CALIFORNIA
ENERGY COMMISSION

California Energy Commission

STAFF REPORT

BamCore Prime Wall Exceptional Method Compliance Option

Gavin Newsom, Governor
June 2020 | CEC-400-2020-009

California Energy Commission

Michael Shewmaker
Primary Author

Payam Bozorgchami
Project Manager

Peter Strait
Office Manager (Acting)
BUILDING STANDARDS OFFICE

Michael J. Sokol
Deputy Director
EFFICIENCY DIVISION

Drew Bohan
Executive Director

ABSTRACT

BamCore, LLC has submitted an application and supporting documentation requesting approval of an exceptional method compliance option for its Prime Wall system, referred to generically throughout this document as a dual-panel hollow (DPH) wall system. The unique DPH wall system consists of interior and exterior wood panels that are installed with minimal blocking before the installation of insulation. The application is consistent with the compliance option procedures in Section 10-109 of the *Building Energy Efficiency Standards*.

California Energy Commission (CEC) staff believes the intent of the application is warranted, and the content of the BamCore proposed changes to the compliance software and documentation is appropriate.

Staff has solicited stakeholder comments and received several public comments during the review period. All comments received supported the DPH system, so no public workshop was held.

This final staff report represents CEC staff's review and recommendation for approval and finalization of the compliance tools and documentation needed to implement the dual-panel hollow wall exceptional method compliance option.

Keywords: California Energy Commission, *Building Energy Efficiency Standards*, California Building Energy Code Compliance — Residential, CBECC-Res, compliance software, BamCore, Prime Wall, dual panel hollow wall, DPH, wall system, laminated veneer bamboo, compliance option, exceptional method, Title 24, Part 6.

Please use the following citation for this report:

Shewmaker, Michael and Rob Hudler. 2020. *BamCore Prime Wall Exceptional Method Compliance Option*. California Energy Commission. CEC-400-2020-009.

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EXECUTIVE SUMMARY

BamCore, LLC has submitted an exceptional method compliance option application to the California Energy Commission (CEC) for a new innovative wall system product known as "Prime Wall." This application includes a request, and proposal, to make modifications to the California Building Energy Code Compliance – Residential (CBECC-Res) software to incorporate this new wall system technology that CEC staff is referring to more broadly as "dual-panel hollow (DPH) walls."

Dual-panel hollow walls, which includes products like the BamCore Prime Wall, is a wall system composed of two structural load bearing panels that form the interior and exterior of the wall assembly. These structural panels are fastened to wood framing at the top and bottom of the assembly and eliminate the need for traditional framing. Instead, these systems rely on minimum blocking to prevent bowing of the panels and result in extremely low framing factors. These low framing factors, in turn, mean there is minimal thermal bridging through the assembly, which leads to better performing wall assemblies than traditional framed wall construction.

After a lengthy review where CEC staff worked closely with the applicant, BamCore, LLC submitted an official/final application to the CEC in accordance with Section 10-109 of the *Building Energy Efficiency Standards* on September 26, 2019.

After reviewing the final application along with the supporting documentation, staff has found the application to be complete, has found the request warranted, and is recommending approval of this application.

CHAPTER 1: Introduction

This final staff report presents the California Energy Commission (CEC) staff's recommendation for approval of an exceptional method compliance option for the BamCore Prime Wall System, referred to more broadly as a "dual-panel hollow (DPH) wall system."

Compliance Option

Public Resources Code, Section 25402.1(b) requires the CEC to establish a formal process for certification of compliance options of new products, materials, or calculation methods. Section 10-109 of the *Building Energy Efficiency Standards,* provides this process, allowing the introduction of designs, materials, or devices that cannot be adequately modeled in the approved alternative calculation methods or are not appropriately accounted for in the approved compliance approaches.

The compliance options process enables new or additional products, materials, designs, or procedures to be used to demonstrate compliance for newly constructed buildings and additions and alterations to existing buildings. The compliance options process encourages market innovation and allows the CEC to respond to changes in building, design, construction, installation, and enforcement.

