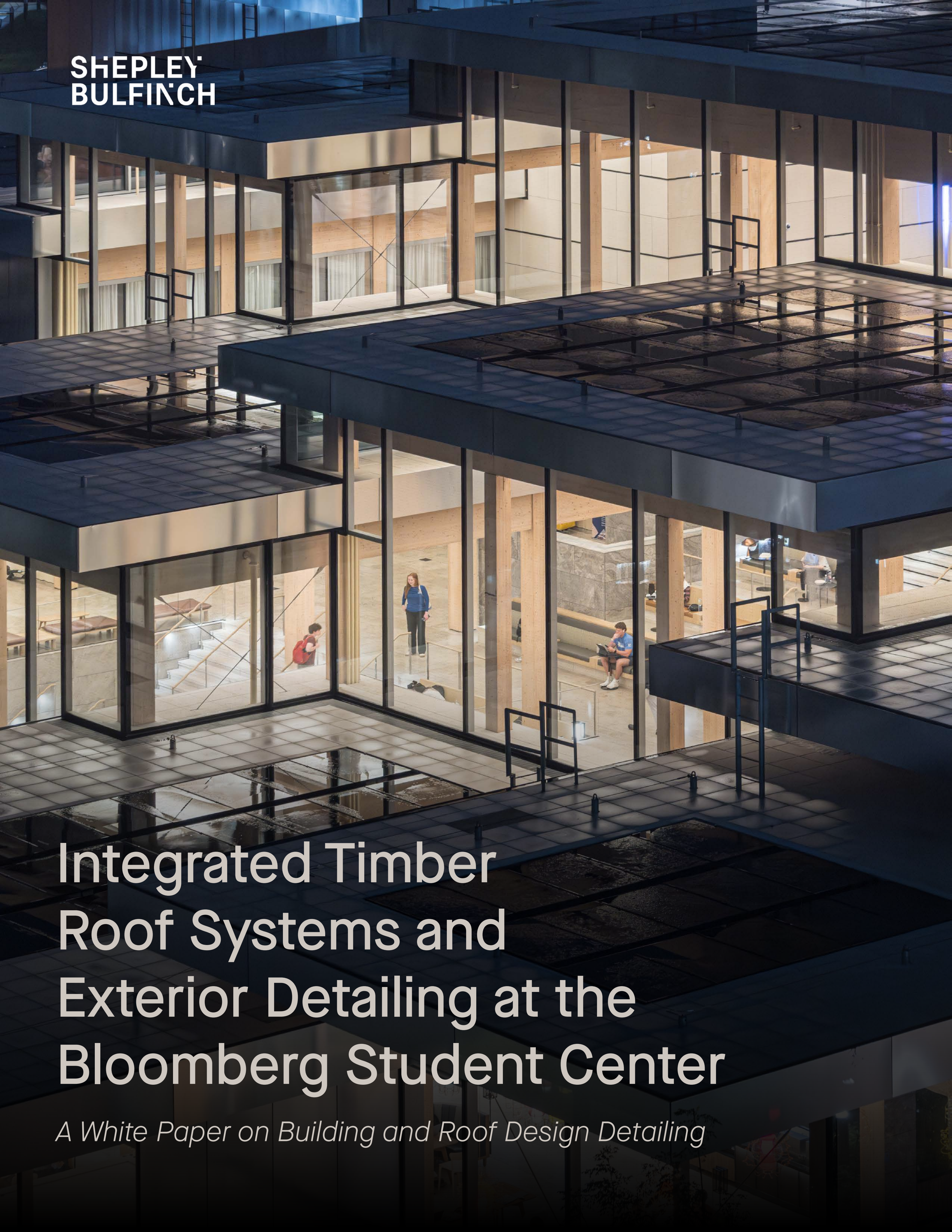
SHEPLEY BULFINCH



Integrated Timber Roof Systems and Exterior Detailing at the Bloomberg Student Center

