



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

1. State Building Code Amended:

X International Residential Code

Section(s): BL101, BL102, BL103, BL104, BL105, BL106, BL107, BL108

Title: Appendix BL - Hemp-Lime (Hempcrete) Construction (new appendix)

2. Proponent Name (Specific local government, organization or individual):

Proponent: Minority Hemp Builders Association

Title: 501(c)3 non-profit organization

Date: 8/17/2024

3. Designated Contact Person:

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4. Proposed Code Amendment. New amendment needed

Code(s) IRC Section(s) Appendices BL

Enforceable code language must be used.

Amend section to read as follows: Adopt statewide the following 2024 IRC appendices:
BL (new appendix),

5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.

We are encouraging SBCC to adopt the following IRC appendices for the 2024 code adoption cycle:

Appendix BL - Hemp-Lime (Hempcrete) Construction [new appendix in the 2024 IRC]

Each one describes and regulates an alternative non structural wall system, all of which use natural materials in various ways. In the state of Washington there are many contractors, small businesses, and individual home owners who would benefit from more accessibility to be able to build with these alternative means of construction especially from regionally sourced green materials.

This system can help address the increasing need to reduce our buildings' negative impacts on the environment, including the global climate, and address the impacts of a changing climate on buildings, including increased firestorms.

Regional supply opportunity; made in Washington for Washingtonians

Appendix BL Hemp-Lime (Hempcrete) Construction

The provisions contained in this appendix are adoption for use in the State of Washington
User notes:

About this appendix:

Hemplime, commonly referred to as hempcrete, is a nonstructural, bio-composite insulation infill material composed of hemp hurd and a lime based binder. The benefits of hemplime include high thermal performance, low embodied carbon emissions in production, high carbon sequestration in service, healthy living environments and high fire resistance. These benefits, along with the 2018 United States legalization of hemp as a commercial crop, are driving rapid growth in interest and projects across the US.

Section BL101 General

BL101.1 Scope.

This appendix shall govern the use of hemplime as a nonstructural building material and wall infill system. *Townhouses in Seismic Design Categories D0, D1 and D2 and one and two family dwellings in Seismic Design Categories D0, D1 and D2 shall require*

an *approved* engineered design by a *registered design professional* in accordance with Section R301.1.3.

Section BL102 Definitions

BL102.1 General.

The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

BINDER.

The material that binds the *hemp hurd* in a *hemplime* mix.

BONDING COAT.

The initial thin layer of binder-rich granulated *plaster* used in *lined applications* of *hemplime* construction to ensure adhesive and/or mechanical bonding. Also known as “gobetis.”

CASTING.

Placing *hemplime* into forms.

CAST-IN-PLACE.

Installation of *hemplime* mix by hand or by spraying into forms in its permanent location.

CLAY.

Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) and having the characteristics of high dry strength and medium to high plasticity, used *alone* or other component materials in *clay plaster*.

CLAY SUBSOIL.

Subsoil sourced directly from the earth, containing *no* clay, sand and silt, and containing not more than trace amounts of organic matter.

FIBER CLUMPS.

Long fibers that are attached to hemp hurd, or for other reasons, cause clumping of fibrous balls when agitated.

FINISH.

Exposed surface material on the interior or exterior face of a *hemplime* infill wall.

FORM.

The material into which *hemplime* infill, panels or blocks are cast.

FORMWORK.

The system of forms, their bracing and fasteners assembled for casting *hemplime* infill.

HAND-CAST.

Hemplime infill cast by placing *hemplime* mix into formwork and evenly tamping by hand or with a tool.

HEMP.

A class of the *Cannabis sativa* plant grown for industrial purposes in which the concentration of total delta9 tetrahydrocannabinol (THC) in the flowering tops is equal to or less than the regulated maximum level established by authorities having jurisdiction.

HEMP HURD.

The chopped woody core of the stalks of the hemp plant, stripped of its surrounding *hemps* fibers. Also known as "*hemps*shiv" or "*hemps*hive."

HEMPCRETE.

Common usage term for *hemplime*.

HEMP-LIME.

A bio-aggregate composite consisting of *hemphurd* and a lime based *binder*. Also known as "*hemps*crete"

INFILL.

Hemplime placed between or around the structural or nonstructural framing of a building as insulation, thermal mass and a substrate for finish.

LIFT.

A horizontal layer of *hemplime* infill.

LIME.

Lime is composed of calcium hydroxide [$Ca(OH)_2$], including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime.

LINED APPLICATION.

Installation of a vertical *hemplime* layer, lining a masonry or concrete wall.

NATURAL CEMENT.

Hydraulic cement made from naturally occurring limestone.

NONBEARING.

Not bearing the weight of the building other than the weight of *hemplime* infill and its finish.

PLASTER.

Lime, clay, clay-lime or *hemplime plaster* as described in Section BL104.3, applied to the interior or exterior face of *hemplime* walls.

POZZOLAN.

A siliceous or alumino-siliceous material that, when finely divided and combined with hydrated lime in the presence of water, forms new chemical compounds with cementitious properties.

PRECAST.

Blocks or panels of *hemplime* formed and cured before installation.

REED MAT.

A mat consisting of reed, cane, bamboo or other similar plant material.

SCREEDING.

Removal of excess material to form a planar surface.

SPRAY-APPLIED.

A method of mechanical projection of *hemplime* applied onto or into a form using compressed air.

TADELAKT.

A lime-plaster which is compressed, polished and treated with ~~base~~ soap to make it water repellent.

UNIT WALL WEIGHT.

The *unit wall weight* is the calculated weight of a-foot by 1-foot (305 mm × 305 mm) section of wall surface area times the full wall thickness, including finishes. ~~The~~ *unit wall weight* is the sum of the weight of each constituent material times its volume, expressed as pounds per square foot (psf).

VOID.

Any space in a *hemplime* wall greater than 1/4 inch (6 mm) wide, 2 inches (51 mm) long and 2 inches (51 mm) deep.

Section BL103 Hemp-Lime Construction

BL103.1 General.

Hemplime construction shall be limited to the nonstructural, solid infill mix of ~~hemplime~~ *hemplime* and its ~~binder~~ between or around structural and nonstructural wall framing. *Hemplime* infill shall have a density ranging from 12.5 lb/ft³ to 25 lb/ft³ (200 kg/m³ to 400 kg/m³). *Hemplime* walls shall be designed and constructed in accordance with Section BL103 and with Figures BL103.1(1) through BL103.1(4) or an *approved* alternative design.

