

STATE AGENCY OUTREACH FOR INCREASED UTILIZATION OF INNOVATIVE WOOD PRODUCTS

Prepared for:



Prepared by:



April 29, 2024
Draft Final Report Section

TABLE OF CONTENTS

INTRODUCTION	4
POTENTIAL FOR UTILIZATION OF IWP BY STATE AGENCIES.....	4
STATE AGENCY OUTREACH.....	6
POLICIES AND PROCEDURES: AGENCIES.....	7
INVOLVED WITH CONSTRUCTION AND MAINTENANCE	7
DEPARTMENT OF GENERAL SERVICES	7
CALIFORNIA DEPARTMENT OF TRANSPORTATION	9
CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION.....	10
POLICIES AND PROCEDURES:.....	11
AGENCIES ADMINISTERING GRANT AND LOAN PROGRAMS.....	11
STRATEGIC GROWTH COUNCIL.....	11
CALIFORNIA ENERGY COMMISSION.....	11
CODES, STANDARDS, AND REGULATORY MANDATES.....	12
DEPARTMENT OF GENERAL SERVICES - DIVISION OF THE STATE ARCHITECT	12
CALIFORNIA BUILDING STANDARDS COMMISSION	13
OFFICE OF THE STATE FIRE MARSHAL.....	14
CALIFORNIA AIR RESOURCES BOARD.....	14
SUMMARY OF AGENCY PROCUREMENT PROCEDURES.....	16
RECOMMENDATIONS	17
ACCOUNT FOR CARBON BENEFITS OF IWP IN PROCUREMENT DECISIONS.....	17
SUPPORT CONTINUED IWP RESEARCH	17
ENCOURAGE CONTINUING EDUCATION	17
REQUIRE USE OF IWP IN PROJECTS FUNDED BY STATE GRANT PROGRAMS.....	18
MODIFY TITLE 24 CLT AND GLULAM INSPECTION REQUIREMENTS.....	18
ISSUE IWP FOCUSED EXECUTIVE ORDER	18
CONSIDER IWP COLLABORATIVE INITIATIVE.....	18
ATTRACT MT/CLT PRODUCERS.....	19
STATE AGENCY OUTREACH COORDINATOR	19
CONDUCT REVIEW OF STATE POLICIES REGARDING IWP AT FIVE-YEAR INTERVALS.....	19

LIST OF FIGURES

Figure 1. DGS Staff Response Regarding Use of IWP.....	8
Figure 2. DGS Staff Response Regarding Considering Use of IWP.....	8

LIST OF APPENDICES

Appendix A. Board of Forestry Letter of Introduction

Appendix B. Draft Executive Order

List of Abbreviations

Agencies

DGS	Department of General Services
DSA	Division of State Architect
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CARB	California Air Resources Board
HCD	Department of Housing and Community Development
OPR	Office of Planning and Research
CBSC	California Buildings and Standards Commission
CEC	California Energy Commission
OSFM	Office of State Fire Marshal
SGC	Strategic Growth Council

Other Terms

CLT	Cross Laminated Timber
IWP	Innovative Wood Products
EO	Executive Order
TSS	TSS Consultants
IBI	International Biochar Initiative
CMU	Low Carbon Masonry Unit
AHSU	Affordable Housing and Sustainable Communities Program
BUILD	Building Initiative for Low Emissions Development
GHG	Greenhouse Gas Emissions

INTRODUCTION

This report describes findings generated from review of existing California state agency procedures for selection/procurement of innovative wood products (IWP). The report is based on outreach to state agencies, targeting specific staff (both technical and executive level) with responsibility for product testing and selection as well as review of pertinent publications and websites. The objectives of this review included: 1) providing descriptions of agency procedures and evaluating the degree to which they recognize IWP as acceptable substitutes for other materials they have historically used; 2) identifying agency staff concerns about use of IWP or conversely, their suggestions for increasing consideration of their use; and 3) recommending changes to agency procurement procedures that would increase consideration and adoption of IWP for state projects.

POTENTIAL FOR UTILIZATION OF IWP BY STATE AGENCIES

There are several IWP that have emerged in the marketplace over the past few decades. Some of these have an extensive track record, particularly in Europe, Canada, other states, and in California's private sector, while others have only been adopted for experimental or very limited uses.

The following is a description of the wood products considered in this investigation, their current uses in California, and the potential for utilizing them in state agency-sponsored construction, maintenance, and other projects. Some products that were evaluated in a literature review and research analysis report sponsored by the Joint Institute in 2020¹ were not included in this review e.g., liquid and gaseous transportation fuels and chemically and thermally treated wood. That review included extensive information on mass timber variants and concludes that there are no potential limitations to wider use in California except for the lack of in-state production facilities. Potential for wider use is especially promising given changes to the building code made permanent in 2021 permitting wood structures up to 18 stories. The upsurge in mass timber construction in the state over the past few years supports the finding of that literature review.

Mass Timber: Mass timber generally refers to fabricated structural elements such as cross laminated timber (CLT), including glue, nail, and doweled panels, beams, and posts as well as mass plywood. Mass timber construction projects in California include residential, commercial, and institutional buildings. Given state policy regarding embodied carbon and reduced greenhouse gas emissions considered on a life-cycle basis, there is great potential for use of mass timber as a substitute for more carbon-intensive building materials in state building construction projects, other public sector construction projects subject to review and approval by state agencies, and private sector construction projects subject to state oversight or funding. Studies have indicated that substituting mass timber for steel and concrete in mid-rise buildings (5-10 stories) can reduce emissions associated with manufacturing, transporting, and installing building materials by 13-26 percent.² There are no producers of mass timber structural elements in California.

¹ [Literature Review and Evaluation of Research Gaps to Support Wood Products Innovation \(ca.gov\)](#)

Wood Wool and Wood Fiber Cement Panels: Wood wool and wood fiber cement panels have applications in conventional building construction and specialty projects such as acoustically certified facilities. Wood wool cement sound walls, shooting ranges, and entertainment studios have been built in California at a modest scale by federal agencies, county sheriff departments, and sports/entertainment venues. Wood fiber cement panels are used extensively in private sector residential, commercial, and industrial construction. Although Portland cement has a high level of embodied carbon, incorporation of wood wool or wood fiber results in less net embodied carbon in the panel. There is modest potential for using these products in state building construction projects, other public sector construction projects subject to review and approval by state agencies, and private sector construction projects subject to state oversight. Currently, the greatest potential for wood wool cement panels is for highway sound walls and acoustically certified facilities (e.g., shooting ranges). Neither wood wool nor wood fiber cement panels are manufactured in California.