A White Paper on Building and Roof Design Detailing

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Executive Summary

The Bloomberg Student Center at Johns Hopkins University (JHU) realizes an ambitious architectural vision: a fully integrated, multi-roof timber system that maintains a rigorous visual datum while concealing complex building services. This white paper documents the design intent, technical mandates, innovations, and lessons learned that enabled 29 unique roof planes to read as a unified roofscape, continuing seamlessly from exterior to interior. Key advances include: the selection and acoustic customization of dowel-laminated timber (DLT); the introduction of supplemental weak-axis steel ("oversteel") to enable long cantilevers; a trench infrastructure that hides most electrical and low-voltage systems; a novel air-barrier termination method at timber-to-envelope interfaces; and a robust, low-slope-compatible waterproofing and fascia integration strategy.

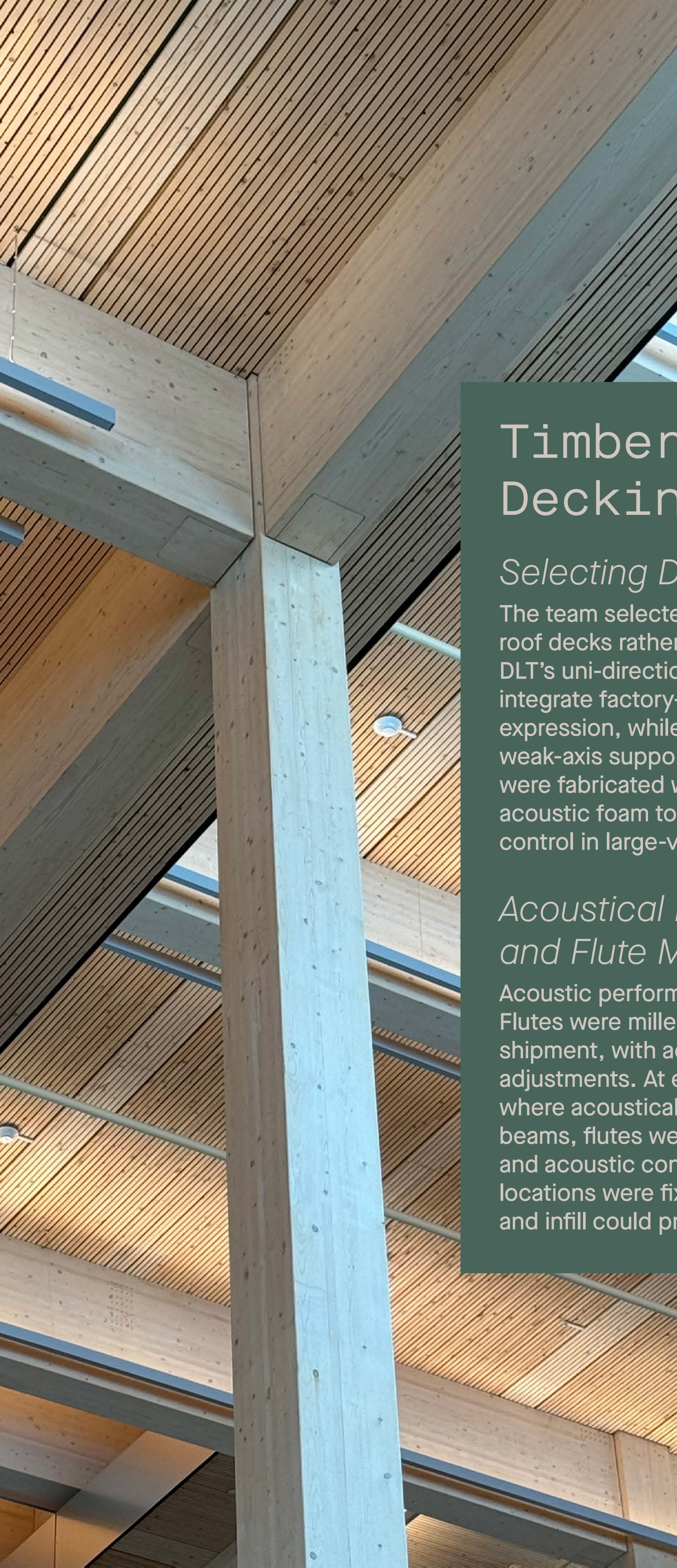
Project Context

Campus and Site Conditions

- 150,000-GSF, four-story student center located on a hilly site in Baltimore, deep excavation of approximately 45 feet was required for the lowest level.
- Each of the four floors attains grade access by working with the natural topography, enhancing universal access and campus connectivity.

