Consortium Name: **Pacific Northwest Mass Timber Tech Hub**
Geographic Boundaries: Oregon and Washington, Idaho, Montana, and Colorado
Selected Core Technology Area(s): #10 - Advanced materials science, including composites 2D materials, other next-generation materials, and related manufacturing technologies, and #4 - Natural and anthropogenic disaster prevention or mitigation.
Sector Introduction: Since 2015 the Pacific Northwest region (PNW) has been a leader in the emerging field of mass timber design, manufacturing, and construction. Mass timber products consist of lumber, wood-veneer, or strand elements, fastened together to form large panels and other major structural building elements that, in many cases, can replace concrete and steel. Their large size, combined with factory prefabrication using advanced computer-controlled technologies, allows for very rapid construction with minimal waste, and enhances fire resistance. Perhaps most importantly, they are manufactured from a renewable resource and have low embodied energy compared to concrete and steel, resulting in buildings with much lower carbon footprints. Ten years ago, there were fewer than 10 mass timber buildings in the United States: today there are over 1,860 structures in design, construction or completed in all 50 states, and this figure is growing at around 25% per year.[i]

EDA recognized early the potential of mass timber in the PNW, with the 2015 award of an Investing in Manufacturing Communities Partnership (IMCP) designation to Oregon and SW Washington. This catalyzed developments, notably investment in the first certified US manufacturing facility for cross-laminated-timber panels (CLT) in southern Oregon, a USDA Tall Wood Prize award to a Portland building project, Framework, and the construction in Portland of Carbon 12, which was the tallest wood building in the U.S. until 2022. Oregon State University (OSU) used an EDA Build to Scale grant (2016) to fund critical R&D work enabling several Oregon mass timber buildings to receive permits, informing updates to Oregon's building code, and supporting R&D that resulted in a $40M manufacturing facility investment by Freres Engineered Wood in Lyons, Oregon. Simultaneously, industry in Washington built many pioneering mass timber buildings, and two CLT factories were opened in 2018 and 2019 with technical assistance from Washington State University (WSU).

In 2022 the Oregon Mass Timber Coalition (OMTC), consisting of OSU, University of Oregon (UO), Port of Portland, Oregon Dept of Forestry, Business Oregon and Oregon Dept of Land Conservation & Development, received a $41.4M EDA Build Back Better Regional Challenge (BBB-RC) award, which is funding lab facility construction, a mass timber housing innovation campus, forestry research, workforce development, housing design and testing, and code and zoning outreach to municipalities. In 2023, UO led a bistate OR/WA effort that secured an inaugural $1M Type 1 National Science Foundation Regional Innovation Engines (NSF-RIE) award that will fund a comprehensive analysis and stakeholder engagement process to create a strategic blueprint for a regional mass timber R&D ecosystem.

With this early start, the expertise of architectural, engineering and construction (AEC) firms in WA and OR is in high demand across the US, and over half of the nation's manufacturing and fabrication capacity resides in the region[ii]. Based on public and private investments to date, **we believe the PNW can become a globally competitive cluster of mass timber manufacturing and design within ten years**. Tech Hub designation will be a critical tool in achieving this vision. Building on the work of the BBRC and NSF-RIE, we propose to create a vehicle to deploy the resources to enable sustained growth and development of the mass timber sector by:

1. Expanding the successful Oregon Mass Timber Coalition fully to WA; while building and strengthening strategic partnerships in MT, ID and CO.
2. Leveraging the excellent R&D infrastructure offered by anchor R&D facilities (OSU, UO, WSU) to create a lab-to-market innovation program that connects R&D to industry and entrepreneurial development expertise.
3. Creating a public/private forum for solutions to regulatory and market barriers that can be addressed through policy changes, legislation and/or incentives, and connects producers with sources of private capital.
4. Developing scalable supply chain strategies to provide a steady flow of sustainable wood products to support the growing mass timber industry.
5. Building on BBB-RC outcomes to further increase supply of workforce housing.
6. Expanding workforce/talent development pipelines to support greater and inclusive access to training across the supply chain in rural and urban communities.
7. Connecting rural and urban underserved communities through education of shared interests in sustainable forestry management, wildfire reduction, expanded markets for mass timber manufacturing and mass timber design and construction.

Key Designation Factors

1. Technology-based potential of the region for global competitiveness;

The PNW is the prime location for a world-class manufacturing cluster in mass timber. Heavily-forested[iii], Oregon and WA are the #1 and #2 producers of lumber nationwide[iv]. The states' AEC firms are highly experienced with mass timber, with 16% of U.S. mass timber projects located in the two states[v]; since 2016, Portland has hosted the industry's largest annual international conference. The TallWood Design Institute (TDI), an R&D and education partnership between OSU and UO launched in 2015, has produced over 100 research projects on mass timber, on topics spanning seismic and fire resilience, durability, energy efficiency, acoustics, adhesives, carbon/lifecycle impacts and affordable housing and retrofit solutions. TDI's outreach activities provide the AEC and manufacturing communities with a rich knowledge base on mass timber, with an industry networking group of 1,000 members. WSU's Composite Materials and Engineering Center (CMEC) is an interdisciplinary research facility that has received international acclaim over five decades of collaboration with industry, government, and other universities. OSU and WSU have worked extensively with the wood products industry to develop and test new products, including the CLT facility and Freres' Mass Ply facility noted above, and with Boise Cascade to design its new Veneer Laminated Timber product. WSU provided critical R&D support for the Mercer CLT plant in Spokane.

