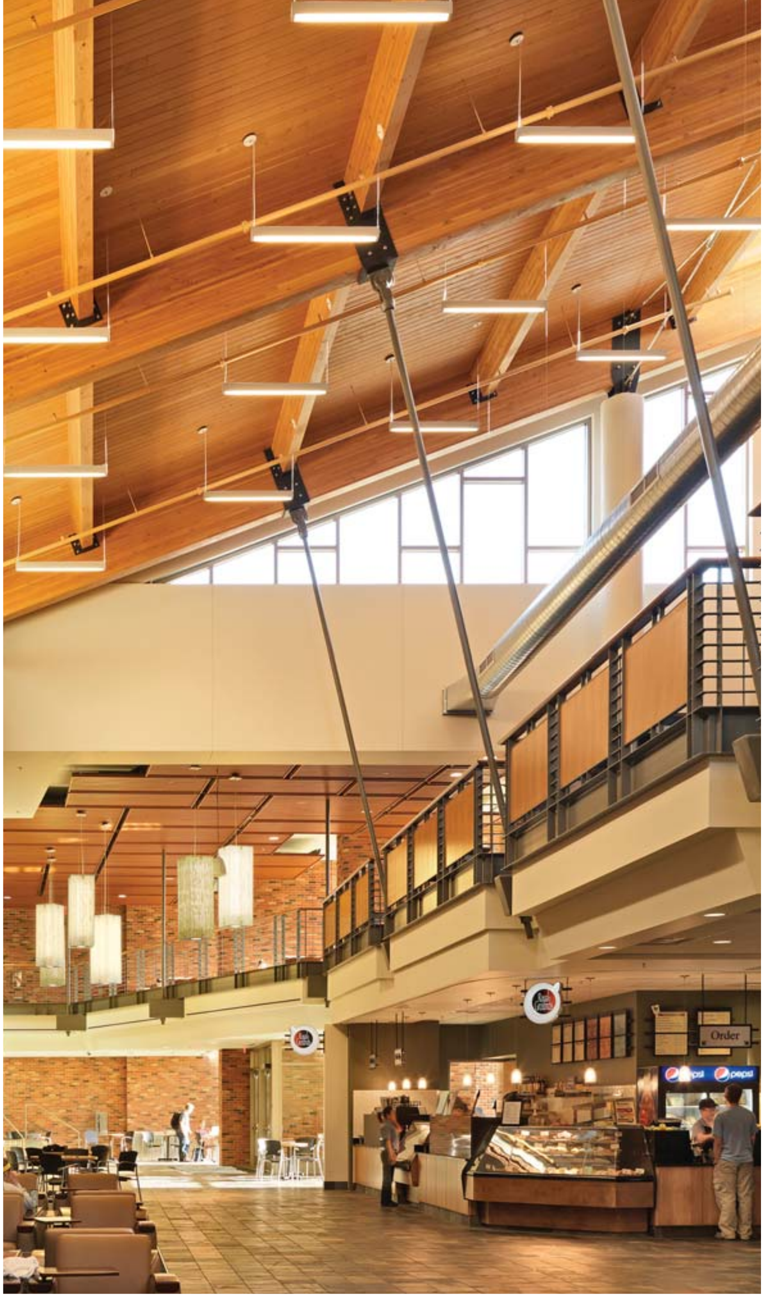
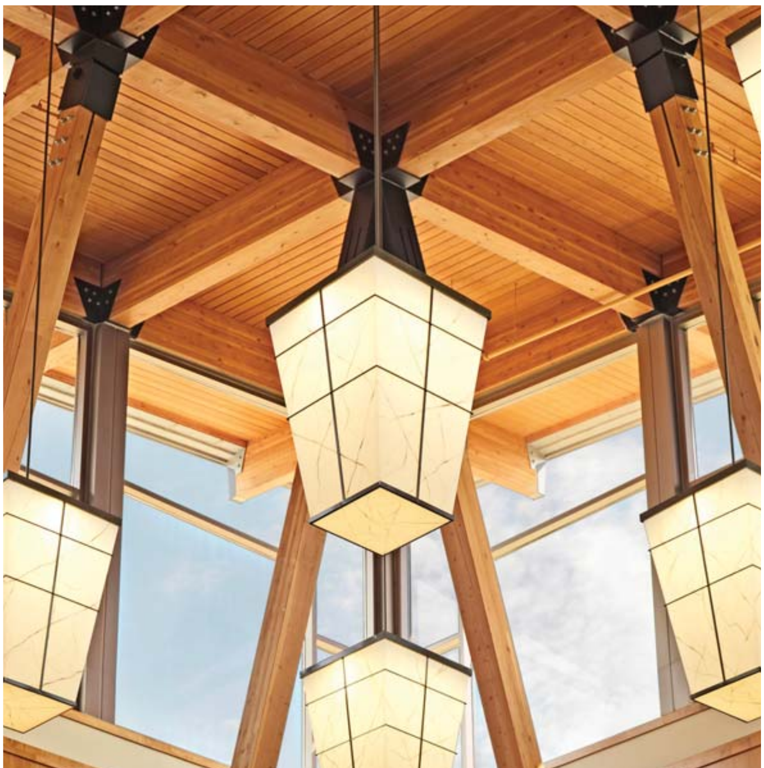