Architectural Vision and Team

The project treats the roofs as a continuous surface that passes through clerestory zones to become interior “shelves.” A strict fascia datum governs the top and bottom of the visual edge; rooftop equipment, pavers, and PV arrays are constrained not to exceed fascia height. The delivery model relied on intensive, multinational design assist from Shepley Bulfinch (executive architect), Bjarke Ingels Group (design architect) StructureCraft (timber), Lindner (curtain wall), Knippers Helbig (structural and exterior envelope consultant), WJE (enclosure) and others, coordinated in Revit/Rhino with weekly cross-continental working sessions.



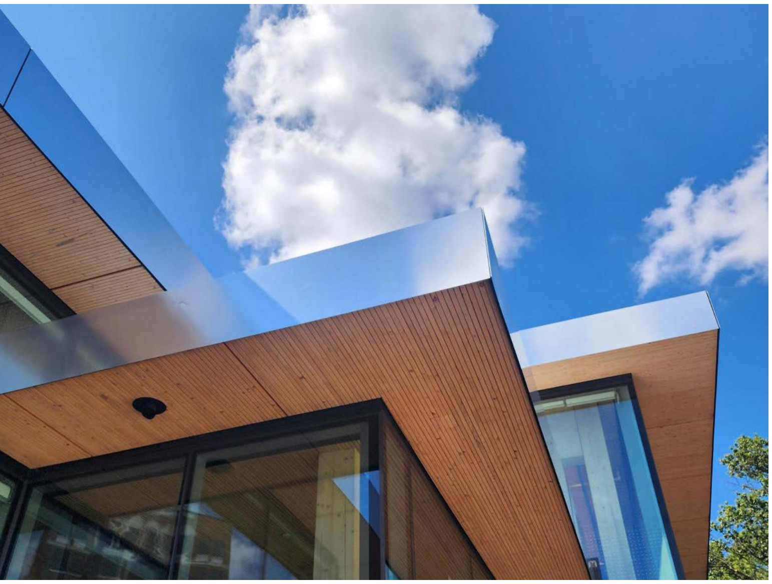
Timber Roof & Decking System

Selecting DLT over CLT

The team selected dowel-laminated timber (DLT) for the roof decks rather than cross-laminated timber (CLT). DLT's uni-directional lamellae offered the opportunity to integrate factory-routed acoustic flutes and a refined ceiling expression, while acknowledging the need for supplemental weak-axis support where cantilevers occur. The DLT panels were fabricated with routed voids subsequently infilled with acoustic foam to deliver significant acoustic reverberation control in large-volume spaces.

Acoustical Decking and Flute Management

Acoustic performance depended on precise coordination. Flutes were milled in the factory and infilled prior to shipment, with additional stock available for field adjustments. At exterior–interior transitions, and at locations where acoustically rated partitions intersect the deck or beams, flutes were stopped or infilled to maintain both fire and acoustic continuity. Early in design development, wall locations were fixed to tight tolerances so factory routing and infill could proceed without rework.



Overhangs and Oversteel

Because DLT provides strong capacity along the lamination axis but limited transverse capacity, weak-axis cantilevers required steel support members—oversteel. These elements were introduced after fascia heights were already established, triggering iterative re-calculation of slopes, insulation thickness, drain locations, and local deck thicknesses on a roof-by-roof basis.