Biochar: Biochar has many applications in landscaping (soil amendment and water retention), stormwater filtration, solid waste treatment, and decontamination of hazardous wastes. It also sequesters carbon in a stable long-term form that can offset emissions from activities such as pile burning during forest management.³ Biochar has been widely accepted in Europe and at least one state (Washington) for these uses. Biochar soil amendment is commercially available in limited quantities from big box gardening stores. Biochar production globally increased three-fold between 2021 and 2023.⁴ As of 2021, there were 15 producers of biochar in California, but none were producing large quantities.⁵ Biochar has some potential (limited due to lack of supply) for use by state agencies.

Biochar and Cellulose Nanocrystal-Infused Cement and Biochar Infused Asphalt: Biochar and cellulose nanocrystal infused cement, biochar infused asphalt and variants utilizing additives such as biomass power plant fly ash have not been widely adopted by the private or public sectors as a replacement for conventional products in road and bridge construction projects. One nanocrystal cement bridge project was constructed in California as a proof of concept.⁶ In the future, if current studies warrant commercial production, these may be used for state agency sponsored paving, construction, and maintenance projects. Initial findings from biochar infused asphalt research (sponsored by U.C. Davis, Arizona State University and Caltrans) confirm that bio asphalt has longer wear and produces fewer emissions (e.g., reduced volatile organic compounds) over its service life.⁷ As noted in a following section of this report, U.C. Davis is also investigating the performance of several different cellulose materials combined in cement. Caltrans refers to cement with additives such as biochar and cellulose nanocrystals as “supplemental cementitious materials.” They may include fly ash and bottom ash from biomass energy plants as well as biochar and cellulose nanocrystals. Studies sponsored by the Joint Institute and conducted by researchers at Oregon State University indicated that cellulosic infused Portland cement had 19 percent lower GHG emissions than conventional cement.⁸

³ https://bof.fire.ca.gov/media/kdunxevi/demo-handout-1-biochar-in-the-woods-using-portable-flame-cap-kilns_doi-10-379165543.pdf

⁴ <https://biochar-international.org/2023-global-biochar-market-report/>

⁵ https://www.researchgate.net/figure/List-of-active-biochar-producers-in-California_tbl1_353939753

⁶ <https://www.fs.usda.gov/research/fpl/news/releases/wood-new-concrete>

⁷ <https://pubs.acs.org/doi/10.1021/acssuschemeng.2c06292> and <https://www.tandfonline.com/doi/abs/10.1080/14680629.2021.2012238>

⁸ https://bof.fire.ca.gov/media/4najhupx/3-8-23-bof-cnc-carbon-reduction-in-cement-final-report_ada.pdf

Wood Fiber Insulation: There is one producer of wood fiber insulation in the United States.⁹ They produce loose fill, batts and boards that can be used substitutes for other types of insulation made from non-renewable materials such as fiberglass and petroleum-based foam with high levels of embodied carbon. The top installation contractors are in Kansas, Missouri, and Nebraska. There is an outlet for products located in Reno.¹⁰ Wood fiber insulation has potential for use in state building construction projects, other public sector construction projects subject to review and approval by state agencies, and private sector construction projects subject to state oversight or funding.

STATE AGENCY OUTREACH

The following state agencies responded to our outreach efforts:

- Air Resources Board (CARB)
- Buildings and Standards Commission (CBSC)
- California Energy Commission (CEC)
- Department of Forestry (CAL FIRE)
- Department of General Services (DGS)
- Division of the State Architect (DSA)
- Department of Transportation (Caltrans)
- Office of Planning and Research (OPR)
- Office of the State Fire Marshal (OSFM)
- Strategic Growth Council (SGC)

Survey questions were delivered by phone, letter, and/or email, and included the following.

- Has your agency utilized any IWP (mass timber, wood wool cement panels, wood fiber cement panels, wood fiber insulation, cellulose nanocrystal- or biochar-infused cement or biochar) in your projects? If so, what products and what types of projects?
- If your agency has not used any of the listed products to date, has it considered their use and determined that use of other products better meets your objectives? What were the deciding criteria?
- What is the process used to determine the materials that your agency will use in its projects? Is the process documented in a set of procedural guidelines? Can you provide TSS with a copy of that document (please provide an Internet address or electronic copy of the procedures)?

Initial contacts were made via emails to executives and staff members identified as knowledgeable about material procurement procedures used for state construction and maintenance projects. These initial contacts yielded few responses. Agency website searches did not reveal any published procurement protocols with the exceptions of requirements included in general mandates, such as the “California Green Buildings Code,” “Buy Clean California,” and “Department Sustainability

⁹ <https://www.timberhp.com/>

¹⁰ <https://www.timberhp.com/find-a-distributor>

Roadmaps” (see Task 2 chapter). Initial outreach was followed up with letters to agency personnel by the Joint Institute for Wood Products Innovation (Joint Institute) under the signature of the Joint Institute Co-Chair and Board of Forestry and Fire Protection (Board) Chair, Dr. Keith Gilliss (see Appendix A). Follow-up letters were sent to by Patrick Wright, Director of the Governor’s Wildfire and Forest Resilience Task Force (Task Force), at the request of the Joint Institute, as the Joint Institute and Task Force have a close working relationship. The responses to all outreach efforts are described below.

POLICIES AND PROCEDURES: AGENCIES INVOLVED WITH CONSTRUCTION AND MAINTENANCE

Department of General Services

DGS is comprised of a headquarters office in Sacramento and four regional offices located in Sacramento, San Diego, Los Angeles, and Oakland. The four regional offices carry out project plan review, construction oversight, and project close-out activities. The headquarters office develops and oversees Division of State Architect (DSA) programs, policies, and procedures, and performs general administrative functions.

With over 150 architects, engineers, designers, and project managers, DGS is involved with much of the building design and construction completed or authorized by the State. However, there exist no specific procedures for employees to follow in determining whether to incorporate IWP in the projects they design or authorize.¹¹ Instead, employees rely on their individual knowledge and experience with applicable legislation, building codes, regulations, and client preferences in relation to proposed projects.