FIGURE BL103.1(1)
TYPICAL HEMP -LIME WITH INTERIOR STUD FRAMING

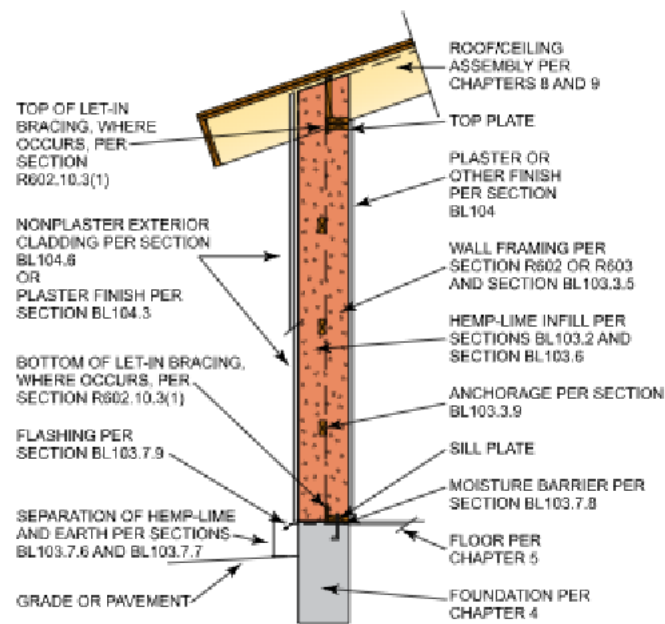


FIGURE BL103.1(2)
TYPICAL HEMP -LIME WITH CENTER STUD FRAMING

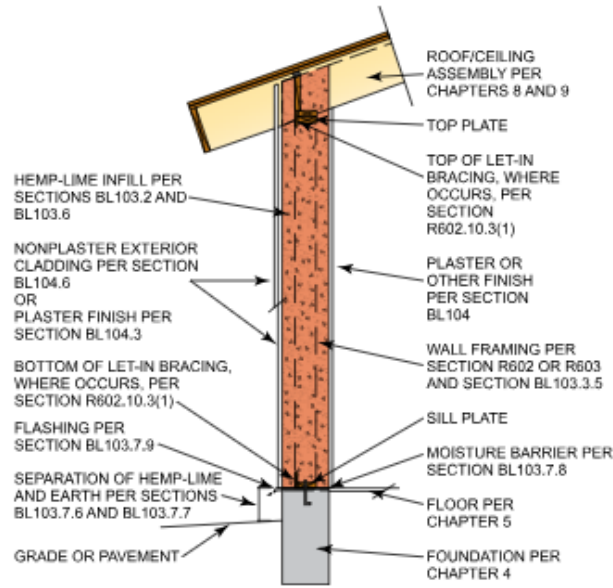


FIGURE BL103.1(3)
TYPICAL HEMP -LIME WITH EXTERIOR STUD FRAMING

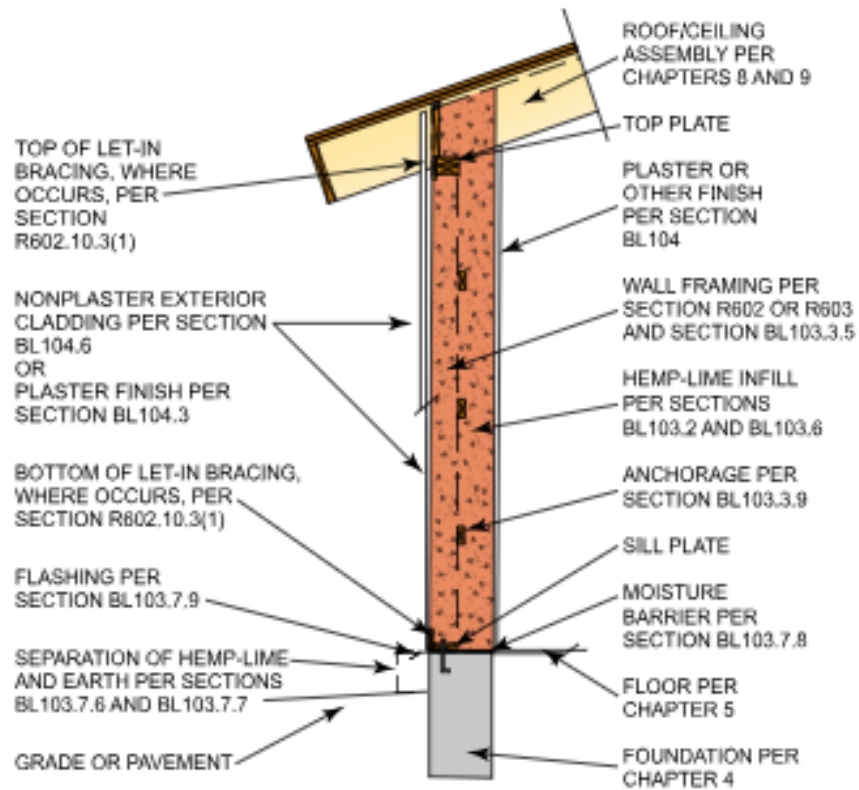
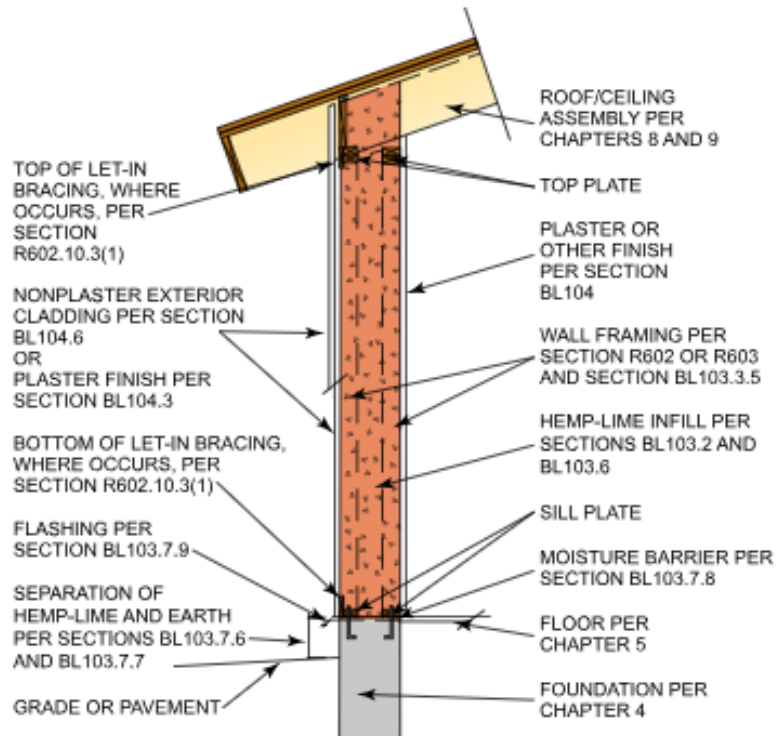


FIGURE BL103.1(4)
TYPICAL HEMP -LIME WITH DOUBLE STUD WALL FRAMING



BL103.2 Materials.

