

LIGHT STRAW CLAY

1. **Scope.** This appendix shall govern the use of light straw clay as a non-loadbearing building material and system. Unless stated otherwise in this section, the provisions of the *2011 Oregon Residential Specialty Code, 2010 Oregon Mechanical Specialty Code, 2011 Oregon Plumbing Specialty Code, 2011 Oregon Electrical Specialty Code and all other applicable codes* shall apply to buildings using light straw clay.
2. **Definitions.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein.

CLAY. Soil that contains a majority of particles smaller than 2 µm. (per ISO 14688) that also exhibit a high plasticity Index (per ASTM D 4318)

CLAY SLIP. A suspension of clay particles in water.

CLAY SOIL. Soil containing 50% or more clay per volume.

INFILL. Light Straw Clay mixture which is placed between the structural members of a building.

LIGHT STRAW CLAY. A mixture of straw and clay compacted to form an insulated wall between or around structural members and around wall openings. Also known as Clay-Straw, Clay-Fiber, Straw-Clay, or SLC.

MONOLITHIC. A continuous wall without seams.

NON-LOAD BEARING. Not bearing the weight of the building other than the weight of the light straw clay itself and its finish.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

VOID. Any space in a light straw clay wall that allows a 2” sphere to be inserted.

3. Non-loadbearing Light Straw Clay Construction.

- a. **General.** Light straw clay shall not be used to support the weight of the building beyond the weight of the light straw clay material and its finish. The light straw clay either surrounds or acts as infill between the structural members.
- b. **Structure.** The structural support of the building shall be designed in accordance with the *2011 Oregon Residential Specialty Code*.

4. Material Specifications.

- a. **Straw.** Straw shall be wheat, rye, oats, rice or barley, and shall be free of visible decay and insects. Alternative cellulose materials such as wood chips may be substituted for straw when approved by a building official.
- b. **Clay soil.** Soil used for the clay slip in the light straw clay mix shall have a minimum clay content of 50% by volume, as determined by ASTM E2392

- c. **Light straw clay mixture.** All straw stems shall be mixed with clay slip until they are thoroughly and evenly coated such that there is no more than 5% uncoated straw. Additionally, all straw, when compressed in the wall cavity, shall not have any excess moisture such that free water will not be squeezed from the light straw clay.

5. Wall Construction.

- a. **Wall thickness.** Light straw clay walls shall be 12 inches thick.
- b. **Distance above grade.** Light straw clay shall not be used below grade. The foundation shall be constructed so that the bottom of the light straw clay wall is at least 8 inches above final exterior grade.
- c. **Moisture barrier.** An ORSC approved moisture barrier shall extend across the full width of the foundation stem wall between the light straw clay wall and the stem wall. All penetrations through the moisture barrier, as well as all joints in the barrier, shall be sealed with asphalt, caulking or an ORSC approved sealant.
- d. **Sill plate.** A sill plate shall be used over the moisture barrier and foundation stem wall in accordance with ORSC R319.1, or may be untreated wood when over a framed floor. Sill plates shall be fastened in accordance with the ORSC R403.1.8 and R602.11
- e. **Perimeter insulation:** Foundation thickness may be reduced by up to 3” less than the light straw clay in order to accommodate perimeter insulation.
- f. **Wood and light straw clay contact.** Untreated wood structural and non-structural members in exterior and interior walls may be in direct contact with light straw clay.
- g. **Non-wood structural members.** Non-wood structural members in contact with light straw clay in exterior walls shall be resistant to corrosion or coated to prevent corrosion with an approved coating.

6. Wall Reinforcing.

- a. **Vertical reinforcing and blocking.** Vertical wall reinforcing shall be a minimum of 2x4s at 32 inches on center, or per an approved design by an architect or an engineer. This vertical reinforcing shall be horizontally blocked every 8 feet with minimum 2x4 blocks.

- b. Stabilizing bars.** Non-structural horizontal bars to stabilize the light straw clay infill shall be installed at 24 inches on center and secured to vertical members. Stabilizing bars may be of any of the following: $\frac{3}{4}$ in bamboo, $\frac{1}{2}$ inch fiberglass rod, 1" wood dowels, wood 1x2.