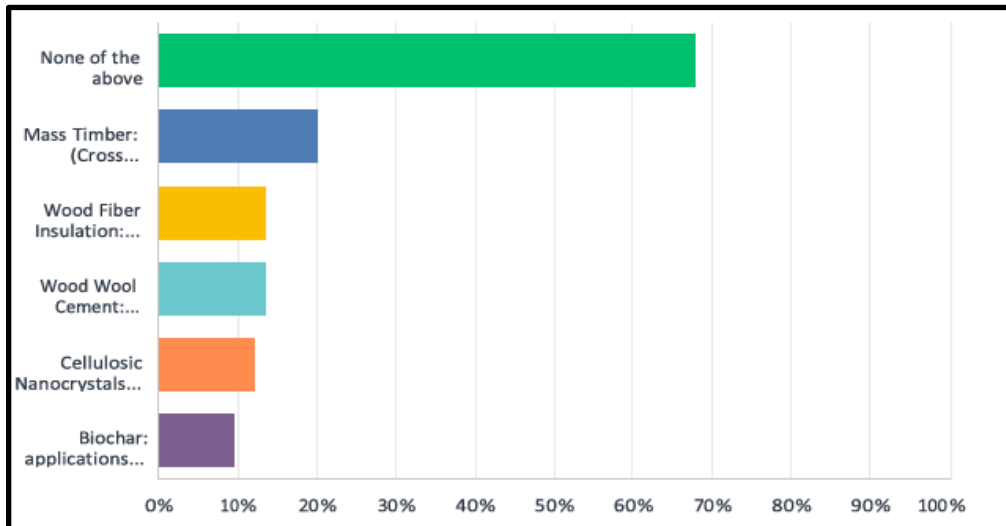
In response to our inquiries, DGS developed a four-question survey for all design team employees. The results of the first three questions of the survey are shown in the following graphs and tables. The fourth question had to do with the age of the respondents, which was not applicable to our research.

Question 1. Please indicate if any of your projects have used one or more of these products (IWP).

All 155 employees responded to this question, with two-thirds indicating that they have not used IWP for their projects. Figure 1 shows DGS employee responses.

¹¹ Per discussions with Tom Wells, Principal Architect, DGS, Personal Communication, October 13, 2023
State Agency Outreach in Support of Increased Utilization of IWP
TSS Consultants

Figure 1. DGS Staff Response Regarding Use of IWP

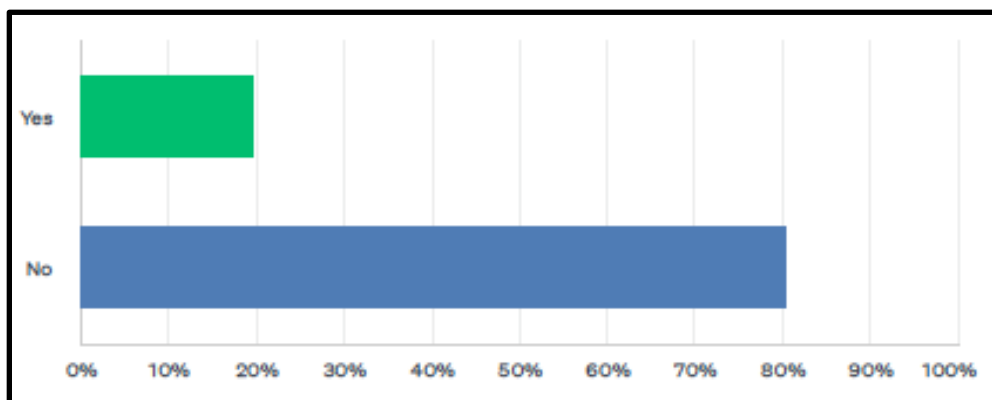


It is notable that these responses seemed to contradict information obtained through other sources. For example, only one example of cellulosic nanocrystals use in California has been identified, and it was in a bridge construction project in Yreka (not a state sponsored project). Additionally, wood fiber insulation is not generally available in the state. The only producer in the U.S. is in Maine and the nearest outlet for it is in Reno.

Question 2: If your projects have not used any of the above, were any considered?

There were 148 responses and only 20 percent (29) considered using IWP. Figure 2 shows DGS employee responses.

Figure 2. DGS Staff Response Regarding Considering Use of IWP



The responses to this question also seemed to contradict the answers to the first question. For example, in response to the first question, 31 respondents indicated that they had used mass timber in their projects.

Question 3: Provide examples of your projects that have deployed IWP.

Eight individuals provided some detail on their projects.

- Glulam was used as cladding panels throughout the building envelope at Bateson Renovation project. This 308,000 square foot building occupies a full city block in Sacramento and was designated a historically significant building in 2016.
- CLT was used for a residential center multipurpose building (location unknown).
- Glulam beams were used in CAL FIRE projects (locations unknown).
- Glulam was used in an outdoor dining shade structure at a skilled nursing facility (location unknown).
- Glulam was used for an internal floor framing system at the CAL FIRE Santa Cruz auto shop.
- CLT and glulam were used at a Richards Boulevard office complex in Davis.
- Wood wool cement panel were used to install a roof (location unknown).
- Residential mid-rise "podium" projects were built using glulam (location unknown).

Unfortunately, in addition to the low number of projects described and the relative lack of detail, all responses were anonymous, and it was not possible to follow up with designers to inquire about how they made their choices of materials for construction. None of the projects involving mass timber are identified on the WoodWorks.org website.¹² Moreover, as noted below, the use of glulam in CAL FIRE projects conflicts with what a CAL FIRE representative reported about costs of glulam precluding its use for their projects. It is likely that the reported use of glulam by DGS indicates that CAL FIRE designers were not involved with these projects.

California Department of Transportation

Caltrans manages more than 50,000 miles of California's highway and freeway lanes; provides inter-city rail services; issues and administers permits for more than 400 public-use airports and special-use hospital heliports; and works with local agencies on improvements to local transportation systems. Caltrans has six primary programs: Aeronautics, Highway Transportation, Mass Transportation, Transportation Planning, Administration, and the Equipment Service Center. Among its core values is, "We are empowered to seek creative solutions and take informed risks."¹³

The potential uses of IWP by Caltrans include biochar for landscape maintenance and water retention as well as storm drainage filtration. There is also potential for utilizing cellulose nanocrystal and biochar infused cement and biochar infused asphalt for paving and bridge construction. Wood wool cement panels have been used for at least one sound wall (on private property) next to a California freeway and have potential for use as freeway noise barriers.