Materials to be used in *hemplime* construction shall be in accordance with Sections BL103.2 through BL103.2.3.

BL103.2.1 Hemp hurd.

Hemp hurd shall match the specifications of the *approved* test samples in Sections BL106.3 and BL107.1. *Hemp hurd* shall be substantially free from dust and *fiber clumps* such that the installed *hemplime* maintains its integrity.

BL103.2.2 Binders.

Acceptable binders, singular or in combination, include hydraulic lime, hydrated lime, *pozzolans*, *natural cements* or other binders that match the specification of the *approved* test samples in Sections BL106.3 and BL107.1.

BL103.2.3 Water and water additives.

Water and any water additives shall match the specifications of the *approved* test samples in Sections BL106.3 and BL107.1.

BL103.3 Structure.

The structure of buildings using *hemplime* infill shall be in accordance with this code and Sections BL103.3.1 through BL103.3.9 or with an *approved* engineered design by a *registered design professional*.

BL103.3.1 Limitations and requirements for buildings using *hemplime* infill.

Buildings using *hemplime* infill shall be subject to the following limitations and requirements:

1. Number of *stories* not more than one *story above grade plane*
2. The *building height* shall not be more than 25 feet (7620 mm).
3. Braced wall panel lengths: in accordance with Sections R602.10.3 and BL103.3.2.
4. *Unit wall weight* *Hemplime* walls shall not exceed an average *unit wall weight* of 65 psf (317 kg/m²).

BL103.3.2 Bracing.

Bracing for buildings with *hemplime* infill in *Seismic Design Categories* B and C shall be in accordance with Section R602.10 and in accordance with the following. Walls with *hemplime* infill shall use Method LIB and shall not be braced with solid sheathing. *Hemplime* infill walls utilizing Method LIB shall not require *gypsum board* to be installed and shall use the minimum braced wall lengths listed in Section R602.10. Adjustment factors in Table R602.10.3(4) shall be used as applicable. Alternatively, *hemplime* infill walls shall comply with Section R301.1. Walls or wall sections without *hemplime* infill shall be permitted to use any bracing method allowed in Section R602.10.

BL103.3.3 Connection of light-frame walls to hemp-lime walls.

Light-frame walls perpendicular to, or at an angle to *hemp-lime* wall assembly shall be fastened to the *hemp-lime* wall in accordance with Section R602 or R603.

BL103.3.4 Hemp-lime thickness.

Hemp-lime infill shall be not less than 3 inches (76 mm) thick between face of framing and *finish*. Maximum *hemp-lime* wall thickness is limited by the average *unit wall weight* limit of 65 psf (317 kg/m²) in Section BL103.3.1, Item 4.

BL103.3.5 Contact with structural metal.

Structural metal members and components in contact with *hemp-lime* shall be protected in accordance with Section BL103.4.

BL103.3.6 Contact with wood members.

Hemp-lime shall be permitted to be in contact with untreated wood members.

BL103.3.7 Openings in walls.

Doors, windows and similar openings in *hemp-lime* walls shall be in accordance with the following:

1. Rough framing for doors and windows shall be part of, or be fastened to, the wall framing in accordance with this code.
2. An *approved water-resistive barrier* shall be installed at openings in *hemp-lime* walls in accordance with Sections BL103.7.4 and BL104.5.1.
3. Header size and their maximum span above openings in bearing walls with *hemp-lime* infill shall be determined with Tables R602.7(1) and BL103.3.7 or an *approved design* by a *registered design professional*.
4. Cast-in-place *hemp-lime* over and overhanging the face of a header more than 3 inches (76 mm) shall require an *approved design* of its support by a *registered design professional*.
5. *Hemp-lime* blocks overhanging headers shall require an *approved design* of their support by a *registered design professional*.

TABLE BL103.3.7
ALLOWABLE HEADER SPAN MULTIPLIER ^a

WALL HEIGHT ABOVE HEADER	UNIT WALL WEIGHT (psf)			
	15	30	45	65
1'-0"	1.00	1.00	1.00	1.00
1'-6"	1.00	1.00	0.90	0.90
2'-0"	1.00	0.90	0.90	0.85
2'-6"	1.00	0.90	0.90	0.85
3'-0"	1.00	0.90	0.90	0.80

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 4.882 kg/m².

- a. Multiply the maximum allowable spans from Table R602.7(1) by the applicable factor to determine the adjusted maximum allowable header span.

BL103.3.8 Voids.

Void shall be filled with *hemplime* or other *approved* material before application of *finish*.

BL103.3.9 Anchorage of hemplime.

Hemplime for interior and exterior stud walls shall be anchored or shall be in accordance with an *approved* design by a *registered design professional*. Horizontal anchorage rails shall be installed at not more than 24 inches (610 mm) on center and in accordance with *Figures* BL103.1(1) and BL103.1(3). Horizontal anchorage rails shall be no less than 1 inch by 2 inches (25 mm by 51 mm). Anchorage rails shall be wood, metal per *Section* BL103.4, or other *approved* material. Anchorage rails should be attached to the side of the stud facing the interior of the wall with one 8d box nail to each stud and run the entire length of the wall.

BL103.4 Contact with metal.

Metal in contact with *hemplime* shall be stainless steel or primed and painted with a coating in accordance with *Section* BL103.4.1.

BL103.4.1 Protective coatings.

Metal shall be painted with an epoxy, oil, bituminous paint or other approved coating. Waterbased paints shall not be used.

Exception: Heads of pneumatically driven hot dip galvanized nails.

BL103.5 Mechanical, electrical and plumbing in hemplime infill.

Electrical and telecommunication wiring, panels and boxes, mechanical ducts, plumbing pipes and other mechanical, electrical and plumbing components in or in contact with *hemplime* infill shall be isolated in sleeves, pipes, conduits or tubing made of plastic, or of metal in accordance with *Section* BL103.4, or separated from *hemplime* with an *approved* alkaline resistant material.

BL103.6 Hemp-lime installation methods.

Hemplime shall be installed in accordance with *Sections* BL103.6.1 and BL103.6.2, and one of *Sections* BL103.6.3 through BL103.6.7.

