

# LIMESTRONG BUILD™

HIGH PERFORMANCE POZZOLAN + LIME

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## Troubleshooting Guide

THIS GUIDE ADDRESSES COMMON PROBLEMS that may arise during mixing, applying, and curing Limestone Build (LSB) Binder and Finish plasters. Even if not currently experiencing an issue, reading through this guide will emphasize the areas that are commonly problematic, especially with those new to working with lime plaster, and serve to prevent problems from arising.

THIS GUIDE IS CROSS-REFERENCED with other LSB Guides that provide deeper information and instruction on the referenced issues. Where possible, we have provided solutions and remedies, although in some cases, a redo is what is needed to get it right.

### PREPARATION

- Painter's masking tapes and common duct **TAPE AREN'T STICKING WELL ENOUGH** or long enough for functional surface masking. **DO THIS:** Use a quality stucco tape<sup>[XR1]</sup>. Stucco tapes are developed to stick to a variety of surfaces and hold up to the rigors of an active, messy plaster site. It is typically red, but comes in other colors as well. Looks like duct tape, but is magnitudes-of-performance-quality better. It is also rated for how many days it can stay on and still remove cleanly. You're working with long-curing lime plasters, so go for the 30-day stuff.

- **VOIDS, CRACKS AND OTHER SUBSTRATE DAMAGE.** **DO THIS:** well in advance of applying the scratch coat (so the filled-in areas have time to cure), go in a fix all issues. *It's absolutely critical that the substrate is right.*

- voids in mortar joints** need to be tuck-pointed with a bit of stiff LSB mixed at a 1:2 ratio (binder:sand).

**DO THIS:** First clean out all mortar crumbs and dust. Use compressed air to blow the void clean. Dampen before pointing. Allow to cure for at least 72 hours.

- Spalling** on brick, block, and poured concrete. **DO THIS:** Remove all loose matter and dust. Check for and pry off any chips that are forming. Thoroughly dampen the cleaned area and fill with stiff LSB. Particularly deep voids, where whole chunks are missing, may need to be filled in stages—multiple layers of cured LSB.

- Deterioration of the substrate surface** (soft/old brick, cob, adobe, EPS foam, lime plaster, whatever) must be removed. **DO THIS:** The best way is to scrub it off with a stiff brush, thereby giving you full control over how aggressive you need to be to remove the soft, friable material and expose a sound surface. Also look to see if a damaged, deteriorated, or poorly-performing roof system is allowing runoff/shed water to run down or splash back on the wall. If so, remedy that situation before applying plaster.

- Cracked and damaged lime plaster** on old buildings. **DO THIS:** First, determine that the plaster surface is indeed lime plaster and not a Portland-cement-charged stucco variety—lime plaster over cement stuccos is not a wise move in the long term<sup>[1]</sup>. **DO THIS 2:** remove bits of broken plaster. Small cracks should be gouged out, cleaned, dampened, filled with LSB, and allowed to cure.

- Structural Movement.** Large, deep cracks are likely caused by structural movement and should be investigated and remedied. For example, if the movement and cracking appears to be caused by settling, determine if the settling is



### FOOTNOTES [0]

[1] The two plaster types—Portland cement based and lime-based—behave, breath, react and even move differently with environmental, weathering, and building movement stresses. Cement plaster is harder and more brittle than lime plaster, and when it cracks, that crack will eventually telegraph through the covering lime plaster as well.

### CROSS REFERENCES [XR]

[XR1] LSB Publication: **Plaster Tools and Equipment**

likely to continue (poor/damaged foundational support, low spots that repeatedly collect water, improper grading or gutter drainage that doesn't run off away from the building, non-existent/non-functional foundation drainage in wet climates? Correct the issue as necessary). If you've determined the settling that caused the cracking unlikely to continue, then you can just gouge, clean, and fill the crack. Remove any loose or spalled bits. Thoroughly clean and dampen before filling and leveling with LSB.