Exceptional Method Compliance Option Application for BamCore Prime Wall

The exceptional method compliance option application the CEC received from BamCore, LLC includes a request and proposal to modify the California Building Energy Code Compliance — Residential (CBECC-Res) software. This application is for incorporating a new type of wall assembly, referred to generically as "dual-panel hollow walls," into the standards. This type of dual-panel wall construction is unlike anything else available on the market. As a result, it is not able to be accurately modeled within the current CBECC-Res software.

The BamCore application contains a comprehensive proposal that details the exact changes that will need to be made to the CBECC-Res compliance software for the full thermal benefits of the dual-panel hollow wall to be realized. These changes are discussed in the Proposed Modifications and Guidance for Verification section of this report.

Dual Panel Hollow (DPH) Walls

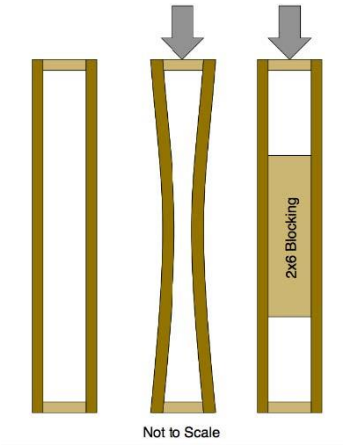
What Is a Dual-Panel Hollow (DPH) Wall?

A DPH wall is a unique type of wall construction that uses parallel interior and exterior load-bearing panels to provide the structural strength for the wall assembly, as well as some thermal benefit. DPH walls can be constructed using any type of wood structural panel.[1] These

1 From Title 24, Part 2, Section 202 definitions:
Wood structural panel. A panel manufactured from veneers, wood strands or wafers or a combination of

panels are then fastened to wood top and bottom plates and use minimal vertical blocking that does not span the full height of the wall. As shown in Figure 1, the blocking itself is not load bearing and is there strictly to connect the two panels and to prevent them from bowing.

Figure 1: Partial Blocking



Source: BamCore LLC - Exceptional Method Application
(Section 2, Page 3)

What Is a BamCore Prime Wall?

The BamCore Prime Wall is a specific type of DPH wall system that uses laminated veneer bamboo panels for the interior and exterior faces of the wall assembly. As shown in Figure 2, the panels consist of four ¼-inch-thick laminated veneer bamboo layers covered with ⅛-inch Douglas fir veneers on both faces, resulting in a nominal thickness of 1¼ inches. These panels are then joined together using wood top/bottom plates with minimal vertical blocking that does not span the entire height of the wall and fastened together using half-lap joints as shown in Figure 3.

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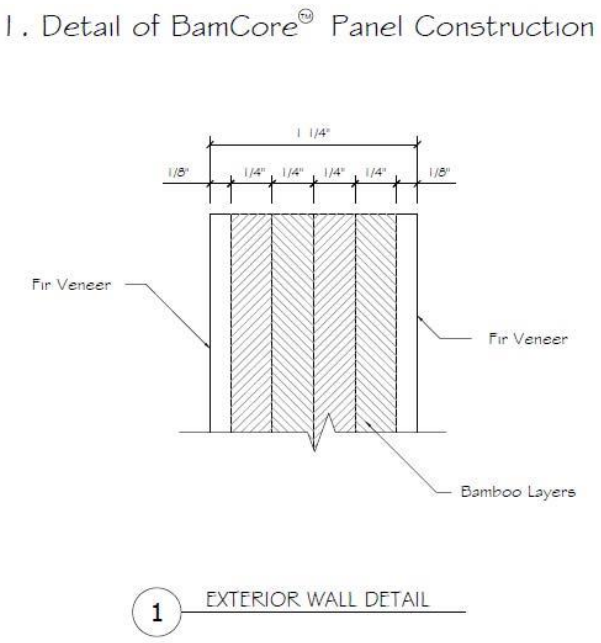
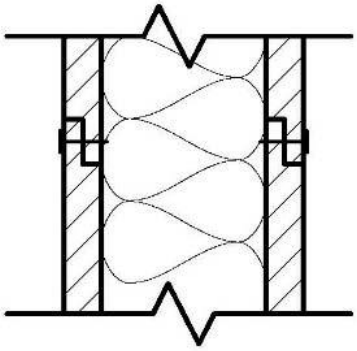
veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:
Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive;
Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive; or
Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