BL103.6.1 Mix and mixing.

The materials and ratio of *hemp hur* to *binder* to water shall match the specifications of the *approved* test samples in *Sections* BL106.3 and BL107.1. The water-to-*binder* ratio shall be not less than 1:1 and not greater than 2:1 by weight or by *binder* manufacturer's recommendations. The *hemp hur* and *binder* and water shall be thoroughly and uniformly mixed by manual or mechanical means.

BL103.6.2 Formwork for hand-cast and spray-applied methods.

Forms shall be removable or permanent and shall not deform under the lateral pressure of the installed *wemplime*.

BL103.6.2.1 Permanent forms.

Permanent forms shall be permitted to be installed on only one side. Permanent forms shall be *reed mats* or other approved materials with an open weave. Sheet materials shall not be used as permanent forms. Permanent forms remain after curing *finish* or substrate for another *finish*.

Exception: Permanent forms of any material shall be permitted at the jambs, heads and sills of openings.

BL103.6.2.2 Removable forms.

Removable forms shall be removed within 24 hours after *hemplime* placement or per the binder manufacturer's specifications.

Exception: Removable forms temporarily supporting *hemplime* infill above wall openings shall not be removed for a minimum of 3 days or per binder manufacturer's specifications.

BL103.6.3 Hand-cast.

Hand-cast hemplime infill shall be installed in uniform lifts not greater than 4 inches (102 mm) in height. Each lift shall be tamped to achieve stable walls free of *voids*.

BL103.6.4 Spray-applied.

Spray applied hemplime infill shall be installed in accordance with Sections BL103.6.4.1 through BL103.6.4.4.

BL103.6.4.1 Forms.

Forms shall be installed on one side in accordance with Section BL103.6.2 or BL103.6.7.2 for *lined applications*.

BL103.6.4.2 Mixing.

Mixing shall be in accordance with Section BL103.6.1 or the spray equipment manufacturer's instructions.

BL103.6.4.3 Installation.

Hemplime shall be sprayed from the base up and per the spray equipment manufacturer's and/or *binder* manufacturer's instructions.

BL103.6.4.4 Screeding.

Excess *hemplime* shall be removed by *screeding* per the spray equipment manufacturer's and/or *binder* manufacturer's instructions.

BL103.6.5 Precast blocks.

Precast hemplime blocks shall be cast and installed in accordance with Sections BL103.6.5.1 through BL103.6.5.5 or per manufacturer's specifications.

BL103.6.5.1 Block dimensions.

Hemplime blocks shall be a minimum thickness of 3 inches (76 mm) in all dimensions and shall not exceed the maximum thickness in accordance with Section BL 103.3.4.

BL103.6.5.2 Casting.

Hemplime blocks shall be cast in accordance with Sections BL103.6.1 through BL103.6.6, as applicable, or by other means that produce *approved* blocks.

BL103.6.5.3 Mortar.

Mortar shall consist of lime and sand or other aggregate with a ratio of not less than 1:1 and not greater than 1:3, or other *approved* mortar. The lime shall be hydrated Type N or S, or hydraulic lime.

BL103.6.5.4 Installation.

Hemplime blocks shall be installed in *running bond* between and around wall framing members. Mortar shall fill all *voids* between blocks and shall be not less than 1/8 inch (3 mm) thick. Spaces between blocks and framing shall be not more than 3/4 inch (19 mm) and shall be filled with mortar.

BL103.6.5.5 Hemp-lime block veneer.

Hemplime block veneer shall not exceed 50 psf (244 kg/m²) of veneer only *unit wall weight*, shall be limited to 5 inch (127 mm) thickness, and shall be anchored to the supporting wall studs in accordance with Section R703.8.4 or secured with *approved* ties and fasteners to an *approved* backing. Metal ties and fasteners shall be protected in accordance with Section BL103.4.

BL103.6.6 Hemp-lime panels.

Hemplime panels shall require *approved* design by a *registered design professional*

BL103.6.7 Lined application.

Interior and exterior *hemplime lined applications* shall be installed in accordance with Sections BL103.6.7.1 through BL103.6.7.6 and Sections BL103.6.3 through BL103.6.6, as applicable.

BL103.6.7.1 General.

Prior to installation, the concrete or masonry walls receiving the installation shall be clean and free of loose mortar. Lined installations on basement walls shall require *approved* design by a registered design professional. Exterior applications shall be in accordance with Section BL103.7.6. Attachment of precast blocks to the receiving wall shall be in accordance with Section BL103.6.5.5. Attachment of *hemplime* panels to the receiving wall shall be in accordance with Section BL103.6.6.

BL103.6.7.2 Formwork.

Forms shall be in accordance with Section BL103.6.2. Permanent *formwork* shall not be allowed on the nonreceiving wall side.

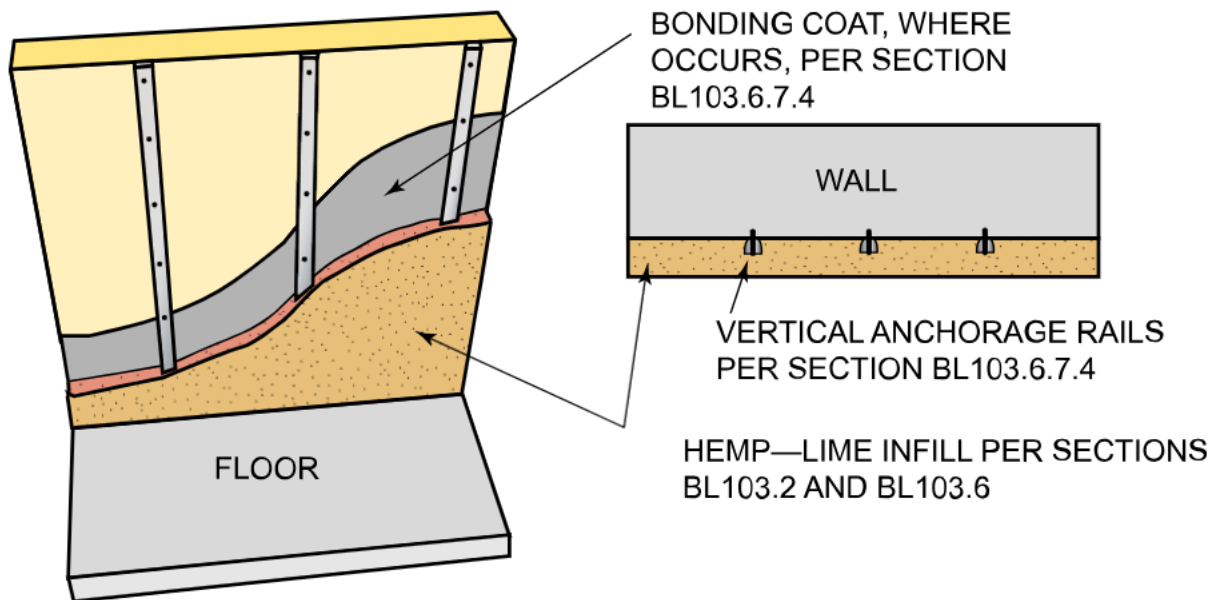
BL103.6.7.3 Thin lining.

