The following table was first published in 1965 by the SMA and been recently updated. The SMA offers this as a general troubleshooting guide of problems or unwanted conditions found or related to portland cement plaster/stucco walls. The chart lists the conditions, possible causes, preventions or possible remedies. Not all of these conditions are in the control of the plastering contractor. This chart can also be used as a pre-installation discussion guide for plaster/stucco projects to help avoid unwanted conditions.

Stucco Manufacturers Association (SMA)

PORTLAND CEMENT PLASTER TROUBLESHOOTING - CAUSE AND CURE

CONDITION	CAUSE	PREVENTION OR POSSIBLE REMEDY
SOFT PLASTER	Cement fails to set	Do not use old cement, shelf life is typically one year.
	Excessive aggregate	Measure aggregate (calibrated box) to establish proper shovel count or use pre-blended mix.
	Inadequate damp curing	Keep damp for 24 hours. Fresh soft plaster may be redeemed by continuous wetting until proper set and hardness are obtained.
	Inadequate or excessive mixing	After all materials are in the mixer, minimum two (2) but not more than ten (10) minutes.
	Impurities in water or aggregate	Test water and aggregate. Use washed plaster sand
	Freezing temperatures	Plaster may harden upon resumption of damp curing above 40 degrees F. If plaster does not harden, remove and re-plaster.
	Improper use of admixtures (soap, gypsum, detergents, etc.)	Do not add ad-mixtures not approved by manufacturer of cement/stucco.
	Low temperatures (retarding hydration)	Damp cure above 40 degrees F. until plaster hardens. Do not damp cure below 40 F.
	Poor quality or improperly graded aggregates.	Specify ASTM standards for aggregates. Use clean, angular and graded sand.
SHRINKAGE CRACKS	Excessive cement/lime in mortar mix	Adhere to ASTM ratios of sand to cement/lime. Lime is cementitious
	Inadequate curing	Enforce moist curing of plaster to avoid rapid evaporation, particularly in warm windy weather. Refer to manufacturer SMA. curing
	Too much suction in base material	Control suction by pre-wetting base ahead of plaster application.
	Over-restraint	Wherever possible use unrestrained construction. (relieve stress)
	Improper aggregate	Follow ASTM C 897 for gradation & use washed plaster sand
	Hot, dry, windy weather	Shield or spray with water to keep moist. Or delay work until cooler
	Finish coat harder or denser than basecoats	Provide uniform density (hard float) of brown (base) coat. Smooth trowel finish stucco will tend to crack more. If possible use texture cement finishes or specify a lamina.
	Variations in plaster thickness	Apply in uniform and trowel even
STRUCTURAL CRACKS	Transfer of structural stresses (thermal, wind-load, seismic, dimensional change, creep, plastic flow, deflection, wood shrinkage and warping, sheathed backing,	Separate plaster membrane from structural members wherever possible to inhibit transfer of stresses greater than plaster membrane can absorb.

	impact, vibration, etc.)	
	Foundation settlement Expanding soil	Provide solid firm foundation (dimension, reinforcing, pad, etc.) Provide adequate foundation stabilization for soil conditions.
	Insufficient or irregular plaster thickness	Use grounds to establish nominal thickness of plaster. Substrate and framing in-plane tolerances must meet industries standards.
	Reinforcement (lath) not properly embedded in plaster membrane	Avoid over fastening, attach lath along framing supports per code (6 to 8 inches o.c.)
	Re-entrant cracks (cracks at corners of openings, i.e. windows/doors etc).	Avoid panel sheathing and lath joints aligning at corners. Specify control joints or lamina. Consider butterflies per SMA recommendations
	Improper framing-design	Deflection, use L/360. Do not bind floor line deflection joints.
PLASTER DETERIORATION	Alkalinity (sulfates)	Stop plaster above soil grade or control moisture in adjacent soil.
	Freeze-thaw deterioration	Seal larger cracks and joints in plaster.
	Reactive aggregate	Use low alkali cement and prohibit use of reactive aggregates.
	Painting with oil paint or non-breathing type coatings	Avoid non-breathing type (low perm) coatings over stucco. SMA recommends 7 or higher.