# George K. Brushaber Commons

## Glulam framing and creative engineering produce wood solutions that meet both form and function requirements

**Jason Pederson, Structural Engineer**

*The new 106,000-sq.ft. George K. Brushaber Commons building on Minnesota's Bethel University campus houses student dining, the campus store, an informal performance venue as well as other office, meeting and support spaces relevant to student life.*

Its close proximity to Lake Valentine and its location at the end of a series of inter-connected academic buildings makes the commons a destination for students, faculty, alumni and visitors. It was conceived as, and has become since its opening in March 2009, a living room for students. Many materials were considered for the high volume public spaces with considerable emphasis on budget and constructability.

Ultimately a wood structure comprised of glulam beams, purlins and wood deck was chosen for its warm appeal and timeless aesthetic. The existing adjacent main performance hall also includes a gabled wood roof structure and was an important design reference. Interior brick veneer compliments the wood structure, echos the exterior aesthetic of the majority of existing academic buildings and helps bring the exterior into the main building's lobby.

Glulam wood framing was used in the dining hall and south link areas of the new student commons building. In the dining hall, the slanted glulam columns, or arms, were a major design feature. These elements were required to support both gravity loads and lateral loads of this clerestory space. Wood-clad steel tubes were initially considered for these members, but glulam wood members were ultimately selected for their aesthetic appeal and fire-resistant characteristics.

One challenge of this space included the design of two-way cantilevered roof framing that extended outside of the building envelope. At the south link, the roof framing was constructed between two existing buildings and over an existing underground classroom. The design vision was of a skyway bridge to link these existing facilities with the new student commons. The west edge of the skyway was to be suspended from the roof framing by slanted steel tie rods, so the initial design called for the roof to be framed with steel. However, because a wood aesthetic was desired, glulam wood framing was ultimately chosen. The challenge for this space was to design the wood assembly to support the skyway while mitigating the potential for long-term deflection of the roof due to the weight of the skyway (a phenomenon know as creep).

The goal of the structural design for both the dining hall and south link was to provide a wood solution that met strength, performance, and aesthetic requirements for these unique spaces. Engineering challenges, and their solutions, are summarized below.

**Above** and **below**: Roof framing was constructed between two existing buildings and over an existing underground classroom. It consists of primary glulam wood girders at 20 feet on center that support both secondary glulam beams and a suspended skyway below

### Dining Hall

The roof framing consists of a two-way system of glulam wood beams cantilevering four feet to eight feet outside of a clerestory window space. The system is pitched on the diagonal, which induces a permanent lateral force on the framing elements in addition to wind and gravity loads. A 3D analytical model was created to confirm loads to these elements, and to evaluate whether or not the lateral drift of the system was within acceptable tolerance.