For storm drainage filtration and landscaping, Caltrans has found that biochar will break down to very fine sizes under compaction and does not stay in place unless it is covered with another

¹² <https://www.woodworksinnovationnetwork.org/projects/>

¹³ [About Caltrans | Caltrans](#)

material. Caltrans also found that many suppliers do not test the material to International Biochar Initiative (IBI) standards. Research into the use of biochar for storm water filtration is continuing and there is one experimental application located at the intersection of I-680 and I-80 in Cordelia.¹⁴ The use of biochar in landscape maintenance or design is not planned. While Caltrans uses wood mulch, biochar is not included in soil amendments. Further, there is no research currently being undertaken into its possible landscaping applications, including water retention.¹⁵

The use of wood wool cement panels for sound walls along freeways has been proposed by proponents of the technology.¹⁶ Caltrans has not conducted research necessary for it to be adopted as a suitable alternative to conventional materials, and there are no plans to do so. Instead, they are studying the potential for the development of low-carbon masonry units (CMU),¹⁷ which incorporate substantially more fly ash (50 percent) than Portland cement (15 percent).¹⁸

For pavement applications, there has been considerable research completed and continuing at the U.C. Davis Pavement Research Center and Oregon State University (and elsewhere). Some studies have presented findings supporting the addition of cellulose nanocrystals to Portland limestone cement or biochar infused asphalt. The French firm Effage is testing a plant-based asphalt called biophalt on one mile of road in France.¹⁹ However, a great deal of research is still needed to address the potential benefits of adding cellulose (biochar, rice straw, pine oil, etc.) to cement or asphalt. Caltrans is currently supporting a study at U.C. Davis looking at 14 combinations of concrete mixtures including several different forms of cellulose.²⁰ Given the time needed for product discovery, development, and commercialization, it does not appear that pavement with wood fiber or other plant-based material will be available within the short-term.

California Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (CAL FIRE) is dedicated to the fire prevention, fire protection, and stewardship of over 31 million acres of California's wildlands. In addition, it provides a variety of emergency services in 36 counties via contracts with local governments. It also enforces California's Forest Practice Regulations on private and other non-federal lands.²¹

CAL FIRE is responsible for the design of their buildings with oversight from DGS. Buildings are categorized as essential or non-essential. Essential buildings include fire stations, command centers, and air bases. Non-essential buildings include dormitories and training facilities. CAL FIRE has 3,000 total structures, including 236 fire stations. Current and foreseeable budgets provide for the replacement of 20 structures per year. According to CAL FIRE staff, the Department is unable to

¹⁴ Jeremiah Ketchum, Division Chief of Environmental Analysis, Caltrans, Personal Communication, December 22, 2023.

¹⁵ Jeremy Ketchum, Division Chief of Environmental Analysis, email, December 12, 2023.

¹⁶ Martin Twer, Biomass Program Director, The Watershed Center, Personal Communications, August 2023.

¹⁷ Tim Greutert, Chief of the Materials Engineering and Testing Services subdivision, Caltrans, personal communication, February 20, 2024.

¹⁸ [Concrete Masonry: An Optimized Low Carbon Wall \(angelusblock.com\)](https://angelusblock.com)

¹⁹ [French Company Eiffage Is Testing Plant-Based Asphalt Called Biophalt \(rideapart.com\)](https://rideapart.com), September 28, 2022.

²⁰ Dr. John Harvey, U.C. Davis, personal communication, February 22, 2024.

²¹ [California Department of Forestry and Fire Protection | CAL FIRE](https://www.fire.ca.gov)

use glulam due to its cost and unavailability of suppliers in California. When putting projects out to bid, glulam and CLT are not cost competitive in comparison to steel and concrete.²² Note that in response to the survey of DGS designers, the use of glulam at CAL FIRE facilities was reported.

In addition to cost, potential fire and earthquake considerations also affect the choice of materials by CAL FIRE. Experimental tests have indicated that mass timber performs well when exposed to fire and under seismic stress.^{23 24} Existing budget constraints and assumptions about advantages of steel and concrete compared to mass timber suggest near-term wider use of mass timber by CAL FIRE is not likely. There is no evidence of other IWP use by CAL FIRE for its construction or maintenance projects.

POLICIES AND PROCEDURES: AGENCIES ADMINISTERING GRANT AND LOAN PROGRAMS

Strategic Growth Council

California lawmakers established the Strategic Growth Council (SGC) in 2008 to support sustainable community development in California. The Council's mission is to promote state agency coordination to improve air and water quality and natural resource protection, increase the availability of affordable housing, improve transportation, reduce greenhouse gas emissions, and support climate change adaptation and resilience.²⁵ Among its programs, it selects grantees for the Affordable Housing and Sustainable Communities program (AHSC). This is an important part of California's climate and equity strategy, funding affordable housing developments (new construction or renovation) and transportation infrastructure. The grants are processed and administered by the Department of Housing and Community Development.

The AHSC guidelines for evaluating proposed projects contain no preference for the types of materials used in the construction of their projects if they meet Building Code and other California requirements. Most projects are built with height maximums not requiring the use of concrete to realize cost savings.²⁶ In the event that multi-story buildings are proposed for grant funding, there would be an opportunity to employ the use of IWP for structural support, floors, and ceilings. This could be encouraged by modifications to the grant guidelines to mandate consideration of the use of IWPs because of its potential life cycle carbon benefits as compared to other construction materials.

California Energy Commission

The California Energy Commission (CEC) administers the Building Initiative for Low Emissions Development (BUILD) program. It is designed to provide technical assistance and incentives for new all electric low-income residential buildings that reduce greenhouse gas emissions (GHG). The program was authorized by Senate Bill 1477 (Stern, Chapter 378, Statutes 2018). An

²² Mike Duggan, Assistant Deputy Director, CAL FIRE, Personal Communication, December 12, 2023.

²³ <https://www.woodworkingnetwork.com/news/canadian-news/new-research-confirms-mass-timbers-fire-safety-taller-buildings>

²⁴ [10-story Timber Rocking Frame Sails Through Seismic Shake Tests | Engineering News-Record \(enr.com\)](#), May 9, 2023

²⁵ [20230609-SGC 2022 Annual Report.pdf \(ca.gov\)](#)

²⁶ Marc Caswell, Program Manager, AHSC, Strategic Growth Council, personal communication, March 13, 2024

implementation plan and Final Guidelines were approved by the CEC and then approved by the California Public Utilities Commission on February 28, 2022.²⁷ The guidelines exclusively relate to electricity and do not address the potential for other approaches to reducing GHG emissions.

The CEC also administers a grant program entitled The Next EPIC Challenge: Reimagining Affordable Mixed-Use Development in a Carbon-Constrained Future (GFO-20-305). This solicitation provides up to \$48 million per year for a design-build competition that challenges multi-disciplinary project teams to design and build mixed-use developments using innovative energy technologies, tools and construction practices. The objective is to create designs that are affordable, equitable, emissions free, resilient to climate change impacts and extreme weather events.²⁸ As the CEC articulates, “Building decarbonization – primarily achieved through energy efficiency, onsite renewable generation and storage, and full end-use electrification – is a key strategy for realizing the state’s goals to reduce greenhouse gas emissions.”²⁹ Four projects that were awarded funding in 2023 are listed on the CEC website.³⁰ None of the projects proposed IWP as an option for creating designs that are emissions free and resilient to climate change. Grant evaluation guidelines do not create incentives for use of IWP.