PORTLAND CEMENT PLASTER CRAZE CRACKING-EFFLORESCENCE

UNWANTED CONDITION	POSSIBLE CAUSE	POSSIBLE REMEDY OR FUTURE PREVENTIVE CONDITION
Crazing (alligator or check-cracking).	Improper and inadequate curing.	Avoid rapid evaporation of moisture for a minimum 24 hours. Control suction, pre-wet absorptive bases
	Rich mixes.	Do not use mixes with excessive cement or lime ratios.
	Overworking surface.	Do not over-work or over trowel finish. Smooth texture is recommend to have a lamina specified
	Too thick application	Install plaster coats not to exceed manufacturers or SMA recommendations
Efflorescence (discoloration or bloom created by salts traveling in solution).	Water-borne contaminants.	Use only clean potable (drinking) water. If needed, check water for salts (ASTM).
	Aggregate-borne contaminants.	Check aggregates for impurities (ASTM).
	Base-borne contaminants.	Check surface to be plastered; alkali: salts may be present in material to which plaster is applied and may be brought out in solution with the water in plaster.
	Cement.	Avoid additives not recommended by cement manufacturer
	Moisture migration brings soil salts into plaster membrane.	Install weep screed for framed walls at floor line. Masonry-avoid stucco contacting soil with alkalinity issues (check masonry prior to plastering for signs of efflorescence)
	Excessive evaporation drawing water out, carrying salts to the surface	Dark color can increase evaporation. Encourage lighter tones to minimize hot walls and accelerated evaporation

DISCOLORATION OF STUCCO

Discoloration - uneven color	Color pigment unevenly mixed.	Add all pigment and mix thoroughly. Encourage proprietary pre-mixed finish coats whenever possible.
	Trowel burning or dry floating finish coat.	Do not over-trowel or float without water in one area.

	Control of water.	Use water as uniform as possible in cement finish. Basecoat surface must be uniformly moistened to control suction for cement. Primers may be used for acrylics to insure color uniformity.
	Finish mixed with inconsistent water additions	Acrylic: Paint per manufacturers recommendations Cement: Fog coat
	Curing (cement finish coat should not be damp cured)	If extreme wind or heat require color coat to be cured, it should be done with a very fine fog spray. Do not allow water to run down the wall face.
	Dirty tools or floating water.	Keep tools and working water clean.
	Scaffold Lines	Work to maintain a wet workable joint. The longer the time to plaster a lower level of a wall panel increases the likelihood of scaffold lines. Use adequate clean water when floating cement finish.
	Rain on fresh finish coat.	Avoid plastering either immediately before or after rain. Do not apply acrylic to up facing horizontal surfaces
	Stains from flashings, rusted screeds, roofs and untreated wood, etc	Protect from staining from drip and run-off from adjacent materials. Use non-corrosive flashing, lath, trims and fasteners.
	Dark colors, pigment separation (migration).	Avoid dark, heavily pigmented colors in floated cement sand or smooth trowel finish
	Uneven thickness of basecoat.	Provide for uniform thickness of all coats.
Dark stains or spots appearing after heavy rains	Possible material incompatibility, bituminous leaching issue	Insure building paper, house wraps, flashings, sealants and PVC windows are all chemically compatible to each other
Rust stains on corners	Possibly a rusty nail. Acrylic finish coat over wire nose aid will rust in damp regions	Use corrosion resistant fasteners. For acrylic finish coats use PVC nose or pre-prime wire nose in damp regions.