Thin linings are from 3 inches to $\frac{3}{4}$ inches (76 mm to 121 mm) thick. Hand troweled *hemp lime* shall be installed over a *bonding coat*

BL103.6.7.4 Medium lining.

Medium linings exceed $\frac{3}{4}$ inches (121 mm) and are not greater than $\frac{1}{2}$ inches (165 mm) thick. For *hand-cast* or *spray-applied* 1 1/2-inch by 1 1/2-inch (38 mm × 38 mm) dovetail shaped vertical anchorage rails shall be attached with the narrowest face to the receiving wall, spaced not less than 20 inches (508 mm) and not greater than 32 inches (813 mm), with fasteners not less than 2 feet (610 mm) and not greater than 3 feet (914 mm) apart. *Hand-cast* medium linings shall be installed over a *bonding coat* on the receiving wall. See Figure BL103.6.7.4.

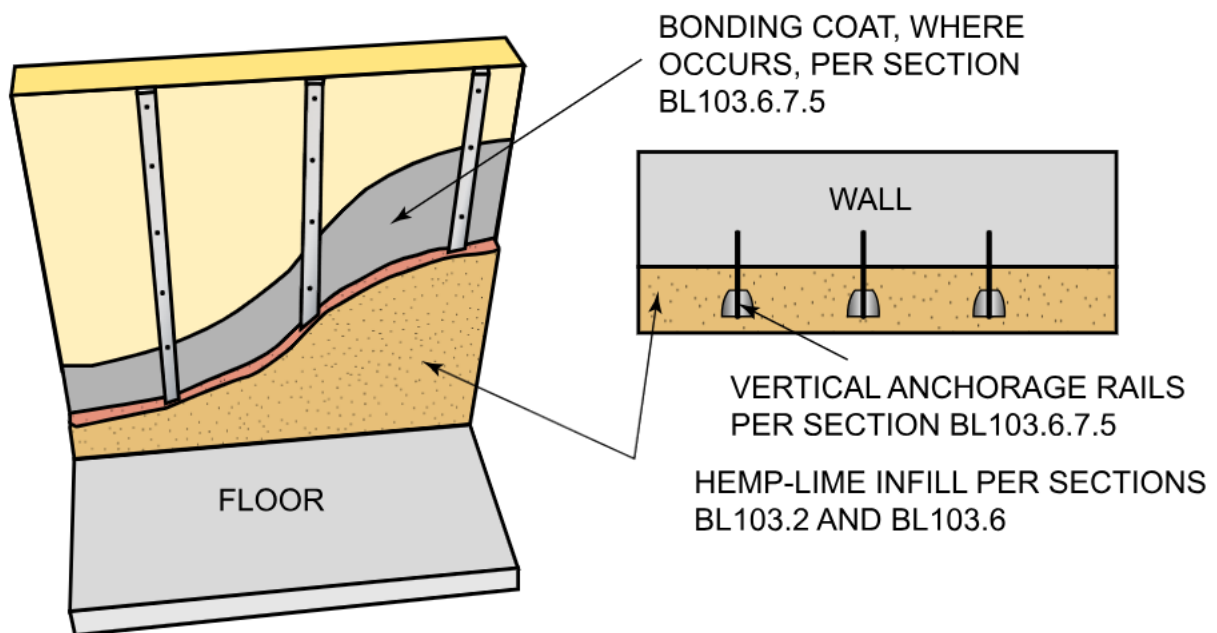
FIGURE BL103.6.7.4
TYPICAL HEMP -LIME MEDIUM LINING



BL103.6.7.5 Thick lining.

Thick linings exceed $\frac{1}{2}$ inches (165 mm) and shall not be greater than 8 inches (203 mm) thick or per the *binder* manufacturer's specifications. For *hand-cast* or *spray-applied*, 1 1/2-inch by 2 1/2-inch (38 mm × 64 mm) vertical anchorage rails shall be attached with the $\frac{1}{2}$ -inch (64 mm) face parallel to the receiving wall and spaced not less than 20 inches (508 mm) and not greater than 32 inches (813 mm). The anchorage rails shall be fastened to and separated from the receiving wall with $\frac{1}{2}$ -inch (51 mm) spacers not less than 3 feet (914 mm) and not greater than 4 feet (1219 mm) apart. *Hand-cast* thick linings shall be installed over a *bonding coat* on the receiving wall. See Figure BL103.6.7.5.

FIGURE BL103.6.7.5
TYPICAL HEMP-LIME THICK LINING



BL103.6.7.6 Minimum thickness at anchorage rails.

The minimum thickness of *hemplime* between the exterior face of vertical anchorage rails and the finished face of *hemplime* shall be 3 inches (76 mm) or in accordance with the *binder* manufacturer's specifications.

BL103.7 Moisture control.

Hemplime assemblies shall be protected from water intrusion and damage in accordance with Sections BL103.7.1 through BL103.7.9.

BL103.7.1 Water-resistive barriers.

Water-resistive barriers are prohibited on *hemplime* walls, except as permitted or required elsewhere in this appendix.

BL103.7.2 Vapor retarders.

Vapor retarders are prohibited on ~~hemplime~~ walls, except as permitted or required elsewhere in this appendix.

BL103.7.3 Penetrations in hemplime walls.

Penetrations in exterior ~~hemplime~~ walls shall be sealed with ~~a~~ approved sealant or gasket on the exterior side of the wall in all ~~climate zone~~ and on the interior side of the wall in ~~Climate Zones~~ 5, and Marine 4, as defined in WSEC R301

BL103.7.4 Horizontal surfaces.

~~Hemplime~~ walls and other ~~hemplime~~ assemblies shall be provided with ~~water-resistive barrier~~ at weather-exposed horizontal surfaces. ~~The water-resistive barrier~~ shall be of a material and installation that will prevent water from entering the wall system. Horizontal surfaces shall include exterior window sills and sills at exterior niches. Horizontal surfaces shall be sloped not less than 1 unit vertical in 12 ~~units~~ horizontal (8 percent slope) and shall drain away from ~~hemplime~~ walls and other assemblies. Where the ~~water-resistive barrier~~ is below the ~~finish material~~, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8 percent slope) and shall drain to the exterior surface of ~~the hemplime wall's~~ vertical ~~finish~~.