CODES, STANDARDS, AND REGULATORY MANDATES

Department of General Services - Division of the State Architect

DSA is a branch of DGS. It develops accessibility, structural safety, and historical building codes and standards governing the construction of various public and private buildings throughout California, including K-12 schools and community colleges.³¹ Through the California Green Standards Building Code,³² DSA regulates sustainable practices that reduce negative impacts on the environment or provide a positive environmental impact. These mandatory measures target energy efficiency, water efficiency, water conservation, material conservation, resource efficiency, and environmental quality.³³ To promote sustainability, DSA collaborates with stakeholders, experts, and public entities to develop green regulations that govern the construction of buildings in California. It proposes changes to the California Building Standards Code³⁴ and it develops and publishes interpretations of code, policies, and procedures necessary for stakeholder understanding and coordination of enforcement among the DSA regional offices.

DSA is one of several state agencies that proposes changes to the California Building and Administrative Codes through the Building Standard Commission’s rulemaking process. The creation of regulation is directed through law. Regulations govern how the law will be enforced.³⁵

²⁷ [Building Initiative for Low-Emissions Development Program - BUILD | California Energy Commission](#)

²⁸ [GFO-20-305 - The Next EPIC Challenge: Reimagining Affordable Mixed-Use Development in a Carbon-Constrained Future](#)

²⁹ GFO-20-305, Solicitation Manual, December 2020

³⁰ <https://www.energy.ca.gov/media/9124>

³¹ [About Us \(ca.gov\)](#)

³² <https://www.dgs.ca.gov/BSC/CALGreen>, California Code of Regulations, Title 24, Part 11,

³³ [Sustainability Plan Review \(ca.gov\)](#)

³⁴ [Title 24 Overview](#)

³⁵ [CALGreen Code Development](#)

Although its authority for state-funded construction is generally limited to the accessibility provisions for persons with disabilities and renovations to state-designated historic structures where they have plan review and approval authority only, it could have a role in promoting wider use of IWP through changes to the building code.³⁶

The California Code of Regulations requires continuous monitoring of structural glulam and CLT production for some state projects.³⁷ Continuous monitoring is defined in code as “The manufacture of all structural glued laminated and cross-laminated timber shall be continuously inspected by an approved agency (approved agency is not defined). The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.”³⁸ This applies to structures subject to regulation by DSA (public elementary and secondary schools, community colleges, and state-owned or state-leased essential services buildings) and/or by the Office of Statewide Health Planning and Development (hospitals and correctional treatment centers). Since there are only a few inspectors in the state certified to conduct these inspections, and all production occurs outside the state, this requirement imposes a significant constraint on use of mass timber by those two state agencies. An alternative process that would permit inspectors to be certified at factories or allow other means of wholesale certification would incentivize greater use of these products.³⁹ Representatives from Woodworks.org are attempting to find alternatives to continuous monitoring by working with the DSA.⁴⁰

California Building Standards Commission

The California Building and Standards Commission (CBSC) has the authority to propose changes to the California Green Standards Building Code for nonresidential structures that include new buildings or portions of new buildings, additions and alterations, and all occupancies. Any state department can recommend changes to codes during annual evaluation cycles. In the past, the State Fire Marshall has proposed changes to allow use of mass timber for multi-story buildings. These changes, which allowed mass timber construction for buildings up to 18 stories, became part of the state’s Building Code in 2021. Future changes allowing more exposure of wood in mass timber constructions, currently part of the 2024 International Building Code, will likely be adopted in California in 2025.⁴¹ Additional changes, like modification of the Title 24 requirement for continuous monitoring of mass timber production for certain state projects could be proposed by the DSA or the Office of Statewide Health Planning and Development.

AB 2322 (signed into law in 2022) requires mandatory building standards for fire resistance based on occupancy risk categories in moderate, high, and very high fire severity zones in state responsibility areas, local responsibility areas, and in land designated as a Wildland Urban Interface area by cities and other local agencies under specified provisions of the California Building Standards Code. The bill requires those building standards to apply to nonresidential, critical infrastructure buildings and to include certain fire rating requirements for structures under specified

³⁶ Eric Driever, Principal Architect, Architectural Codes and Standards, DSA, phone conversation, October 30, 2023

³⁷ Title 24, California Code of Regulations, Sections 1701.A.1.1., 1705A.5.5. and 1705.5.5

³⁸ Ibid.

³⁹ Matt Larson, Preconstruction Director, XL Construction, personal communication, February 9, 2024.

⁴⁰ Chelsea Drenick, Regional Director, Woodworks.org, personal communication, April 22, 2024.

⁴¹ Ibid.

risk categories. The 2022 Building Code, Title 24, Part 2, Chapter 7A sets forth criteria for materials and construction methods for exterior wildfire exposure. Section 707A.4, permitted exterior wall assemblies include:

“An assembly of sawn lumber or glue-laminated wood with the smallest minimal nominal dimension of four inches. Sawn or glue-laminated planks splined, tongue-and-groove, or set close together and well spiked”.

Mass timber construction is permitted in moderate to very high fire severity zones with the provision that exterior cladding provides increased safety during a fire. In addition, taller buildings are required to have a certain percentage of gypsum-covered surfaces. Taller buildings have relatively greater gypsum requirements.⁴² As indicated in the following section of this report, the satisfactory performance of mass timber during a fire has been established through research and testing.

Office of the State Fire Marshal

The OSFM Code Development and Analysis Division reviews all of California's regulations relating to fire and life safety for relevancy, necessity, conflict, duplication and/or overlap. The OFSM prepares the California State Fire Marshal's fire and life safety regulations and building standards for review and adoption by the CBSC.⁴³ In 2022, then State Fire Marshall Mike Richwine, went on record with the following statement:

“The early adoption of mass timber codes can be a benefit to California in many ways, but I would like to highlight three of those advantages in this proposal (referring to changes that allow mass timber multi-story structures). Number 1, it has the potential to increase the market demand for mass timber production in California to meet the needs of the construction industry. Number 2, it will increase the pace and scale of our wildland fire prevention and forest management goals of treating 500,000 acres per year by thinning the forest of smaller diameter trees that can be used in the production of cross laminated timber and other mass timber assemblies. And while wood products provide the benefit of storing carbon, another benefit or advantage is that mass timber construction can also help reduce the carbon footprint of concrete and steel production.”⁴⁴

Regarding performance of mass timber buildings when exposed to fire, studies have found that it can out-perform concrete and steel because of its propensity to char, forming a protective layer while retaining strength. This slows combustion significantly, allowing time for safe evacuation and facilitating suppression.⁴⁵

California Air Resources Board

The California Air Resources Board's (CARB) mission is to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. It is also responsible for taking actions to fight climate change.