Roof Typologies and Design Mandates

The roofscape comprises 29 distinct roofs. Each varies in size, drainage strategy, insulation build-up, and local structure, yet all adhere to common visual rules. The top of fascia aligns with the plane of roof pavers and PV; the bottom of fascia aligns with the underside of interior DLT flute bottoms; and paver joints align in plan across clearstories to reinforce the perception of a continuous surface. Interior shelf zones use an open mesh support, allowing broad cable pathways while keeping the finished surface flush with exterior pavers.

Hidden Infrastructure Systems

The Trench System

To preserve the clarity of the exposed timber ceiling, the team developed a system of longitudinal trenches located at DLT panel joints. Typically spaced at approximately seven feet (panel width), these widened zones house both line-voltage and low-voltage systems with physical separation. Type X gypsum boards was used in two layers, enabling rating of the DLT deck across trenches. Removable wood covers, color-matched to the timber with grooves to match the DLT acoustic fluting, maintain a unified appearance. In the final ceilings, only fire sprinkler piping remains visible.

Device Layout and Routing Logic

Each of the 29 roofs were documented with enlarged reflected ceiling and roof plans locating luminaires, occupancy sensors, smoke detectors, wireless access points, and shade power feeds relative to the trenches. Wiring strategies leveraged flutes for short runs, crossed beams at predetermined pockets, and then dropped into the trenches for long runs to vertical chases. Perimeter mini-trenches fed exterior shades through curtain wall mullions with strategic high/low-voltage separation.

Air Barrier and Membrane Integration

Airtightness at Timber-to-Envelope Interfaces

A key innovation enabled air-tight continuity at the head of curtain walls and metal panels below DLT decks. Between each timber board, factory-drilled vertical holes were introduced on both sides of the envelope line. In the factory, a silicone air-barrier sealant was injected to bond between boards and form an effective air seal; an additional bead on top of the partition line and the overlaying plywood diaphragm completed the assembly. Deflection heads and an extruded silicone bellow allowed for the inherent movement of the timber structure while maintaining continuity from the wall to the DLT deck.

Waterproofing Strategy and Fascia Integration

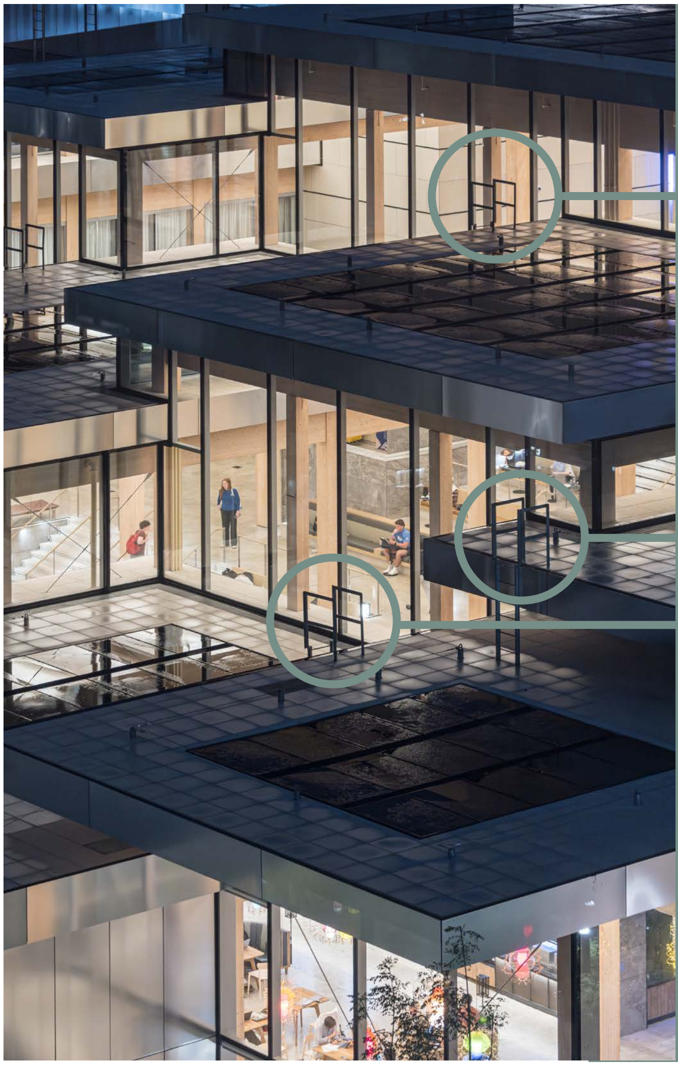
Given the low-slope mandates and tight fascia datum, a hot rubberized asphalt (HRA) system was adopted for primary waterproofing, paired with liquid-applied flashing to transition over the timber curb and onto the backside of the aluminum fascia. Insulation buildups varied by roof to resolve drain locations and oversteel interferences. A continuous timber curb supports the metal fascia, which protects the vulnerable DLT end grain, while weeps at fascia low points provide pressure moderation and drainage redundancy.