Figure 2: BamCore Prime Wall Panel Construction



Source: BamCore LLC - Exceptional Method Application
(Section 2, Page 4)

Figure 3: Half-lap Joints



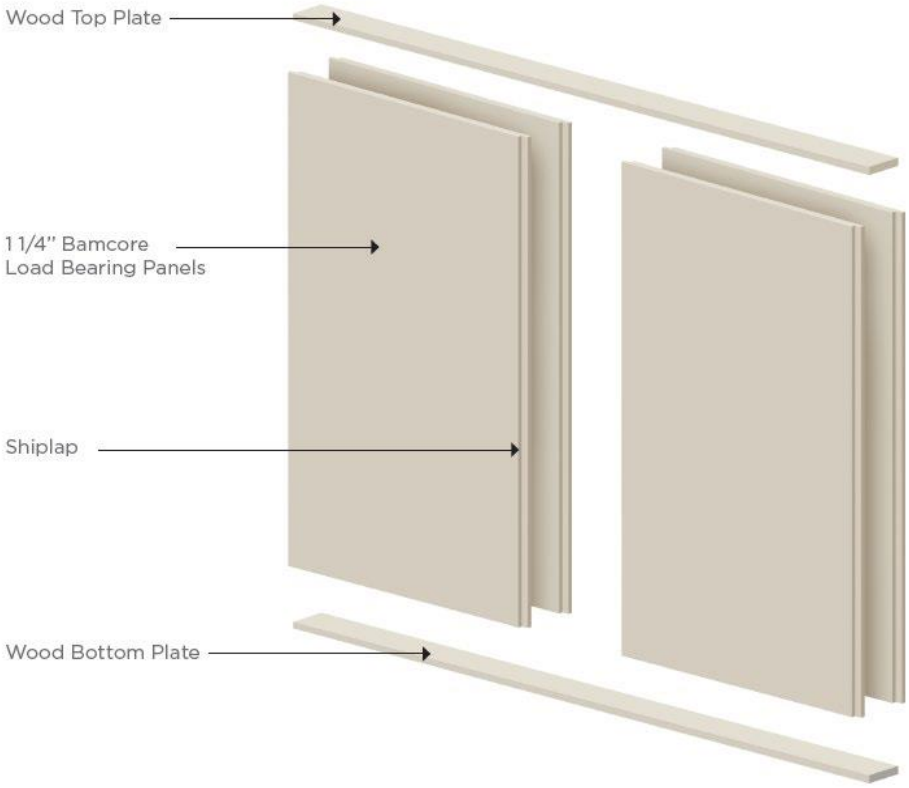
Source: BamCore LLC - Exceptional Method Application
(Section 2, Page 5)

The BamCore Prime Wall may be designed using 2x6, 2x8, 2x10, or 2x12 top and bottom plates, resulting in outer wall dimensions from 8 inches to 13¾ inches. These dimensions result in a cavity ranging from 5½ inches to 11¼ inches that can then be pumped full of insulation achieving a total assembly R-value[2] from R-22 to R-40. However, this value will vary

2 From Title 24, Part 6, Section 100.1(b) definitions:
R-value is the measure of thermal resistance of insulation or any material or building component expressed in $ft^2 \cdot hr \cdot °F/Btu$.

depending on the type of insulation used and the thickness and density to which it is installed. An example of a typical Prime Wall assembly is shown below in Figure 4.