The PNW's first generation of mass timber buildings have served as fertile sources of technical knowledge. The 2015 USDA Tall Wood Prize spawned a series of tests that informed the design of many other buildings and enabled their permitting. OSU's own Peavy Forest Science Center was the first U.S. building to utilize an innovative CLT "rocking wall" system that enables it to be rapidly put back into service following a major seismic event. First Tech Credit Union, a 5-story office building in Hillsboro, OR, demonstrated that mass timber could be constructed at lower cost than an equivalent steel building. Woodland, WA-based machinery manufacturer USNR is supplying US mass timber producers with hydraulic presses in an industry dominated until now by European suppliers. Portland firm CutMyTimber has

pioneered the use of industrial robots for mass timber beam fabrication, while general contractor Swinerton Builders developed a robotic screw-inserting machine to speed up building assembly. A well-funded startup, Timber HP, plans to locate a major wood fiber insulation plant in the PNW which will manufacture products that are cheaper and more sustainable than standard fiberglass materials. OSU's Collaborative Robotics and Intelligent Systems (CoRIS) Institute and an NSF-RIE on semiconductors will facilitate R&D to integrate smart home systems into mass timber buildings. Mass timber products are still in their infancy in terms of their technological evolution and, given the region's wood products R&D expertise, this Hub is ideally positioned to lead future innovation and foster US competitiveness.

2. Role of the private sector);

The Tech Hub will be steered by a governing body that includes the private sector, R-1 universities, and public agencies, who will collaborate to build on the work of the NSF-RIE to identify barriers, challenges, and opportunities for the region's mass timber sector and to propose and design programs to address them. An advisory board consisting of key stakeholders will further guide and advise the Tech Hub partners.

TDI has a solid track record of working collaboratively with industry. Annual grants/appropriations received from the USDA Agricultural Research Service fund an internal call for proposals to researchers, which are ranked by a committee of AEC professionals, manufacturers, and other private-sector experts to ensure research has maximum impact on marketplace challenges and opportunities. In 2021 TDI established a consortium for Research on Architecture, Engineering and Construction of Timber Structures (REACTS). 18 firms contribute to a research fund and oversee an R&D program of benefit to the group and industry at large. Our philosophy for the Tech Hub is that the member institutions and public agencies should serve as facilitators and executors, leveraging our respective expertise, capabilities, and mandates, but should take direction from industry about the kinds of activities and programs needed to strengthen the supply chain, attract and increase capital investment, secure sustainable material sources, attract and train skilled workers, and maximize competitiveness.

3. Regional coordination & partnerships;

The PNW Mass Timber Tech Hub will undertake the Hub activities described above, and coordinate with complementary projects and initiatives. These include the OMTC, the NSF-RIE Development award to advance mass timber technologies, Oregon's planned Center for Innovation Excellence in Mass Timber Housing, the REACTS Consortium, new state-federal forestry partnerships to provide more consistent fiber supply, and the myriad other research, workforce development and private investment activities ongoing within the region. There has already been robust communication and coordination among these groups; the Tech Hub will formalize these linkages, providing an overarching administrative and communications framework to engage industry and capital investment entities to grow the sector. OSU/UO will serve as the lead coordinating organization for activities in OR, while WSU will coordinate WA activities. A regional innovation officer (RIO), based at OSU, will manage the Tech Hub, supported by two program officers with responsibility for admin/finance and communications.

4. Equity & diversity;

Diversity, equity and inclusion considerations have been cornerstone elements of the OMTC and NSF-RIE. The mass timber sector faces many challenges; construction labor shortages, an aging and shrinking logging workforce, and difficulties for mass timber manufacturers in

attracting and retaining young skilled workers in rural communities. This presents an opportunity to diversify the workforce, highlighting career opportunities to those who have not traditionally considered them. To ensure new jobs and workforce training are accessible to diverse workers and stakeholders, the OMTC established an Equity Oversight Committee, with representatives from underserved community-based organizations, to provide guidance and oversee key decisions. At the universities there is strong commitment to DEI; for example, OSU's Office of Institutional Diversity (OID) and its College of Forestry's own DEI efforts organized by the Associate Dean for Inclusive Excellence and Director of Tribal Initiatives, and UO's Center on Diversity and Inclusion. In designing its NSF-RIE project, UO included a series of Change Labs, a participative, inclusive approach to making progress on complex social challenges[vi]. Lessons learned from the Change Labs will inform the creation of the NSF- RIE ecosystem blueprint. The Tech Hub will be a beneficiary of all of these resources. Mass timber initiatives bridge the divide between urban residents and the rural communities that have been economically disadvantaged by mill closures for decades. The involvement of community-based organizations will extend the reach of our activities to both urban and rural low-income individuals and communities of color, who are disproportionately affected by the housing crisis, and natural disasters. Multicultural engagement will allow diverse community members increased access to training and employment in the forestry, manufacturing, and construction trades. When contracting with private industry, the Tech Hub will ensure work scopes include consultation with CBOs, Tribes, and potentially impacted residents and communities.