Overhangs, Shading, and Exterior Performance

Exaggerated overhangs mitigate solar gain on a highly glazed envelope while celebrating the timber soffits. To meet code requirements for protecting overhangs exceeding four feet in depth, exterior dry-pipe sprinklers were routed above insulation and around steel, a process that required precise penetrations and careful sequencing.
All exterior glazing incorporates bird-friendly frit. PV arrays were originally designed for angled mounting but ultimately installed flat to remain within fascia height and accommodate the compound roof drainage geometries and support tolerances.

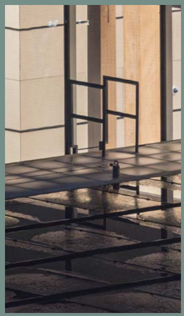
Mechanical Wells and Equipment Integration

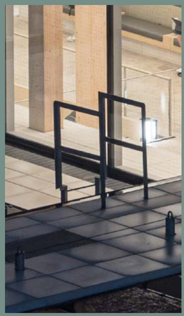
Five recessed mechanical wells consolidate rooftop equipment out of sight: four smaller smoke-exhaust wells and one large well with stair access from the interior. Most wells are formed within concrete cores; one uses a steel-framed, light-gauge deck. Grated tops align with roof pavers, allowing top-down maintenance access without disturbing the roof datum.



Maintenance and Access Strategy

For maintenance personnel, the 29-roof network is navigated by ladders, with required tie-offs, rather than by parapet rails or direct doors. Windows at clearstories are serviced from roofs; some upper surfaces require man-lifts from grade. The owner prioritized the purity of the fascia/roof datum and concealed equipment over conventional serviceability, within code allowances.





Construction Coordination and Design Assist

The project's success hinged on an extended, multinational design-assist process with weekly workshops among Shepley Bulfinch, StructureCraft (Vancouver), Lindner (Germany), Knippers Helbig, WJE, and BIG. Every unique edge and junction was modeled in Revit and Rhino, often in 3D, to standardize details where possible and isolate true one-off conditions. Early locking of wall and partition locations, penetrations through glulam, and device layouts minimized field rework but demanded an unusually high level of decisiveness in design development.

Key Lessons Learned

- For DLT decking,commit early to envelope head details when mass timber is factory-processed; late changes ripple across routing, infill, and membrane tie-ins.
- If DLT is selected for its acoustic and aesthetic merits, anticipate weak-axis reinforcement and plan roof slopes and drains to dodge added steel.
- Standardize a trench module that suits the densest program area; then apply it broadly to simplify coordination and future access.
- Use electronic leak detection (ELD) on complex, overburdened roofs to de-risk commissioning and long-term performance.
- Model and review every condition in 3D—inside and out—to catch edge cases created by compounding constraints (fascia datum, PV height, drains, oversteel).

Conclusion

The Bloomberg Student Center demonstrates how a high-performance, multi-roof timber system can achieve exacting visual goals without sacrificing building performance, physics, or lifecycle reliability. Through rigorous coordination and targeted innovation—from concealed trenches to novel air-barrier terminations—the team delivered an integrated roofscape that advances best practices for mass timber and complex envelopes alike.