- **ADVERSE WEATHER CONDITIONS.** If weather (or climate) conditions are ill-suited to applying and properly curing lime plaster can not be avoided, then efforts to mitigate those conditions must be taken. DO THIS: Preplan the approach and determine the order in which the walls will be plastered so that application can be done on the shaded/protected walls as long as possible. Have shading tarps, wind and rain shield sheeting, and the means to securely position and hang them on the job site, in place, and functional BEFORE mud is mixed and application begins. The consequences of failing to do so not only adversely impacts the working conditions and behavior of the plaster going on the wall, but will also show up months or years later in the improperly cured plaster rendering.

## MIXING LIMESTRONG BUILD

- The **MUD BATCH IS TOO WET; TOO SOFT.** DO THIS: holding to the blend ratio of binder-to-sand used for the batch, add additional binder and additional sand, a little at a time, allowing the mixer to integrate the ingredients. When the mud appears right, allow it to continue mixing for five (5) minutes after the last addition of binder:sand and reevaluate. Run a couple of the fresh mud tests<sup>[XR2]</sup> to verify. Note how much addition binder and sand was needed to reach proper workability and readjust the water amount down for the next batch.

BEST PRACTICE: Add only three-quarters of the anticipated water needs for the batch to begin with, then add additional water, working up to the right consistency. It's much more efficient to add water to reach workable fluidity than adding dry ingredients. Also remember that mixing time matters: determine if batch is correct only after it has mixed for a minimum of five minutes.

- The **MUD IS TOO STIFF, UNWORKABLE.** DO THIS: first determine if the mud has been churning in the mixer for at least five minutes after the last of the batch-water was added. If so, add additional water in small amounts until mud reaches proper consistency. Allow the mixer to run an additional five minutes or more. Run a couple of the fresh-mud tests<sup>[XR2]</sup> to verify. Make a note of the total water needed for future batches.

- If the mixer operator is working too far ahead of the applicators, the mud will sit too long and will need to be retempered to bring it back to workability. DO THIS: Make adjustments to the mix schedule so fresh-mixed mud arrives "just in time" and retempering needs are much less frequent. Lime plaster can be retempered for up to 24-hours after initial mixing. Lime plaster can also be tightly covered and held in a mud tub, then retempered when needed, during that 24-hour window.

- Weather-fueled evaporation can have a lot of influence on mud-moisture content as well. In such instances, the mud could be mixed slightly wetter, so that by the time it goes from the mud board to the wall, it's right.

- If the mixer operator is overfilling the mixer tub, the mud may be insufficiently blended and fattened (see next), resulting in poor workability.

- The **BATCH TAKES WAY TOO LONG TO THOROUGHLY MIX.** It could be that the mixer is over-filled. DO THIS: Recalculate the batch size for that mixer. Mortar mixers are most efficient when the horizontal mixing shaft is just slightly covered with mud as it turns. This allows the attached paddles to effectively churn the ingredients into a well-mixed mud. Remember, when mixing lime plasters, a longer mixing time is better (5 minutes minimum; 10+ minutes even better), as it enhances workability by "fattening" the mud, making is smoother, stickier, and easier to put on the wall.

- A **BATCH TAKES TOO LONG TO MAKE.** The mud can't keep up with the demand at the wall. More applicators, or a more rapid application process, (like spraying) demand enough mixer capacity and operator training to meet anticipated demand. DO THE FOLLOWING:

- Rent or buy a mortar mixer with a higher capacity—don't just over-fill the one you have.

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### CROSS REFERENCES [XR]

[XR2] LSB Publication: **Mixing Limestrong Build Plaster**—Testing (page 04)

—Ensure the mixer operator is trained and practiced and confident enough in the ratios<sup>[XR3]</sup>, the add-order, and recognizing a well-mixed batch so he or she can operate efficiently and effectively. Operating a mixer is hard work—damp sand is heavy! So is water. Binder bags weight in at 45 lbs each. As the hours drag on, you may need a second trained operator to step in to provide relief and keep production humming along. Or you may need two operators working in tandem.