5. Composition and capacity of the regional workforce;

Employment in the forest sector has sharply declined in the last 40 years; in OR and WA, combined jobs in the timber industries have fallen from around 148K to 54K today.[vii] With the projected growth of the mass timber industry, a 2017 analysis[viii] indicated that mass timber manufacturing could stimulate the creation of 2K -6K direct jobs and 5,800 to 17,300 indirect jobs in forestry, manufacturing, design, and construction in OR alone. However, a 2020 study by TDI and Business Oregon[ix] found that inadequate access to skilled workers was a major constraint to growth of Oregon's mass timber industry, prompting the current workforce development project funded by BBB-RC. Mass timber manufacturing requires new skill sets such as computer-numerical-control (CNC) manufacturing and fabrication and rigorous attention to quality management and control systems. The downstream AEC disciplines require new detailed knowledge and understanding of mass timber performance (seismic and fire resilience, durability, acoustics, connection methods, code implications). Industry and professional education programs are becoming available on a limited basis, but to move the industry from niche to mainstream, a much larger effort is needed.

The Tech Hub will foster the creation of new, high-wage job opportunities across design, construction, forestry, and manufacturing that meet emergent needs as the ecosystem expands. We envision the following critical aspects of our workforce development efforts: (1) use of research-based methodologies to understand and adaptively address workforce needs, (2) curriculum development and implementation based on evidence-based practices[x], (3) integration of future tech in education and workforce development curricula, (4) implementation of equitable and inclusive educational programs[xi] and learning ecosystems, (5) flexibility of workforce development programs to enhance broad adoption, and, (6) engagement with elected officials and policymakers to elevate the importance of advanced

manufacturing, smart forestry, and construction within their workforce priorities. We will identify and engage relevant community-based organizations, workforce development boards, and professional trade organizations to participate in strategic activities to ensure diverse voices are included in the co-production of solutions.

6. Innovative "lab to market" approaches;

The Tech Hub will build on previous successful lab-to-market initiatives by providing a robust innovation ecosystem that links entrepreneurs to R&D and targeted resources. The close association of industry and university R&D in the PNW mass timber sector has already resulted in direct and indirect translations of innovations to market applications, such as those noted above. The work of the NSF-RIE will identify private sector needs and structural barriers to growth. The Tech Hub will identify and deploy targeted solutions and resources, including capital financing, workforce training and incubators for new start-ups, to speed commercialization, working with community partners to attract investments in rural communities close to the fiber supply and to urban communities with large scale fabrication and construction opportunities.

7. Impact on economic and national security of the United States;

Many of the PNW's challenges are mirrored across the country and threaten national economic security. Lack of housing and spiraling home prices have reached a crisis point in both rural and urban communities. Climate change is causing widespread drought, flooding, heat domes, and catastrophic wildfires, resulting in staggering health, human safety, and economic impacts. A widening urban-rural divide erodes social cohesion. The built environment is responsible for 47% of global carbon emissions, with 20% coming from building materials and construction. Using mass timber products reduces our nation's carbon footprint, while improving forest health by using wood fiber from restoration projects involving selective harvesting of small diameter trees. This reduces wildfire risk and creates commercial markets for lower-value timber. Mass timber lends itself readily to prefabrication. Its application in modular factory-built housing has the potential to address housing supply and affordability challenges while creating jobs along the supply chain, from forests to mills to factories and construction sites. Modular mass timber structures can be rapidly deployed into disaster zones to replace buildings lost to fire, floods, or earthquakes. While the market for mass timber has grown rapidly in the U.S., domestic manufacturers are facing stiff competition from more experienced European producers. The recently completed 25-story Ascent building in Milwaukee, WI is now the tallest hybrid mass timber building in the world, but the mass timber was sourced from Europe. Investment in the Pacific Northwest Mass Timber Tech Hub will strengthen U.S. competitiveness for these carbon-storing products, increasing our capacity to reduce greenhouse gas emissions, mitigate climate change effects, and provide economic development benefits along the supply chain.

Designation Geographic Constraints that the Consortium might meet*:* The Tech Hub will be located principally in the region covered by the Seattle Regional Office, but planned partners in Colorado and Montana sit outside the region. Our Hub will benefit both urban and rural communities. We have proposed partners in Montana and Idaho, both EPSCoR states. Our housing-focused activities will, in particular, benefit underserved urban communities (particularly in cities such as Portland and Seattle) burdened by affordability and supply challenges.

Appendix of Citations

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[iv] Daniels, J. M., Wendel, K. (2020). Production, Prices, Employment, and Trade in Northwest Forest Industries: 1958-2019. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. URL: https://www.fs.usda.gov/pnw/pnw-datasets/ppet. Accessed 08/01/2023

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