Figure 4: BamCore Prime Wall Typical Assembly



Source: BamCore LLC - Exceptional Method Application
(Section 2, Page 4)

For a more detailed description of the BamCore Prime Wall system, including illustrations and photos, please refer to Section 2 of the application.

Problems with Current Modeling

While this technology is relatively new, the BamCore Prime Wall system specifically has been available on the market for several years, and up until now BamCore has used a workaround to model this type of system in the compliance software. This workaround required users to model these types of products as a traditional wood-framed wall with an equivalent U-factor[3]. It was then up to the user to prove to the local building official(s) the equivalency between the U-factor modeled and that of the actual wall system being installed.

The problem with this workaround is that it does not accurately capture the full energy benefit

3 From Title 24, Part 6, Section 100.1(b) definitions:
U-factor is the overall coefficient of thermal transmittance of a fenestration, wall, floor, or roof/ceiling component, in Btu/hr·ft^2·°F, including air film resistance at both surfaces.

provided by a DPH wall. The workaround fails to consider the reduced framing factor, as well as the thermal benefit provided by the heat capacity of the structural panels themselves.

Supporting Documentation and Calculations

To support the proposed default values, the application provides test results for the Prime Wall laminated veneer bamboo panels from certified laboratories as justification, as well as certified test results for complete wall assemblies to substantiate the overall values calculated using the components. A summary of these calculations and reports is included below.

Framing Factor Calculation

The basis of the calculation for the 6.65 percent framing factor proposed for dual-panel hollow walls came from the *Characterization of Framing Factors for Low-Rise Residential Building Envelopes in California*.[4] The November 2001 report prepared for the CEC by Enermodal Engineering Limited in association with Chitwood Energy Management is the basis of the framing factor assumptions for the compliance software. A copy of this report was included within the appendices of the application.

From this report, the applicant used the findings to apply an assumption for window and door percentages per wall area and applied them to its wall system to calculate a framing factor. For more information please consult the application, Section 3, Subsection A, Item 3 (Typical framing spacing — vertical and horizontal, framing factors).

U-Factor Calculation

While a dual-panel hollow wall may be constructed in various final configurations, to give an idea of the thermal performance provided by the BamCore Prime Wall system, the application includes a U-factor calculation for an example assembly. This example assembly assumed 2x6 top/bottom plates, with loose-fill insulation installed in the 5½-inch cavity equal to R-19.25, resulting in an assembly U-factor of 0.045. A recreation of this calculation (Figure 1) can be found below in Section 3 of this report.

This calculation was done in accordance with the assumptions found in Reference Appendices JA4, Table 4.3.1 (U-Factors for Wood-Framed Walls). For more information, please consult Section 4 of the application.

DrJ Engineering Technical Evaluation Report (TER)

To show compliance with California Building Code, as well as international residential and commercial building codes, as a structural panel, the application includes a technical evaluation report issued by DrJ Engineering. This report shows the key engineering metrics including comprehensive strength, fire resistance, infiltration rate, and thermal performance. A copy of this report was included within the appendices of the application.

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4 Enermodal Engineering Limited. November 2001. *Characterization of Framing Factors for Low-Rise Residential Building Envelopes in California*. California Energy Commission. Publication Number: P500-02-002.

Intertek Test Reports

To support these metrics and the application proposal for default values summarized in the Proposed Default Values section of this report by including test results performed by Intertek for the following ASTM tests:

- ASTM E283-04(2012) – Standard Test Method for Determining Rate of Air Leakage Through Exterior Window, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- ASTM C1363-2011 – Standard Test Method for the Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
- ASTM C518-17 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

For more information and a copy of these reports, please consult the appendices of the application.

Thermal Conductivity of Engineered Bamboo

In support of the specific heat proposed for the BamCore Prime Wall laminated veneer bamboo panels, the application includes a scholarly article titled "Thermal Conductivity of Engineered Bamboo Composites."[5] This article shows that for the given density of the BamCore Prime Wall laminated veneer bamboo panel the specific heat for Guadua and Moso bamboo ranges from 1.75 joules per kilogram kelvin (J/kg·K) to 1.80 J/kg·K.