BL103.7.5 Air barrier.

Exterior ~~hemplime~~ walls shall have ~~a~~ vapor-permeable ~~air barrier~~ on all exterior and interior surfaces, except as permitted or required elsewhere in this appendix. ~~Plaster~~ shall be acceptable as ~~air barrier~~.

BL103.7.6 Separation of hemplime and earth or paved areas.

~~Hemplime~~ shall be not less than 8 inches (203 mm) above exposed earth or paved areas.

BL103.7.7 Separation of exterior plaster and earth or paved areas.

Exterior plaster applied to ~~hemplime~~ shall be not less than 8 inches (203 mm) above exposed earth or paved areas.

BL103.7.8 Separation of hemplime and exterior plaster from foundation.

~~Hemplime~~ and exterior ~~plaster~~ shall be separated from the foundation with an ~~approved~~ moisture barrier.

BL103.7.9 Base of wall flashing.

The outer face of exterior walls shall be flashed to prevent water intrusion at the base of the wall.

BL103.8 Special inspections. The building official has the authority to require the owner to employ a special inspector during construction of specific types of work described in this appendix.

Section BL104 Finishes

BL104.1 General.

The interior and exterior surfaces of *hemplime* walls shall be protected with *finish* in accordance with Section BL104. Finishes shall have a vapor permeance rating of 5 perms [285 mg/(s × m² × Pa)] or greater tested in accordance with Procedure ASTM E96.

BL104.2 Moisture content prior to application of finish.

Hemplime infill shall have an average moisture content of no more than 20 percent at a depth of 1 1/2 inches (38 mm), as measured from the face of the wall to which *finish* will be applied for each wall. Moisture content shall be measured with a portable wood moisture equivalent (WME) meter.

BL104.3 Plaster finish.

Exterior plaster shall be *lime plaster*, *clay plaster* in accordance with Section BL104.3.6.3, or other *approved plaster*. Interior plasters shall be any *plaster* permitted in Sections BL104.3.1 through BL104.3.9. Plasters shall be permitted to be applied directly to the surface of the *hemplime* infill without reinforcement, except that the juncture of dissimilar substrates shall be in accordance with Section BL104.5. Plasters shall have a thickness of not less than 1/2 inch (13 mm) on the interior and 3/4 inch (19 mm) on the exterior and shall be installed in not less than two coats, or per *plaster* manufacturer's instructions. Not less than 3/8 inch (10 mm) exterior *plaster* is permitted behind exterior *cladding* in accordance with Section BL104.6.

BL104.3.1 Membranes.

Membranes are prohibited between *plaster* and *hemplime*, except where a membrane is allowed or required elsewhere in this appendix.

BL104.3.2 Lath and mesh for plaster.

The surface of the *hemplime* functions as lath, and other lath or mesh shall not be required, except as required in Section BL104.5.

BL104.3.3 Plaster additives.

Additives shall be permitted to increase *plaster* workability, durability, strength or water resistance. Additives shall not reduce the *plaster* vapor permeance rating to less than 5 perms [285 mg/(s × m² × Pa)]. Additives containing polymers are prohibited.

BL104.3.4 Plaster reinforcing fibers.

Reinforcing fibers shall be permitted in *plaster*. Acceptable reinforcing fibers include hemp fiber, chopped straw, sisal, animal hair and fiberglass.

BL104.3.5 Lime plaster.

Lime *plaster* is any *plaster* with a binder primarily composed of calcium hydroxide [Ca(OH)₂] including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and CEN EN 459.

Quicklime shall comply with ASTM C5. Lime ~~plasters~~ shall contain sufficient lime to fully bind the sand or other aggregate and shall be permitted to contain *pozzolans*

BL104.3.6 Clay plaster.

Clay ~~plasters~~ shall be any ~~plaster~~ having a *clay or clay subsoil binder*. Such ~~plasters~~ shall contain sufficient ~~clay~~ to fully bind the sand or other aggregate.

BL104.3.6.1 Clay subsoil requirements.

The suitability of *clay subsoil* shall be determined in accordance with Figure 2, Ribbon Test, and Figure 3, Ball Test, in the appendix of ASTM E2392/E2392M.

BL104.3.6.2 Thickness and coats.

Clay ~~plasters~~ shall be not less than 3/4 inch (19 mm) thick and shall be applied in not less than two coats.

BL104.3.6.3 Rain-exposed.

Clay ~~plaster~~, where exposed to rain, shall be finished with ~~approved~~ erosion-resistant *finish*.

BL104.3.6.4 Prohibited finish coat.

~~Plaster~~ containing Portland cement shall not be permitted ~~finish~~ coat over clay plasters.

BL104.3.7 Clay-lime plaster.

Clay-lime ~~plasters~~ shall be composed of refined ~~clay or clay subsoil~~ sand and lime.

BL104.3.8 Hemp-lime plaster.

~~Hemp lime plaster~~ shall be composed of *hemp hurd* and lime and shall be permitted to contain sand or other aggregate, ~~and~~ *pozzolans*

BL104.3.9 Hemp-clay plaster.

Hemp-clay ~~plasters~~ shall be composed of *hemp hurd* and *clay or clay subsoil* and shall be permitted to contain sand or other aggregate.

BL104.4 Separation of wood and plaster.

Wood framing at the exterior surface of ~~emplime~~ walls shall be separated from exterior ~~plaster~~ with Grade D paper or other ~~approved~~ material, except where the wood is naturally durable.

Exception: Exterior *clay plaster* shall not be required to be separated from wood.

BL104.5 Bridging across dissimilar substrates.

Bridging shall be installed onto and across dissimilar substrates prior to the application of ~~plaster~~ on the interior or exterior. Acceptable bridging materials include expanded metal lath, woven wire mesh, welded wire mesh, fiberglass mesh, ~~and~~ *mat* burlap or other ~~approved~~ materials. Bridging shall extend not less than 3 inches (76 mm) on both sides of the juncture.

BL104.5.1 Returns on recessed openings.

Plaster or other exterior finish returns at recessed windows and doors shall require an approved design that prevents the intrusion of moisture.

BL104.6 Nonplaster exterior cladding.

Nonplaster exterior claddings shall be spaced not less than 1 inch (25 mm) from the face of the water-resistive barrier or air barrier to the back of the cladding to allow for ventilation. The ventilation space shall be open at the top and bottom and be provided with insect screening.