⁴² Crystal Sujeski, Chief of Code Development and Analysis, Office of the State Fire Marshall, Personal Communication, March 27, 2024.

⁴³ [Code Development and Analysis \(ca.gov\)](https://www.ci.emeryville.ca.us/DocumentCenter/View/14071/Item-93---Mass-Timber-Construction)

⁴⁴ <https://www.ci.emeryville.ca.us/DocumentCenter/View/14071/Item-93---Mass-Timber-Construction>

⁴⁵ <https://www.naturallywood.com/wood-performance/fire/>

CARB plays several roles in the potential use of IWP. While it defers to Caltrans regarding testing and use of materials it uses that may reduce air pollution, CARB could promote research into reducing volatile organic compounds and toxic pollutant emissions through use of biochar-infused cement and asphalt.

In September 2022, Governor Newsom signed Assembly Bill 2446 (Holden), which requires CARB to develop a framework for measuring and reducing the embodied carbon of building construction materials, primarily at the materials production stage, with a target of 40 percent net reduction in GHG emissions associated with buildings no later than the end of 2035, and an interim target of a 20 percent net reduction by the end of 2030. Overall, California has committed to reducing GHG emissions by 55 percent below 1990 levels by 2030 and achieving carbon neutrality no later than 2045.⁴⁶ The state has made (and continues to make) considerable progress in reducing GHG emissions from buildings through energy efficiency, clean renewable energy, and building electrification. As a result, embodied carbon in the materials used to construct buildings represents the majority of remaining building-related emissions.⁴⁷

Embodied carbon refers to the lifecycle GHG emissions resulting from the extraction, manufacturing, transportation, installation, maintenance, and disposal of goods, including building materials. Tackling embodied carbon in new construction is critical for ensuring that California can achieve its housing and climate goals, because housing production in California is anticipated to increase significantly over the next 10 years.⁴⁸

CARB's efforts to implement AB 2446 will focus on in-depth assessments of technology, market, cost-effectiveness, and policy instruments. According to CARB, research indicates that embodied carbon can be reduced through strategies such as the optimal use of building materials with high-recycle material content or low embodied carbon products. A current CARB-funded contract with U.C. Santa Barbara⁴⁹ and a pending one with U.C. Berkeley/Davis will deliver background information and the quantification method for implementing AB 2446 by the summer of 2024. Researchers will examine the capacity of technologies and policy instruments that will support CARB in developing a cost-effective and feasible strategy.⁵⁰ The U.C. Santa Barbara project will review data, quantifications, existing and emerging low-carbon technologies, low-carbon design and construction practices, and global policies to better understand the scales and sources of embodied carbon emissions associated with California's building materials and the potential technology, construction, design, and policy strategies for reaching the reduction targets.⁵¹

Life cycle analysis will be a key component of the successful implementation of AB 2446. There are several published life cycle analyses comparing construction with mass timber versus concrete and

⁴⁶ <https://www.gov.ca.gov/2022/08/12/governor-newsoms-ambitious-climate-proposals-presented-to-legislature/>

⁴⁷ <https://legiscan.com/CA/text/AB2446/id/2607014>

⁴⁸ <https://www.hcd.ca.gov/regional-housing-needs-allocation>.

⁴⁹ *A Review of Embodied Carbon Data, Embodied Carbon Emissions, and Emissions Reduction Technologies and Policies for California Building Construction Materials, Contract 22STC014, 2024*

⁵⁰ [Technical Feasibility, Cost-effectiveness, and Policy Strategies for Reducing Embodied Carbon in Building Materials | California Air Resources Board](#),

⁵¹ *A Review of Embodied Carbon Data, Embodied Carbon Emissions, and Emissions Reduction Technologies and Policies for California Building Construction Materials, Contract 22STC014, 2024*

steel with results favoring the use of mass timber.⁵² CARB is also assessing the potential for creating factory built affordable housing with mass timber, an approach that is a centerpiece of the Oregon Mass Timber Coalition.⁵³

Regarding the use of biochar for stormwater filtration or hazardous waste treatment, the issue of disposal of biochar after it has been used was raised by CARB staff as a potential concern.

CARB is not involved with evaluating alternatives to conventional cement or pavement, but SB 596 requires CARB to develop a strategy for the cement industry to achieve net zero emissions by 2045.⁵⁴ The strategy was due on July 1, 2023. CARB staff is currently working on the draft strategy and expects to release it in the next few months.⁵⁵

SUMMARY OF AGENCY PROCUREMENT PROCEDURES

Our outreach to state agencies and review of information posted on their websites indicates that they do not have specific, identifiable procurement procedures or policies directly focused on deployment of IWP in state sponsored projects. In the case of DGS, survey results indicate that some designers have used IWP for their projects, but the vast majority (80 percent) have not considered their use. It is unknown if lack of consideration is based on lack of personal knowledge or other factors.

Regarding Caltrans, there is no evidence that IWP including biochar, wood wool cement panels or cellulosic or biochar infused cement will be deemed acceptable products for use in Caltrans sponsored projects any time soon.

Some CAL FIRE projects designed by DGS have used IWP. CAL FIRE is on record however, that products such as glulam are too costly for use in projects that it sponsors.

Agencies administering grant programs targeting affordable housing and carbon-neutral development (SGC and CEC) could incentivize use of IWP by favoring proposals that utilize them. At the present time, that is not the case. It should be noted, however, that the first affordable housing project implemented under the mandate of EO-N-06-19 (Sonrisa) was a mass timber project.

There are obstacles to wider use of IWP by state agencies that are outside the purview of their procurement procedures. The absence of producers in California is an obvious issue. There is no near-term potential for producers in the state. Continuous monitoring of structural glulam and CLT production as required by Title 24 for some state projects affects the cost and availability of mass timber produced outside of California. “Buy California” requirements may also affect the potential for use of products from other states. In summary, the outlook for wider use of IWP by state agencies is quite limited under existing procurement practices and market conditions.

⁵² https://www.mdpi.com/journal/sustainability/special_issues/mass_timber_sus

⁵³ Conference call with CARB staff on February 24, 2024.