While there was no specific study completed for the BamCore Prime Wall Panel the applicant has instead proposed to use the more conservative value of 1.75 J/kg·K for the specific heat of Guadua bamboo[6]. Guadua bamboo is also one of the primary bamboo species used by BamCore. For more information, please consult Section 3 of the application, and a copy of the article is in the appendices.

Proposed Modifications and Guidance for Verification

The application received includes a complete proposal for modifications to the CBECC-Res compliance software. These changes include adding a new wall construction type with the appropriate framing factor, adding two layers to the construction assembly user input screen for the interior and exterior structural panels, and adding new materials into the material library of the software. A summary of staff's proposals for the default values to be programmed into the compliance software is discussed in the Proposed Default Values section

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5 Shah, Darshil U., Maximillian C. D. Bock, Helen Mulligan, and Michael H. Ramage. December 2015. "Thermal Conductivity of Engineered Bamboo Composites." *Journal of Materials Science* 51, 2991-3002 (2016). https://doi.org/10.1007/s10853-015-9610-z.

6 Guadua bamboo (*Guadua angustifolia)* is a species of bamboo that originates from the tropical forests of Central and South America and is widely considered to be the world's strongest bamboo species. With a tensile strength greater than steal and an extraordinary load bearing capacity, Guadua bamboo has been used in various building applications in South America for decades; including construction and in engineered laminated panels.

of this report.

While there were some initial concerns from CEC staff over the verification for quality insulation installation (QII), a summary of which is discussed below in the Protocols for HERS Verification section of this report, staff and the applicant agreed where additional guidance will be provided by the manufacturer. To help insulation installers and Home Energy Rating System (HERS) Raters[7] achieve/verify compliance with the Residential Appendices 3.5 (RA3.5) QII protocols, BamCore has developed its own insulation guidelines in the form of a technical bulletin to be used in conjunction with the RA3.5 protocols, which still apply without any modifications.

A copy of the BamCore technical bulletin for its Prime Wall system was included within the appendices of the application.

Purpose of Exceptional Method Compliance Option for Dual-Panel Hollow (DPH) Wall System

Once approved, this exceptional method compliance option would allow DPH walls to be modeled accurately using the performance compliance software instead of relying on a workaround that does not accurately represent the unique attributes of the wall system. This allowance will enable the full benefit of the DPH wall to be realized by modeling the proper materials, framing factor, and layers.

7 From Title 24, Part 1, Section 10-102 definitions:
HERS Rater is a person who has been trained, tested, and certified by a HERS Provider to perform the field verification and diagnostic testing required for demonstrating compliance with the Part 6 as described in Title 20, Chapter 4, Article 8, Section 1670(i).

CHAPTER 2:
Staff Evaluation

After a careful review of the data presented within the application, staff concludes that the DPH wall system can have acceptable thermal performance. Furthermore, there are additional energy benefits to be realized from the heat capacity of the BamCore Prime Wall panels that should be captured within the compliance software program. These benefits include reduced heating or cooling loads, or both, resulting in increased thermal comfort for the occupants.

As noted, there were some initial concerns by CEC staff regarding how a DPH wall would comply with the RA3.5 QII protocols. However, after much back and forth between CEC staff and the applicant, CEC staff feels that it has adequately addressed these concerns in BamCore's final application. A summary of this is included below in Protocols for HERS Verification.

Review of Dual-Panel Hollow (DPH) Wall System

Protocols for HERS Verification

With QII now a part of the prescriptive package under the 2019 *Building Energy Efficiency Standards*, and to ensure proper credit would be applied appropriately, staff wanted to be sure that a DPH wall could comply with the QII protocols.