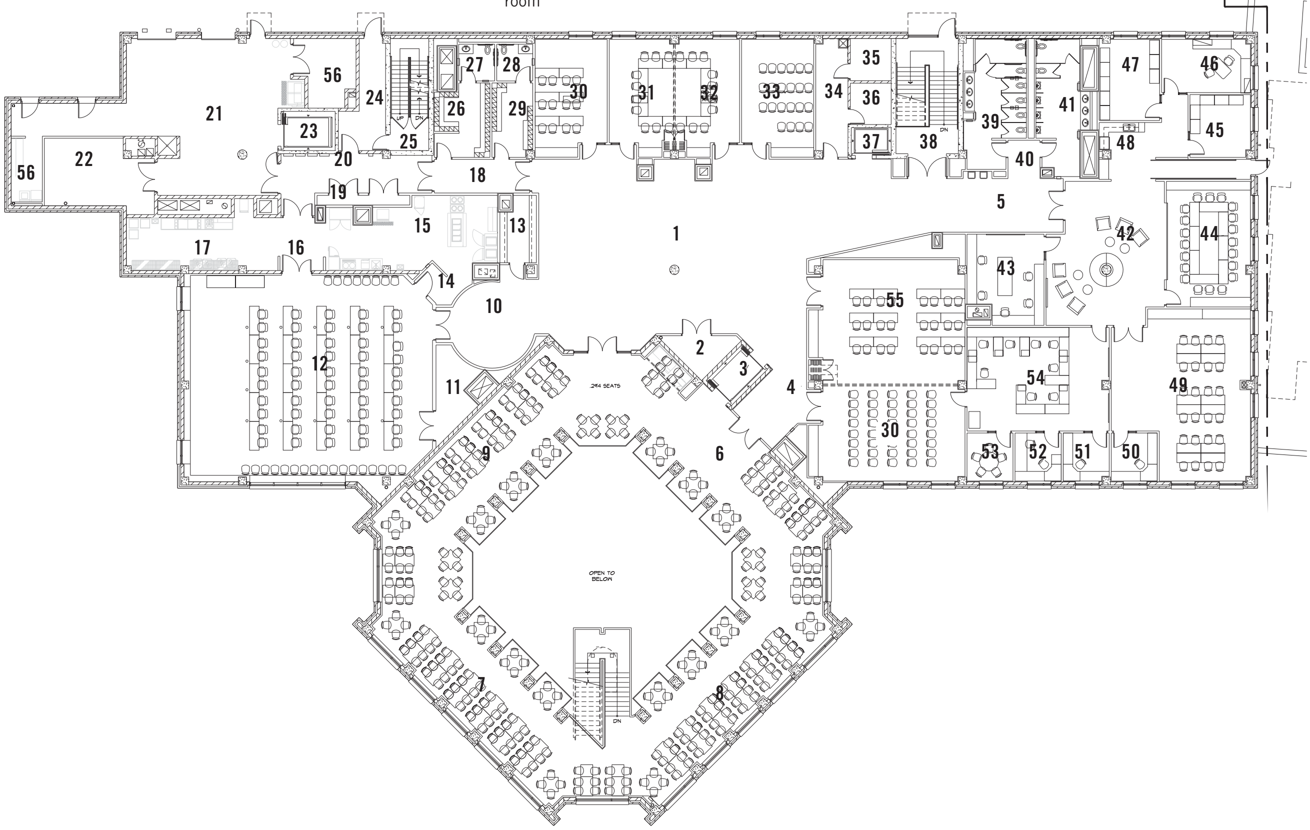
Members were sized for both strength and proportion so that it was not possible to determine the primary framing orientation. The configuration of each exposed connector was carefully coordinated with the architect for symmetry in appearance from each direction. In order to achieve the cantilever in both directions at the corners, a horizontal tube steel ring was added at the roof's outer perimeter and concealed in the flashing system.

Vertical and lateral support of the roof framing is provided by a series of slanted glulam wood columns, or arms, varying from 27 feet to 32 feet in length. In order to minimize bending effects on these elements, a steel pin connector was employed at the top of each member. This approach also aided the erection process as the arms were first connected at the top and then swung into place to connect at the base.

### South Link

The roof framing consists of primary glulam wood girders at 20 feet on center that support both secondary glulam beams and a suspended skyway below. The pitched girders are supported on the east by a concrete-

1. prefunction
2. storage
3. elevator
4. corridor
5. corridor
6. dining
7. dining
8. dining
9. dining
10. rotunda
11. storage
12. board room
13. coats
14. vest
15. warming kitchen
16. hall
17. storage
18. corridor
19. linens
20. corridor
21. receiving/ holding
22. storage
23. elevator
24. vest
25. stair
26. lockers
27. womens
28. mens
29. lockers
30. meeting room
31. meeting room
32. meeting room
33. meeting room
34. jan./storage
35. data
36. electrical
37. elevator
38. stair
39. womens
40. alcove
41. mens
42. student lounge
43. newspaper
44. student conference
45. office storage
46. office
47. office storage
48. kitchen
49. student activities
50. office (opt)
51. office
52. office
53. office
54. bsa offices
55. meeting room
56. laundry



FOURTH FLOOR PLAN

encapsulated steel column and on the west by a new concrete parapet cast over the adjacent building. The girders cantilever 12 feet over the east column, extending outside of the building envelope.

The special geometry of the roof framing, coupled with the need to permanently support the skyway, required careful consideration of load path and erection sequencing. To mitigate the potential for creep under permanent dead loads, the skyway deck was designed to cantilever off of the embedded steel column under its own weight. A load path was developed up the column and down the girder to resolve the lateral load induced by this solution into the new parapet to the west. Once the self-weight was in place, a steel tie-rod was added to the outside edge of the skyway to support a code-prescribed live load of 100 pounds per square foot.

Use of glulam framing at the Brushaber Student Commons demonstrates that creative engineering can support the use of wood solutions that meet the requirements of both form and function. Students who are served by this wonderful facility, now and in the future, will benefit by the environment that the completed wood design has provided.

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