—Ensure that the operation is set up to move material into and out of the mixer in an efficient manner. Is the sand pile close enough to the mixer? Is the binder? Is the water barrel? Is there a dedicated hose so the water barrel can be replenished without the mixer operator having to go hunt the working end of the hose?

—Ensure a clear and unobstructed path for wheelbarrow access and egress to and from the mixer and to and from the walls. Do you need another wheelbarrow (or two)? Another square-point shovel? Are ramps secure and safe to roll on?

• **BATCH QUALITY IS INCONSISTENT.** The issue is most likely caused by inconsistent ingredient amounts or even by the order in which ingredients are added. DO THIS: The mixer operator must make note of the how much binder to how-much-sand to how-much-water mixed-for-how-long is determined and tested<sup>[XR2]</sup> as ideal for a workable, well-mixed batch of lime plaster mud—and then repeat that blend formula and ingredient order consistently, religiously, batch to batch. The operator must also learn to recognize a well-made batch by simply looking in the mixer and observing the behavior and look of the plaster as it churns. Such recognition goes a long ways in producing timely, consistent batches.

—Another possibility: is the sand pile being protected from the weather? Plaster sand will arrive damp, and the amount of the dampness in the sand affects the amount of water used for each batch. In unprotected sand piles, the amount of water content (dampness) will change throughout the day—direct sun, dry breezy conditions, wet ground, moisture-wicking dry ground, humidity, rain—all affect the moisture content of the sand. BEST PRACTICE: Sheet the ground beneath the sand, then tarp over the sand pile. The mixer operator should then take care to replace the tarp and keep it pinned into place between batches.

—Along those same lines, LSB Binder bags MUST be protected from the elements as well (including overspray when cleaning the mixer). Wet—even damp—binder will clump up and not blend thoroughly. Extended mix times will be necessary if you're trying to use wet binder, and even then, small nuggets of moisture-clumped binder may resist assimilation.

• Color of **PIGMENTED PLASTER IS NOT CONSISTENT** batch to batch. Coloring lime plaster adds another carefully-measured, order-important step to the mix process. DO THIS: Reference **LSB Mixing Limestrong Build Plaster—Instructions for Mixing Limestrong Build Finish** for instructions on how to add liquid or powered pigments. The key to consistency in colored batches is **1)** careful consistency in ingredient amounts—pigment, water, binder, sand; and **2)** careful consistency in mix times—the mix time to **a)** fully disperse the pigment in the mix water and the mix time to **b)** fully integrate the colorant into the mud.

—Consistency can be more carefully controlled using LSB Finish, an all-in-one fine-grained plaster product—just add water (and colorant).

—Another factor of consistency is batch size. Since the finish coat goes on thin and more time and care is needed to “finish” it to desired texture, smaller, easy-to-control batches are feasible. DO THIS: instead of using the big mortar mixer, use a five-gallon bucket and a mixing paddle attached to a heavy-duty drill. Limestrong Build Finish comes packaged to work readily with a five-gallon bucket batch size: one bag of LSB Finish makes one bucket-batch of plaster. Also, Limestrong Color System powdered pigment packs can be purchased in a single bucket-batch sizes, eliminating the need to measure/weigh the pigment.

#### BEST PRACTICES:

—The liquid tint container must be fully scraped and rinsed into the batch water each time...as some of the viscous liquid tint will hang up inside the measuring container.

—The colorant—whether liquid or powder—must be thoroughly mixed into the batch water with the paddle attachment before adding dry plaster. Powders will need to be agitated/mixed into the water as added and ultimately longer than liquids to fully disperse and break up the pigment clumps. If small clumps or nuggets of pigment are present in the mixed mud, they will create streaks and bursts of color when troweled onto the wall. Note the full-dispersal mix time so it can be repeated for each batch.