The BamCore Prime Wall system construction is unique in that it is installed at the building site as a single exterior wall, allowing plumbing and electrical lines and batt/blanket insulation to be installed before the placement of the interior panel. However, in the case of loose-fill insulation, which is most often used, the insulation would be pumped into the cavity after the installation of the interior panel.

In typical wood-framed construction, loose-fill insulation is installed using one of two techniques: (1) a fabric or membrane is stapled to the living-space side of the framing, and insulation is then blown through a hole cut by the installer, or (2) an adhesive is added to the loose-fill material allowing the insulation to remain in place until the interior drywall is installed. This allows the HERS Rater to visually and physically assess the insulation before installing the interior wall unit (for example, drywall or sheetrock). Where a dual-panel hollow wall would differ is that rather than using a membrane for the inner containment barrier during installation, it relies on the interior structural panel to contain the insulation.

Because this interior panel is rigid, opaque, and in place before the installation of loose-fill insulation, staff had concerns over how the R-value density measure verification of RA3.5.4.1.2 would be met. To address these concerns, BamCore has provided guidance in its technical bulletin for the cutting of density sample holes so these measurements can still take place. The HERS Rater will still be able to randomly select a minimum of six points from which to perform a density sample test, and then the necessary inspection holes can be cut on site using an off-the-shelf hole saw and later patched over.

Moreover, staff had concerns over how to assess whether the entire cavity has been filled and ensure that the installation would meet the requirements of RA3.5.4.2. To address this concern, BamCore will provide predrilled inspection holes at regular intervals to aid in the HERS verification. It has committed to providing 1-inch access holes within 2 inches of the top/bottom edge of the panel for every other 4-foot-wide section of panel to ensure the entire cavity has been filled. A HERS Rater will then be able to come through, open these predrilled access hatches, and ensure that the insulation has been installed evenly throughout the cavity by probing with a finger or nonmetal probe.

Public Review of Compliance Option

In accordance with Section 10-110(b) of the *Building Energy Efficiency Standards,* the DPH wall compliance option was posted for public review and comment on February 12, 2020. All comments received during this period were in full support of approval for the compliance option. As a result, no workshop was held for this compliance option.

CHAPTER 3:
Proposed Default Values

For this exceptional method compliance option, staff purposes that DPH walls be incorporated into the performance compliance software, CBECC-Res, for showing compliance with the *Building Energy Efficiency Standards*. In the application, BamCore has provided enough evidence and sound justification of the physical and thermal properties claimed in its report.

Staff proposes that DPH walls be incorporated into CBECC-Res with the following default physical and thermal characteristics:

- Framing Factor = 6.65%
- BamCore Prime Panel Average Thickness (inches) = 1.28 inches
- BamCore Prime Panel Material Average Thermal Resistance = R-1.735[8]
    - Note: This value is the average of two tests: one conducted at 35°F, and the other conducted at 75°F.
- BamCore Prime Panel Material Average Thermal Resistance per Inch = R-1.355/in[9]
    - Note: This value is the average of two tests: one conducted at 35°F, and the other conducted at 75°F.
- BamCore Prime Panel Material Average Density = 42.4 lb./ft^3 [10]
- Bamboo Material Average Specific Heat = 0.418 Btu/lb.·°F (1.75 J/g·K)[11]
- BamCore Prime Wall Air Permeability: 0.0003 cfm/ft^2 infiltration; 0.0002 cfm/ft^2 exfiltration (at 1.57 psf)[12]

As an example of the thermal performance level achieved by a default DPH wall, an example U-factor calculation is included below. This example assembly is consistent with Joint Appendices 4.3 (JA4.3), Table 4.3.1 (U-factors of Wood Framed Walls)[13].