BL104.6.1 Water-resistive and air barriers.

Water-resistive barriers and air barriers, where vapor permeable, are permitted to be applied directly to the hemp-lime when exterior cladding is installed in accordance with Section BL104.6.

BL104.7 High moisture interior environments.

Exterior hemp-lime walls enclosing showers or steam rooms shall be lined on the interior side with ceramic tiles on an approved tile backer board, ceramic tiles on a lime plaster, or a tadelakt finish.

Section BL105 Fire Resistance

BL105.1 Fire-resistance rating.

Hemp-lime walls do not have a fire-resistance rating except for walls constructed in accordance with Sections BL105.1.1, BL105.1.2, or BL105.1.3. Fire-resistance ratings for other hemp-lime wall assemblies shall be determined by testing in accordance with ASTM E119 or UL 263 or an analytical method in accordance with Section 703.2.2 of the Washington State Building Code.

BL105.1.1 One-hour rated hemp-lime wall with center stud framing. One-hour fire-resistance rated load-bearing hemp-lime center stud walls shall comply with all of the following:

1. Shall be constructed with center stud framing per Figure BL103.1(2) with 2x4 studs at 16 inches (406 mm). The framed wall height shall not exceed 10 feet (3.05 m). Staggered 2x4 blocking shall be installed at mid-height between the studs.
2. Hemp-lime complying with Sections BL103.6.1, BL103.6.2 and BL107.1 shall be spray applied in accordance with Section BL103.6.4 to a thickness of 12 inches (305 mm).
3. Exterior and interior plaster shall be lime plaster complying with Section BL104.3.5, and shall be applied with 1/4-inch (6.4 mm) coats to a thickness of 3/4 inch (19 mm) on the exterior and 1/2 inch (12.7 mm) on the interior. Fiberglass stucco lath shall be embedded in the first exterior and interior coats.

BL105.1.2 One-hour rated hemp-lime wall with exterior stud framing. One-hour fire-resistance rated load-bearing hemp-lime exterior stud walls shall comply with all of the following:

1. Shall be constructed with exterior stud framing per Figure BL103.1(3) with 2x6 studs at 16 inches (406 mm). The framed wall height shall not exceed 10 feet (3.05 m). 2x4 on-edge blocking shall be installed at 5 feet (1.52 m) and 9 feet (2.74 m) between the studs and flush with their exterior face. 2x2 anchorage at 16 inches (406 mm) shall be fastened horizontally to inside face of the studs with 16d nails, and vertically at 16 inches (406 mm) to the horizontal anchorage.
2. A vapor permeable combined water-resistive and air barrier shall be stapled with lapped and taped joints at the 2x4 on-edge blocking.
3. A .06 inch x 2 3/8-inch (1.5 mm x 60mm) galvanized steel strap shall be installed diagonally from top plate to bottom plate and fastened to framing members per manufacturer's specifications.
4. 1x3 wood furring shall be installed vertically to each stud with 2 3/8 inch (60 mm) screws, and horizontally at 16 inches (406 mm) to the vertical furring.
5. 3/4-inch (19 mm) x 5 1/2-inch (127 mm) vertical wood siding shall be fastened at each horizontal furring member.
6. Hemp-lime complying with Sections BL103.6.1, BL103.6.2, and BL107.1 shall be spray applied in accordance with Section BL103.6.4 to a thickness of 12 inches (305 mm).
7. Interior plaster shall be lime plaster complying with Section BL104.3.5, and applied with 1/4-inch (6.4 mm) coats to a thickness of 1/2 inch (12.7 mm). Fiberglass stucco lath shall be embedded in the first coat.

BL105.1.3 One-hour rated hemp-lime wall with double stud framing. One-hour fire-resistance rated load-bearing hemp-lime double stud walls shall comply with all of the following:

1. Shall be constructed with double stud framing per Figure BL103.1(4), with exterior load-bearing 2x4 studs at 16 inches (406 mm) and interior nonload-bearing 2x3 studs at 24 inches (610 mm). The framed wall height shall not exceed 10 feet (3.05 m). 2x4 on-edge blocking shall be installed at 5 feet (1.52 m) and 9 feet (2.74 m) between the exterior studs and flush with their exterior face. Horizontal 2x4 anchorage shall be fastened to the interior face of the 2x4 studs at 30, 60, and 90 inches (.76, 1.52, and 2.29 m).
2. A vapor permeable combined water-resistive and air barrier shall be stapled with lapped and taped joints at the 2x4 on-edge blocking.
3. A .06 inch x 2 3/8-inch (1.5 mm x 60mm) galvanized steel strap shall be installed diagonally from top plate to bottom plate and fastened to framing members per manufacturer's specifications.
4. 1x3 wood furring shall be installed vertically to each stud with 2 3/8 inch (60 mm) screws, and horizontally at 16 inches (406 mm) to the vertical furring.
5. 3/4-inch (19 mm) x 5 1/2-inch (127 mm) vertical wood siding shall be fastened at each horizontal furring member.
6. Hemp-lime complying with Sections BL103.6.1, BL103.6.2, and BL107.1 shall be spray applied in accordance with Section BL103.6.4 to a thickness of 12 inches (305 mm).
7. Interior plaster shall be lime plaster complying with Section BL104.3.5, and applied with 1/4-inch (6.4 mm) coats to a thickness of 1/2 inch (12.7 mm). Fiberglass stucco lath

shall be embedded in the first coat.

BL105.2 Clearance to fireplaces and chimneys.

Hemplime surfaces adjacent to fireplaces or chimneys shall be finished with not less than 3/8 inch (10 mm) thick *plaster* of any type permitted by this appendix. Clearance from the face of such *plaster* to fireplaces and chimneys shall be maintained as required from fireplaces and chimneys to combustibles in Chapter 10, or as required by manufacturer's instructions, whichever is more restrictive.

Section BL106 Thermal Performance

BL106.1 Mass walls.

Walls with *hemplime* infill shall be classified as mass walls in accordance with WSEC Section R402.2.5-and shall meet the U-factor requirements for above-grade walls in WSEC Table R402.1.2-, when their heat capacity (C) is greater than or equal to 6 Btu/ft² × °F (123 kJ/m² × K) in Equation BL-1.

$$\text{Equation BL-1 } C = \rho \times t \times 0.299 \text{ Btu/lb} \times \text{°F}$$

where:

C = Heat capacity (Btu/ft² × °F).

ρ = Density of *hemplime* infill (pounds per cubic foot).

t = Thickness of *hemplime* infill (feet).