#### CROSS REFERENCES [XR]

[XR3] See LSB Publication: **Mixing Limestrong Build Plaster**—Volume Ratio Tables (page 03)

—After the dry plaster and the rest of the water are added, per instructions, mix the plaster long enough to fully and completely disperse the colorant and fatten the mud (at least five minutes). Make a note of how long the mix time was to achieve full dispersal and then repeat that mix time batch to batch.

—Scrape the sides of the bucket frequently during mixing to insure unmixed powder or colorant is fully integrated.

## APPLYING LIMESTRONG BUILD

- **MUD IS NOT READILY STICKING TO THE WALL.** A few different issues may be to blame. LOOK AT THE FOLLOWING:

—Is the **proper grade-blend of the sand** being used? If the sand particles are all about the same size, rather than the necessary blend<sup>[XR4]</sup> of large to small to fine, the void space ratio<sup>[XR5]</sup> is out of whack and all-important mechanical bonding is severely limited.

—The lime plaster (mud) is **not fat enough**—it hasn't been mixed long enough, (five minutes minimum from addition of the last bit of sand or water; 10 or so minutes is even better) which fully hydrates the lime and aggregate (sand) and creates a creamy, sticky bond.

—**Too much water** in the mix. If the mud is over saturated, it's going to sag and slump on the wall. Add (at ratio) more binder and sand to stiffen. Use one or more of the test methods<sup>[XR2]</sup> to determine proper stiffness/workability.

—**Suction is important** to the bond between substrate-and-scratch coat and coat to coat. You need to dampen the surface before applying plaster. Mist or brush dampen until water beads on the surface. Do not over-saturate to the point of run-off.

—There is **not enough surface tooth**. Lime plaster relies on mechanical as well as chemical bonding—more so than Portland cement-based stuccos. The surface receiving the plaster must have sufficient tooth (key, roughness) for the plaster to hang onto. The scratch coat (first coat) should be keyed or scratched with a scratching tool when still fresh. The leveling (brown/second coat) should be roughened with a sponge float to provide enough tooth to hold onto the thin finish coat.

Smooth surfaces (like precast and poured concrete) will need need scrubbed clean of form release chemicals, followed by some kind of surface pre-treatment (like a polymer-modified thin-set applied with a notched trowel) to provide a suitable surface. They could also be roughened by sand blasting to chew off the slick surface. Chemical bonding agents are also available, but not all are compatible with lime plaster<sup>[2]</sup>.

—**Incompatible surfaces** like EPS foam need to be cleaned of oxidation, then primed with a polymer-modified thin set and trowel-notched to accept lime plaster. Lath can be (and in some cases, by code, must be) used over EPS foam. Painted surfaces need to be...unpainted: stripped and cleaned and roughened. Some concrete and laid-block walls have been treated against moisture—such treatments will also resist the plaster bond and must be removed.

—**Surface isn't clean enough.** Dust, paints, loose grains of plaster sand and lime dust, oxidation, form-release chemicals, oils, mold or other organic growth, and/or soft, unsound, friable surfaces will prevent plaster from forming the necessary bond to the substrate. In the case of stubborn surface contaminants, like form-release chemicals or paints and sealers, aggressive scrubbing or power washing or even sandblasting is necessary to adequately prepare the surface.

- **TOO MUCH MUD IS ENDING UP ON THE GROUND.** DO THIS: Always move the loaded trowel in an upward stroke. Subsequent loaded strokes start lower and move up, blending into the previous. By working in repeated, overlapping up-strokes, the mud stays on the trowel until pushed onto the wall. To overcome the suction between trowel and mud (which can pull the mud back off the wall), move the trowel in a sweeping circular motion to one side as you complete each stroke.

- **PLASTERED WALL LOOKS PATCHY.** Patchiness—working sections are visually not flowing seamlessly into the next—is the result of not working with a wet edge. Keeping a wet edge side-to-side and top-to-bottom becomes more challenging when:

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### FOOTNOTES [0]

[2] Limestrong offers a bond-enhancer called X that can be (blended into the mud; brushed on the surface?) utilized when adequate bond is a concern...when is this coming?