LACK OF BOND

Lack of Bond to Masonry/Concrete	Surface to be plastered is too smooth.	Specify scoring to create proper mechanical key. Blast, chip, apply cement dash bond coat or bonding agent if needed. Test patches are recommended to insure bond.
	Residue or coating on substrate inhibiting a good.	Remove any coating that will inhibit plaster bond to masonry or concrete. Building papers are not recommended between CMU and cement plaster. Do not plaster over elastomeric type coatings.
	Insufficient suction.	Insure surface is not pulling moisture “too” fast from plaster. Moisture is needed for hydration and a chemical bond.
	Improper bonding agent	Use bonders for cement or concrete on exteriors.
Cement Finish popping off Corners	Cement will stick to PVC nose, but not bond long term	Recommend using wire nose aid for cement finish coats

PORTLAND CEMENT PLASTER – LEAKS

UNWANTED CONDITION	POSSIBLE CAUSE	POSSIBLE REMEDY OR FUTURE PREVENTIVE CONDITION
Floor line leaks Framed Walls	Failure to install weep screed at framed wall to concrete slab. Water cannot exit .	Install weep or flashing to prevent water damming and allow for exit at framing to concrete slab or wall
	Reverse lap of WRB and Flashing.	Insure WRB laps over flange of weep screed or flashing
Wall Leaks	Windows not properly rated for wall condition or improperly flashed	Select windows per AAMA standards. Flash per SMA or manufacturers recommendations
	Penetrations/Terminations allowing water entry	Flash or seal all penetrations exposed to rain entry
	Roof to wall leaks	Provide proper counter flashing (Z bar), drips, kick outs or/and diverter.

	Wind-Driven rain over whelming the assembly. (Not common).	**Occurs in conditions of frequent rain and high winds. Increase legs of flashings and overlaps in WRB from two (2) to four (4) or six (6) inches as needed.**
	Porous Plaster (not common)	**Cement plaster is not typically porous. Compact (hard float) brown coat; use SMA or ASTM mix ratios.**
	Large Cracks.	**Hairline cracks are not known to leak. Larger cracks can allow enough water in to overwhelm a concealed barrier system. Use control or expansion joints. Seal wider than hairline cracks in rain prone regions.**
	Trim Miters can open and allow enough water entry, to overwhelm the concealed barrier systems design.	**Seal all gaps that can allow water entry, leave exit points open. Install or "back-seal" trims with sealant prior to plastering is best practice. This protects the sealant form UV and the wall against excessive water entry.**

GENERAL COMMENTS

Flashing with corrosion-resistant metal is important to prevent water penetration of the wall at vulnerable points such as at openings, at tops and sides of trim, under copings and sills, at intersections of walls and roof, under built-in gutters, and at any places where water might gain entrance.

WRB (Water Resistant Barrier) is generally not recommended over masonry/concrete substrates or on ceiling and soffits. Two layers WRB are recommended over sheathings.

Lamina, a fiber re-enforced mesh embedded into a polymer enriched skim coat of cement. Generally used on cement basecoat or a finish stucco. Insure polymer skim coat is compatible with finish coats.

Materials used for plaster must be of good quality. Mixture must be designed to provide a workable, cohesive mixture with low water-cement ratio.

Curing deserves special attention during warm dry weather. It is essential that portland cement plaster retain enough moisture for hydration until setting and hardening has taken place. Moist curing helps develop maximum strength, density and impermeability, reduces shrinkage and offsets crazing and cracking.

Approved Windows should be flashed per the SMA document "Flashing an Nail Flange Window" see SMA details

Use sufficient pressure when applying plaster to insure a bond to substrates and between coats Portland cement plaster must be applied with sufficient pressure to obtain full bond between successive coats.

When lath reinforcement is applied to structure it supports plaster in place and restrains initial shrinkage; one-piece control joints help control minor stress cracking. Two-piece expansion joints allow for greater stress relief.

The brown coat must be compacted and hard floated to densify. This improves water resistance, reduces cracking and provides a good key for the finish coat.

Painting Stucco is an acceptable method to change color. A finish coat of stucco over painted stucco depends on, condition (bond) of the paint, type of paint, and the finish coat being applied. Ask the stucco manufacturer of the finish coat for recommendations.

Decorative foam shapes can be adhesively applied to the basecoat. Then a lamina to coat the shape and apply finish coat to walls and shapes.