- U-factor (Btu/hr·ft2·°F) = 0.045
- R-value (hr·ft2·°F/Btu) = R-22.2
    - Blocking = 2x6 (5.5-inch cavity)
    - Insulation = R-19.25 (Dense pack cellulose: R-3.5/inch * 5.5 inches)
    - Total wall thickness (inches) = 8.935 inches

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8 Intertek. August 2018. *Heat Flow Meter Thermal Transmission Test Report*. Report Number: I6638.01-116-25.
9 Ibid.
10 Ibid.
11 Shah, Darshil U., Maximillian C. D. Bock, Helen Mulligan, and Michael H. Ramage. December 2015. "Thermal Conductivity of Engineered Bamboo Composites." *Journal of Materials Science* 51, 2991-3002 (2016). https://doi.org/10.1007/s10853-015-9610-z.
12 Intertek. July 2018. *BamCore, LLC Test Report – ASTM E283 Testing on High Framing Factor, Wall Assembly #2*. Report Number: I5420.01-109-44.
13 California Energy Commission staff. December 2018. "Table 4.3.1 – U-factors of Wood Framed Walls." *2019 Reference Appendices*.California Energy Commission. Publication number: CEC-400-2018-021-CMF. https://ww2.energy.ca.gov/2018publications/CEC-400-2018-021/CEC-400-2018-021-CMF.pdf.

Table 1:
U-Factor Calculation for Dual-Panel Hollow (DPH) Wall

	Assembly Type: A1				R-values	
	Framing Material: Wood				Cavity Path	Framing Path
	Layer	**Assembly Component**	**Thickness (in.)**	**R-value/in.**	**Cavity R (R_C)**	**Framing R (R_F)**
1	Air film	Outside air film[1]			0.17	0.17
2	Siding	3/8 in. 2-coat stucco[1]	0.375		0.08	0.08
3	Sheathing insulation	None	0	0	0	0
4	Paper	Building paper (felt)[1]			0.06	0.06
5	Structural panel	1.25 in. bamboo laminate[2]	1.28	1.355	1.7344	1.7344
6	Cavity insulation	Dense pack cellulose	5.5	3.5	19.25	
7	Framing	2x6 Douglas Fir	5.5	0.99		5.445
8	Structural panel	1.25 in. bamboo laminate[2]	1.28	1.355	1.7344	1.7344
9	Interior finish	Gypsum board[1]	0.5		0.45	0.45
10	Air Film	Inside air flim[1]			0.68	0.68
		Total wall thickness (in.):	8.935	**Subtotal R:**	24.1588	10.3538
	Framing Factor (FF%):	6.65 %			Assembly U-factor:	0.045
					Assembly R-value:	22.2
	$1/R_C$	0.041392784				
	1-FF%/100	0.9335				
	$1/R_F$	0.096582897				
	FF%	0.0665				
	Notes:	[1]Default values from JA4.3 Assumptions				
		[2]Nominal thickness				

Source: California Energy Commission Staff

CHAPTER 4:
Conclusion

The application for an exceptional method compliance option submitted by BamCore, LLC is warranted and complete. Staff recommends that the CEC approve the DPH wall compliance option and accompanying proposed modifications.

Glossary

CBECC-Res	California Building Energy Code Compliance Software - Residential
CEC	California Energy Commission
DPH	Dual-panel hollow
HERS	Home Energy Rating System
JA	Joint Appendices
QII	Quality Insulation Installation
RA	Reference Appendices
SIPs	Structural Insulated Panels

APPENDIX A:
Changes to Compliance Manuals and Documents

2019 Residential Compliance Manual

Section 3.7.5 "Dual-Panel Hollow (DPH) Walls"

Dual-panel hollow (DPH) walls are a type of structural wall assembly that at first appear similar to structural insulated panels (SIPs) but are different. They are more like a typical framed wall with extremely low framing factors. They consist of two parallel layers of laminated bamboo panels (or other substrate, like wood), an exterior panel, and an interior panel. At a typical thickness of 1¼ inches, each wall component is extremely strong and structurally stable. When delivered to the building site, they remove the need for most full-length, full-width studs and door and window headers, thereby dramatically reducing the amount of framing and allowing for more effective insulation coverage.