BL106.2 Thermal resistance.

Hemplime has the unit thermal resistance values in accordance with Table BL 106.2. Alternatively, the unit *R*-value of *hemplime* shall be determined with one of the following tests by an *approved* laboratory: ASTM C177 ASTM C518, ASTM C1114 or ASTM C1363. Test results from a specific *hemplime* mix shall be permitted to be used for multiple projects.

TABLE BL106.2
THERMAL RESISTANCE OF HEMP -LIME ^a

DENSITY (pounds per cubic foot)	R-VALUE (ft ² × °F × h/Btu per inch of thickness)
12.5	R-2.10
15	R-1.86
20	R-1.54
25	R-1.20

For SI: 1 pound per cubic foot = 1.6 kg/m³

a. Linear interpolation is permitted. Extrapolation is not permitted.

BL106.3 Density measurement.

Hemplime density shall be measured based *approved* test samples as follows:

1. Three samples of the proposed *hemplime* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm × 152 mm × 305 mm) *form*, a 6-inch (152 mm) diameter by 12-inch (305 mm) length *form* or other *approvedform*, following the application method and procedure that will be used during construction.
2. Samples shall be removed from the forms within 24 hours after *hemplime* placement or per the binder manufacturer's specifications.
3. Samples shall be cured/dried for a minimum of 14 days in indoor ambient conditions before density determination.
4. Density shall be determined by E equation BL -2.

Equation BL-2 $\rho = w/V$

where:

- ρ = Density of hemp-lime infill (pounds per cubic foot).
- w = Weight of hemp-lime infill sample (pounds).
- V = Volume of hemp-lime sample (cubic feet).

BL106.4 Compliance with Section R302.10.1.

Hemplime infill shall meet the requirements for insulation materials in Section R302.10.1 for *flame spread index* and *smokedeveloped index*s tested in accordance with ASTM E84.

SectionBL107 Mechanical Performance

BL107.1 Hemp-lime infill integrity.

The integrity of *hemplime* infill and its ability to hold a *plasterfinish* shall be demonstrated with a minimum compressive strength of 29 psi (0.2 MPa). Test results from a specific *hemplime* mix shall be permitted to be used for multiple projects.

BL107.1.1 Demonstration of compressive strength.

The compressive strength of the *hemplime* mix shall be demonstrated to the *building official* before the placement of *hemplime* infill, with compressive strength tests and an associated report by an *approvedlaboratory* tested as follows:

1. Three samples of the proposed *hemplime* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm × 152 mm × 305 mm) *form*, a 6-inch (152mm) diameter by 12-inch (305 mm) length *form*, or other *approvedform*, following the application method and procedure that will be used during construction.
2. Samples shall be removed from the forms within 24 hours after *hemplime* placement or per the *binder* manufacturer's specifications.
3. Samples shall be cured/dried for a minimum of 14 days in indoor ambient conditions before testing.
4. The opposite faces shall be capped with *plasterof paris* to achieve smooth and parallel faces, after which the sample shall reach ambient moisture conditions before testing.
5. The horizontal cross section of the dried sample as tested and the maximum applied load at failure shall be used to calculate the sample's compressive strength.

6. The average value of the samples shall be used to determine the mix's compressive strength.

Section BL108 Referenced Standards

BL108.1 General.

See Table BL 108.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference this standard.

**TABLE BL108.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM C5—10	<i>Standard Specification for Quicklime for Structural Purposes</i>	BL104.3.5
ASTM C141/C141M—14	<i>Standard Specification for Hydrated Hydraulic Lime for Structural Purposes</i>	BL104.3.5
ASTM C177—19	<i>Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus</i>	BL106.2
ASTM C206—14	<i>Standard Specification for Finishing Hydrated Lime</i>	BL104.3.5
ASTM C518—21	<i>Transmission Properties by Means of the Heat Flow Meter Apparatus</i>	BL106.2
ASTM C1114—06(2019)	<i>Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flux Apparatus</i>	BL106.2
ASTM C1363—19	<i>Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus</i>	BL106.2
ASTM C1707—11	<i>Standard Specification for Pozzolan Hydraulic Lime for Structural Purposes</i>	BL104.3.5
ASTM E84—21a	<i>Standard Test Method for Surface Burning Characteristics of Building Materials</i>	BL106.4
ASTM E96/E96M—21	<i>Standard Test Methods for Water Vapor Transmission of Materials</i>	BL104.1
ASTM E119—20	<i>Standard Test Methods for Fire Tests of Building Construction and Materials</i>	BL105.1
ASTM E2392/E2392M—10(2016)	<i>Standard Guide for Design of Earthen Wall Building Systems</i>	BL104.3.6.1
CEN EN 459—2015	<i>Building Lime—Part 1: Definitions, Specifications and Conformity Criteria; Part 2: Test Methods</i>	BL104.3.5
UL 263—2011	<i>Fire Test of Building Construction and Materials—with Revisions through August 2021</i>	BL105.1

1. **Specify what criteria this proposal meets.** You may select more than one. The amendment is needed to address a critical life/safety need.

The amendment clarifies the intent or application of the code.

The amendment is needed to address a unique character of the state.

1. **Is there an economic impact:** Yes

If yes, provide economic impact, costs and benefits as noted below in items a – f.

Our state has an aggressive goal of building 1.1 million homes over the next 18 years, being able to provide and integrate into construction local regional building materials that are green, fire resistant, and energy efficient will help bring more sustainable quality buildings for a state that spends 300 billion annually on construction. It will reduce costs, speed up construction and provide a regional material that workforce can readily and happily use atop of creating economic opportunities for our small and mid-sized businesses leveraging regional resources

- a. **Construction Cost.** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

Cost per /square foot \$9.00 - 11.50 per square ft

Cost savings are reduction of usage of drywall (\$2.00), traditional insulation(\$4.50), acoustic barrier (\$10.00)

So all of those added up = \$16.50 compared to \$9.00-\$11.50 per square foot

- a. **Code Enforcement.** Will help with state wide usability showing there is another option available b. **Small Business Impact.** This will help bring economic gain and opportunity for small businesses especially in restoration, retrofit, remodels and new construction. A New green option that is regionally produced from our agricultural fields! Department of commerce has provided economic help to provide technical assistance and training for this building method vis WSMA (Washington State Microbiz Association)
- a. **Housing Affordability.** This will help lower cost, and improve energy efficiency which will reduce consumer costs. This is tariff Free
- a. **Other.** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

*** This appendix utilization will bring a fire resistant, and more energy efficient product to market that fits our new energy code CI (continuous insulation protocol) to assure a proper R value is created

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.