7. Monolithic Walls.

- a. Formwork.** Formwork shall be sufficiently strong to resist bowing when the light straw clay is compacted into the forms.
- b. Installation of light straw clay.** Forms shall be uniformly loaded with light straw clay and be evenly tamped to achieve stable, monolithic walls that are free of voids. Light straw clay shall be installed in lifts of no more than 6 inches and shall be thoroughly tamped before additional material is added.
- c. Removal of formwork.** Formwork shall be removed from walls within 24 hours after tamping, and walls shall remain exposed until dry. Any visible voids shall be patched with light straw clay prior to plastering.
- d. Cold joints.** Whenever a wall is not continuously built, the top of the wall shall be thoroughly coated with clay slip prior to the application of a new layer of light straw clay in order to prevent cold joints.

8. Openings in Walls.

- a. Doors and windows.** Rough bucks and/or frames for door and window shall be fastened securely to structural members. Windows and doors shall be flashed in accordance with ORSC R703.8.
- b. Window sills.** An ORSC approved moisture barrier shall be installed at window sills in light straw clay walls prior to installation of windows.

9. Wall Finishes.

- a. General.** The interior and exterior surfaces of light straw clay walls shall be protected from mechanical damage, flames, animals and prolonged exposure to water or snow by a weather-resistant finish in accordance with this section.
- b. Moisture content of light straw clay prior to application of finish.** Light straw clay walls shall be dry to a maximum moisture content of 20% at a depth of 4 inches, as measured from each side of the wall, prior to the application of finish on either side of the wall. Moisture content is a self-certified measurement and shall be measured with an approved moisture meter or by other approved means.

- c. **Plaster finish.** Acceptable plaster finishes include clay based and lime based plasters. These may be applied directly onto the interior and exterior surface of the light straw clay walls without reinforcement, except at the juncture of dissimilar substrate greater than 2 inches.
- d. **Bridging of dissimilar substrates.** Bridging shall be installed at the juncture of dissimilar substrates greater than 2 inches prior to the application of plaster. Acceptable bridging materials include: expanded metal lath, fiberglass mesh, reed matting, or burlap. Bridging shall extend a minimum of 4 inches on either side of the juncture.
- e. **Exterior siding.** Exterior wood, metal or composite material siding shall be spaced a minimum of $\frac{3}{4}$ inch from the light straw clay to allow for moisture diffusion. The siding shall be fastened to wood furring strips in accordance with manufacturer's recommendations. Furring strips shall be securely fastened to the vertical wall reinforcing or structural framing at a maximum spacing of 32 inches. An air barrier shall be applied prior to application of siding, consisting of clay plaster or lime plaster or other ORSC approved air barrier. Insect screens shall be installed at top and bottom of spacing.

10. Electrical.

- a. **Electrical wiring.** All wiring within or on light straw clay walls shall meet the electrical provisions within this code. Type UF cable shall be installed or wiring may be run in metallic or non-metallic conduit systems.
- b. **Attachment.** All cable, conduit systems, and junction boxes shall be securely attached to wall framing per provisions of the OESC. Additional framing members shall be installed as necessary to meet NEC requirements.

11. Plumbing.

Water or DWV pipes within light straw clay walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall.

12. Mechanical.

Gas pipes within light straw clay walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall.

13. Fire Resistance.

- a. Light straw clay walls when covered with plaster shall be deemed to be fire resistive.
- b. Light straw clay with a minimum thickness of 7/8 inch (22.4 mm) on both sides may be used between a dwelling and an attached garage as required in ORSC R309.2

14. Thermal Insulation.

- a. **R-Value.** Light straw clay, when installed as according to this appendix, shall be deemed to have an R-value of 1.6 per inch.
- b. **U-Value.** Light straw clay, when installed as according to this appendix, shall be deemed to thermally perform as well as a 2x6 wall with R-21 insulation.