DPH walls are assembled in pieces. The exterior panel is set in place first and face-nailed to the bottom plate. All the electrical and plumbing can then be attached to the inside surface of the exterior panel, and insulation, such as batts or blankets, can also be installed. When the interior panel is attached, the top plate is installed, and loose-fill insulation can be blown into the empty wall cavity. Because various types of loose fill insulation have different densities and R-values per inch, it is important to model the correct one and make sure it is installed properly. DPH construction only apply to wall assemblies, not floors or roofs/ceilings. Batt and blanket insulation can also be used with a DPH wall assembly, provided proper fastening and support techniques are used prior to the interior panel being set in place.

The panels are precisely cut in a factory and shipped to the job site ready for assembly. Due to the extremely tight tolerances and overlapping joints, caulking, and sealing is not required where the panels are joined using a ship lap joint, unless the project's registered design professional (RDP) directs otherwise. Sealing is still required where the outer panel meets the top and bottom plates, where the inner panel meets the top plate and any other penetrations in the outer panel. The bamboo panels alone qualify as air barriers. The cavity between the panels can range from 5½ inches to as much as 11¼ inches wide, allowing cavity R-values from R-19 up to R-48. Assembly U-factors for various wall widths and insulation types can be calculated in the compliance software.

DPH walls are also eligible for quality insulation installation (QII) credits. The manufacturer shall provide specific instructions for how to apply the RA3.5 protocols and shall provide the means to take the minimum number of density samples to ensure compliance with the QII protocols.

2019 Residential Compliance Documents

CF2R-ENV-03 – No changes

CF2R-ENV-21 – Add a Section L, "Special Requirements for Dual-Panel Hollow (DPH) Wall," with similar wording to Sections J and K, or combine all three sections (Sections J, K, and L).

J. Special Requirements for SIPs	
01	SIPs are considered an air barrier when properly sealed at top, bottom, sides and all penetrations.
02	Air barrier is continuous across all surfaces, including between SIPs and non-SIP sections.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

K. Special Requirements for ICF	
01	ICF sections are considered an air barrier when properly sealed at top, bottom, sides and all penetrations.
02	Air barrier is continuous across all surfaces, including between ICF and non-ICF sections.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

CF2R-ENV-22 – Item D01 conflicts with DPH Wall, but it also conflicts with SIPs and ICFs. Add "Exception: Dual Panel Hollow (DPH) Wall, ICF and SIPs."

D. Wall Adjacent to Unconditioned Space	
01	Insulation quality was verified prior to the installation of the interior air barrier (typically gypsum board).

CF3R-ENV-21 – Add a Section L, "Special Requirements for Dual Panel Hollow (DPH) Wall," with similar wording to Sections J and K, or combine all three sections (Sections J, K, and L). Similar to suggested change for CF2R-ENV-21.

J. Special Requirements for SIPs		
01	SIPs are considered an air barrier when properly sealed at top, bottom, sides and all penetrations.	
02	Air barrier is continuous across all surfaces, including between SIPs and non-SIP sections.	
03	Verification Status	• Pass - all applicable requirements are met; or • Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or • All N/A - This entire table is not applicable.
04	Correction Notes	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Correction Notes.		

K. Special Requirements for ICF		
01	ICF sections are considered an air barrier when properly sealed at top, bottom, sides and all penetrations.	
02	Air barrier is continuous across all surfaces, including between ICF and non-ICF sections.	
03	Verification Status	• Pass - all applicable requirements are met; or • Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or • All N/A - This entire table is not applicable.
04	Correction Notes	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Correction Notes.		

CF3R-ENV-22 – Item D01 conflicts with DPH wall, but it also conflicts with SIPs and ICFs. Add "Exception: Dual-Panel Hollow (DPH) Wall, ICF and SIPs". Similar to suggested change for CF2R-ENV-22.

D. Wall Adjacent to Unconditioned Space	
01	Insulation quality was verified prior to the installation of the interior air barrier (typically gypsum board).