⁵⁴ <https://pluralpolicy.com/app/legislative-tracking/bill/details/state-ca-20212022-sb596/783391>.

⁵⁵ Haley Hamza, Air Pollution Specialist, California Air Resources Board, personal communication, April 2, 2024.

RECOMMENDATIONS

To recap, obstacles to increased use of IWP in state sponsored or funded construction and maintenance projects include:

- Lack of consideration of the carbon benefits of IWP as compared to other materials;
- Perceptions of higher cost relative to conventional materials;
- Lack of IWP suppliers in the state;
- Regulatory constraints such as the requirement for continuous monitoring of custom glulam and CLT production for some state projects;
- Lack of research findings supporting use of IWP such as biochar and biochar or nanocrystal infused cement or biochar infused asphalt; and
- Lack of procurement procedures based on consistency within state policies, Executive Orders and legislation advocating reduced greenhouse gas emissions and embodied carbon.

Some of these obstacles may be changed by CARB's efforts to implement AB 2446. The American Institute of Architects (AIA) continuing education requirement for courses in zero net carbon design for California architects, may increase state designers' knowledge of IWP.

In view of existing conditions, the following recommendations are offered for consideration by the Joint Institute.

Account for Carbon Benefits of IWP in Procurement Decisions

State facility designers should follow the lead of the private sector in considering the use of IWP, primarily mass timber and wood wool cement, in their projects. When considering the use of IWP, designers need to specifically consider the life cycle carbon benefits of IWP, in response to the Executive Orders and legislation advocating reduced embodied carbon in state and private buildings. Depending on the outcome of CARB's efforts to implement AB 2446, contractor bids for future publicly financed buildings and infrastructure may be required to include a complete life cycle analysis and establishment of greenhouse gas emission targets. Any cost-benefit analysis of alternative materials should reflect the intangible but real carbon benefits of IWP.

Support Continued IWP Research

The state actively support and expedite testing and experimentation with products such as biochar, biochar asphalt and nanocrystal infused cement to accelerate their adoption for use in state projects, as appropriate and based on research and experimental findings.

Encourage Continuing Education

Evidence from the survey conducted by DGS and our contacts with state agency representatives indicate inconsistent understanding and appreciation of the potential benefits of IWP. State designers need to be required to engage in trainings focused on construction utilizing IWP. There is a mandatory requirement for 10 hours of continuing education to maintain California licenses in architecture, including five hours on zero net carbon design (as of 2023). Mass timber courses are

offered by several entities including the Wood Institute, WoodWorks.org, AIA Los Angeles, U.S Green Building Council and others.

Require Use of IWP in Projects Funded by State Grant Programs

Grant programs administered by state agencies that promote affordable housing and zero net carbon buildings incentivize the use of IWP in proposed projects by including use of them as a requirement in their proposal scoring criteria. This provision should also apply to projects planned pursuant to Executive Order N-06-19. Note that in the past, the state sponsored a mass timber design competition that awarded prizes to four designers.⁵⁶ A competition based on this approach for the construction of one or more state buildings would be a demonstration of commitment to IWP by the state.

Modify Title 24 CLT and Glulam Inspection Requirements

At the present time, Title 24 requires continuous on-site monitoring of custom glulam and CLT production for all projects approved by the DSA and Office of Statewide Health Planning and Development Projects. This is an obstacle to the wide spread use of mass timber for those projects. The California Building Standards Commission or other appropriate entity needs to actively implement changes to Title 24 to allow in-house inspectors at mass timber manufacturers in other states and nations to monitor and certify acceptable characteristics of structural glulam and CLT. Certification can be established by adherence to International Building Code or similar standards (e.g., ANSI A 190.1, *Standard for Structural Glued Laminated Timber* recognized in the U.S. and CSA O177, recognized in Canada, and ANSI/APA PRG 320, *Standard for Performance-Rated Cross-Laminated Timber*), recognized in the U.S. and Canada.

Issue IWP Focused Executive Order

An Executive Order or similar policy modeled on the Army Corps of Engineers mandate to consider use of mass timber in all Corps vertical construction projects⁵⁷ is recommended. The Executive Order might encompass other IWP, depending on their availability and proven performance. Appendix B includes an example of an EO focused on deployment of IWP.

Consider IWP Collaborative Initiative

Although difficult, aligning agencies, educational institutions, designers, producers, and timber suppliers (including the USDA Forest Service) in a consortium modeled on the Oregon Mass Timber Collaborative is strongly recommended. It is acknowledged that such an effort requires funding and long-term commitment on behalf of collaborative participants.

⁵⁶ <https://resources.ca.gov/Newsroom/Page-Content/News-List/California-Promotes-Architectural-Innovation-Through-Mass-Timber-Competition>

⁵⁷ [USACE ECB 2023-14 Mandatory Consideration of Mass Timber in Army Military Construction \(MILCON\) and Civil Works Vertical Construction Projects \(wbdg.org\)](#)

Attract MT/CLT Producers

The state needs to incentivize in-state production of IWP (e.g., mass timber, biochar, wood wool cement). Currently all laminated mass timber products are produced elsewhere (e.g. glulam, CLT etc.) and there are no facilities producing biochar at scale in California. The state should provide financial incentives to attract in-state investments in IWP production. State agencies should be motivated to utilize IWP manufactured in-state for a variety of reasons including lower carbon intensity (due to reduced emissions from transport of IWP), value-added use of California forest resources, more competitive IWP pricing plus in-state employment development.

State Agency Outreach Coordinator

Consideration should be given to creating an IWP coordinator within the Joint Institute. The primary role of this position would be outreach to state agencies to keep them informed regarding the deployment of IWP – both in-state and out of state. Presently there is no consistent strategy to bring state agencies up to speed with current and emerging IWP. The state has led the nation in rollout of climate friendly policies, it is time to back this up with deployment and utilization of IWP by state agencies.

Conduct Review of State Policies Regarding IWP at Five-Year Intervals

Joint Institute consider requesting yearly updates by state agencies involved with materials procurement on progress towards wider use of IWP for their construction and maintenance projects. These could be augmented by updates to the reports prepared for this assignment at five-year intervals. Updates should address utilization of IWP by state agencies, availability of IWP in the state and substantive changes in policies and regulations supporting the use of IWP.