### CROSS REFERENCES [XR]

[XR4] See LSB Publication: **Sourcing Sand**

[XR5] See LSB Publication: **Determining Void Ratio**

1) working a long and/or tall wall, 2) when overly hot, dry, windy conditions are surface-drying the plaster too fast to allow the applicator to keep a wet edge, and/or 3) the applicator is slowed by inexperience. DO ONE OR MORE of the following:

- Use more than one applicator per wall section so as to get more plaster on the wall faster.
- Spray-apply the plaster so as to get more plaster on the wall faster.
- Gently mist the leading edge(s) of the plaster to keep them moist until ready to be worked—typically done by someone other than the applicator.
- Mitigate the influences of adverse weather by working the wall only when shaded and/or shielding the wall from direct sun and drying winds.

Other causes that delay getting mud on the wall quick enough to maintain a wet working edge may include:

4) not enough scaffolding on the job and positioned to allow the applicator(s) uninterrupted access to the entire wall, or 5) the mixing operation is too slow—whether because a) the mixer is under-sized to meet the demand at the wall; b) the mixer operator is inexperienced, under-trained, and/or otherwise struggling to mix consistent, efficient batches; or c) the mix operator has too many other responsibilities on the job site which do not allow for dedicated mixing efforts.

## POST-APPLICATION

- **CRACKING DURING CURING.** There are cracks and then there are cracks.

Small **shrinkage cracks** may develop in the scratch and leveling coats of lime plaster. These cracks are typically short and numerous. Shrinkage cracks are considered normal in the thicker scratch and leveling coats and should not translate to the finish coat if the leveling coat has been properly cured. DO THIS: If extensive, treat shrinkage cracks in the leveling (brown) coat (only within the first 24 hours of the cure) by moistening the surface and, using a wooden float, rubbing in a firm, circular motion to tighten the plaster grains and fill the cracks. Re-key (roughen; add tooth) if necessary with a sponge float<sup>[XR6]</sup>.

Long, thin hairline (or wider) cracks, on the other hand, could be an indication of structural movement and should be evaluated and corrective action taken, as these types of movement cracks (especially on structures with wood framing) will likely telegraph through the finish coat.

- **ADVERSE WEATHER CONDITIONS** during application and/or curing—direct sun, hot dry windy conditions, rain, freezing temperatures—need to be warded against by using protective sheeting, tarps, and other shielding materials. Scaffolding makes a great framework to hold the protective sheeting in place and away from the wall. Do not allow sheeting to contact the curing plaster surface, as it will leave condensation stains.

- The surface of the newly applied plaster is **DRYING TOO FAST.** Direct sun and/or hot dry breezy conditions will suck the moisture out of a freshly-render coat and causing it to skin over. Skinning makes it harder to work to consistent coat depth, keep a wet working edge, and ultimately, the plaster will cure poorly. In such conditions, application needs to stop and mitigation efforts need to be put into place before more plaster is applied. DO THIS: Excessively surface-dried plaster may need to be scraped off and discarded. Freshly applied plaster must be misted sooner and more frequently to prevent premature surface drying. Wet burlap can be hung near the curing wall and kept damp to add more evaporative humidity to the surrounding air and help slow the evaporation from the plaster.

- **LIME STAINS** on wooden features, like window sills and frames, support posts, beams, floors. If wet lime plaster was allowed to sit on unprotected, unmasked wood for any period of time there will be staining from the lime. DO THIS: As soon as possible, remove the plaster and sponge or scrub-brush the area with vinegar. If the stain goes deep, especially in un-treated raw wood, sanding may be necessary. Prevent future problems by masking off everything that is not receiving a lime plaster rendering.

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### CROSS REFERENCES [XR]

[XR6] See LSB Publication: **Lime Plaster Application Guide**—Shrinkage Cracks (page 07)