APPENDIX A. BOARD OF FORESTRY LETTER REQUESTING STATE AGENCY PARTICIPATION IN JI PROJECT

STATE OF CALIFORNIA
GAVIN NEWSOM, Governor

BOARD OF FORESTRY AND FIRE PROTECTION
J. Keith Gilles, Chair

THE NATURAL RESOURCES AGENCY
WADE CROWFOOT, Secretary

P. O. Box 944246
SACRAMENTO, CA 94244-2460
(916) 902-9739
Website: www.bof.fire.ca.gov



November 30, 2023

Gustavo Velasquez, Director, Department of Housing & Community Development

Dear Gustavo:

The Board of Forestry and Fire Protection's Joint Institute for Wood Products Innovation (Institute) is assessing current state protocols looking for pathways to facilitate procurement of innovative wood products (IWP) by State agencies for their construction and maintenance projects. To help inform this effort, we are requesting information from State agencies regarding their design and purchasing protocols as they relate to IWP. The Institute has retained TSS Consultants (TSS) to conduct this research.

In recent years, the forest products sector has produced groundbreaking products, such as:

- Mass timber (used in residential, institutional and commercial buildings)
- Cellulosic nanocrystals (used in cement to cut carbon emission production by up to 20%)
- Wood wool cement panels (lighter, more sound absorption)
- Wood fiber insulation (used in residential and commercial buildings)
- Biochar (enhanced soil amendment and water filtration medium)

To realize the societal and environmental benefits of these products, we are requesting information from you as to whether or not your department regularly incorporates IWP in your design of buildings or purchase of construction and maintenance materials or if your department could do so if design protocols or marketplace changes were made. In particular, we are requesting the following information:

- Published department procedures for considering IWP materials during the design and/or maintenance phases of your projects.
- Document testing and/or certification methods used to determine if new materials are acceptable for use in agency projects.
- Any concerns/perceived barriers associated with procedures for adopting new products. Describe any concerns regarding the use of IWP in building design, construction, or maintenance activities.
- Any suggestions for improving the potential for use of IWP in projects.

We appreciate your time and consideration and welcome any assistance you can provide to help support this project. Please contact Patrick Nevis at (916) 803-8639 or pnevis121@icloud.com to discuss this further.

Sincerely,

J. Keith Gilles
Board of Forestry and Fire Protection Chair
Joint Institute for Wood Products Innovation Co-Chair

APPENDIX B. DRAFT EXECUTIVE ORDER

EXECUTIVE ORDER INNOVATIVE WOOD PRODUCT USE

WHEREAS reducing wildfire severity and restoring healthy and resilient forests requires active forest management, including forest thinning and fuel removal in fire prone areas; and

WHEREAS Senate Bill 901 (Chapter 626 of the Statutes of 2018) calls upon California to significantly increase the amount of forest fuel removal for wildfire mitigation; and

WHEREAS the 2020 Forest Stewardship Agreement between California and the United States Forest Service commits to scaling up vegetation treatment of forests and wildlands to one million acres per year by 2025; and

WHEREAS the 2022 Climate Change Scoping Plan calls for vegetation treatment on 2.5 million acres per year by 2030; and

WHEREAS “California’s Wildfire and Forest Resilience Action Plan,” issued by the Governor’s Forest Management Task Force in January 2021, requires state agencies to develop a comprehensive framework to align the state’s wood utilization policies and priorities, including a comprehensive set of metrics to evaluate biomass availability, usage, investments, and workforce levels to create a sustainable wood products market in the state; and

WHEREAS forest biomass waste utilization promotes economic development in many of the poorest regions of the state, helping to create a circular economy in California’s forested communities; and

WHEREAS the monitoring of wood processing facilities by the University of California Cooperative Extension has shown that California is significantly lacking in manufacturing capability for various mass timber materials and other IWP such as wood fiber insulation, wood fiber and wood wool cement panels for sound barrier walls and building construction and sound panels, biochar for landscaping and water filtration and that their development should be encouraged,

WHEREAS the “Joint Institute Recommendations to Expand Wood and Biomass Utilization in California,” issued by the State Board of Forestry and Fire Protection’s Joint Institute for Wood Products Innovation in November 2020, found that meeting fuel removal requirements would generate tens of millions of bone-dry tons of excess forest wood material annually and provided recommendations for the beneficial use of that forest material; and

WHEREAS the “Joint Institute Recommendations for the Utilization of Innovative Wood Products in California,” issued by the State Board of Forestry and Fire Protection’s Joint Institute for Wood Products Innovation in May 2024 found that progress in the use of innovative wood products is inhibited by State code restrictions, redundant fire suppression requirements, requirements for continuous in-place inspections of the manufacture of mass timber materials, and the lack of incentives to develop the production infrastructure on California; and

WHEREAS past and current research by California and other universities on the life cycle carbon benefits of mass timber and wood fiber and wool products have established their superior performance in achieving the zero net carbon future of buildings and infrastructure in California; and

NOW THEREFORE, I, GAVIN NEWSOM, Governor of the State of California by virtue of the power and authority vested in me by the Constitution and the statutes of the State of California, do hereby issue the following orders to reduce wildfire risks, restore healthy forests, sequester carbon, and accelerate economic development in rural areas by expanding the use innovative wood products.

IT IS HEREBY ORDERED THAT:

1. California Division of the State Architect shall, by December 31, 2025, devise a mandated mass timber building option, similar to that used by the Army Corps of Engineers, to be considered in the design of all new State buildings and structures.
2. Caltrans shall, by December 31, 2030, develop bid specifications for the use of nanocrystals in cement products; biochar in the use of storm and drainage filtration, landscaping, and asphalt; and wood fiber in the use of acoustic sound walls.
3. State agencies shall develop protocols by December 31, 2026, for the inclusion of IWP in their building and maintenance activities.
4. The Department of Housing and Community Development, the Strategic Growth Council, the Air Resources Board and other State agencies, which currently or may in the future, provide grants related to housing, office building, and any other non-industrial construction, will revise by December 2025, their affordable and other housing-related grant request for proposals to include additional evaluation credits to be given to government agency and developer and builder applicants incorporating IWP in their projects.
5. Withdraw California-only requirements by July 2025, from purchasing for any IWP products for construction that are not manufactured in California.
6. GO-Biz shall develop an outreach strategy for the attraction of innovative wood product manufacturers. Included with the strategies will be the identification of specific steps to be taken to present California as the destination for new development, especially in rural areas. The steps would include identification of grants or loans to businesses to help cover initial engineering and environmental review expenses, development of an inventory of possible building sites, of a marketing plan, and of proposed incentives to promote the location of these facilities in California.
7. Agencies will require State architectural, design and engineering personnel to enroll and complete Innovative Wood Product continuing education classes through authorized providers such as WoodWorks and the American Wood Council.
8. The Board of Forestry shall propose a new position, which will provide for the monitoring and encouragement of innovative wood product use or consideration of its use by State agency programs and grant solicitations.