Stonepanels®

**MADE IN U.S.A**

# WHY CONSIDERATION SHOULD BE MADE FOR
# **Stone**Lite®
# LIGHTWEIGHT NATURAL STONE CLADDING SYSTEM

## STRENGTH

3cm to 4cm thick non load bearing veneers/cladding is a relatively new 'tradition' (approx 40 years) with countless 'failures'. Stone has low flexural and very poor impact strength due to its brittle nature. In addition the strength is greatly affected by the flaws and defects prevalent in natural stone.

The stone on **Stone**Lite® is simply a decorative veneer; therefore the natural flaws and defects of the stone are not a factor. The strength of the panel is in the fiberglass – reinforced honeycomb backing. (Technology emanating from the aviation industry). This combination yields vastly improved flexural and impact strength. **Stone**Lite® panels have been tested to over 400lbs/sq.ft. wind load and resists large missile impact and **dynamic hurricane loading** in accordance with **South Florida Building Code. Stone**Lite® has also **passed GSA Level C Blast Criteria** consistent with a "High Level of Protection" per the Unified Facilities Criteria.

**Stone**Lite® DISMISSES problems inherent with 3cm to 5cm "traditional" stone cladding systems such as:

- Finite element analysis.
- Reliance on a system of traditional stone anchors subject to atmospheric elements.
- Movement difficulties during installation - field adjustments & tolerances
- Assumptions and Limitations about loads from the 'System'
- Flexural Analogy
- Moisture Ingress
- Seismic incompatibility
- Impact resistance
- Weather dependent installation in most cases
- Highly skilled stone fabricators / installers
- Heavy Equipment mobilization

## FLEXIBILTY

Stone is extremely brittle and can withstand minimal structural movement. **Stone**Lite® panels are very flexible and can move with the structure. (**Stone**Lite® Seismic Racking Test Report available). This makes **Stone**Lite® ideal for high wind load or seismic situations. This is supported by the favorable experience on projects in South Florida during Hurricane Andrew and the San Francisco Bay area. **Stone**Lite® clad buildings experienced no cladding damage following the 1989 earthquake. In fact, Stone Panels largest market (per capita) is Alaska for reasons of freeze-thaw and seismic.

## BOND STRENGTH

Bonding of the stone to the aluminum honeycomb panel concerns can be dismissed. To obtain **I.C.C. approval**, a sandwich panel must pass many tests. For bond strength the flat wise tension must be a minimum of 50 p.s.i. After an accelerated aging test designed to approximately assimilate 30-year life, strength can be no less than 85% of its original value.

**Stone**Lite® panels achieved an initial strength of 385 p.s.i. (55,400 lbs/ft2) and a post aging strength of 460 p.s.i. (66,200 lbs/ft2) representing an INCREASE in strength of 20%, due to post curing of the epoxy resin, which gains strength over time.

Considering that a.) The initial strength exhibits a safety factor of over 2,000:1 when subjected to a 100 m.p.h. wind and b.) The post ageing strength is HIGHER; obviously extrapolation of such results would only show an infinite life expectancy.

Further investigation also shows that the bond strength always exceeds the cohesive strength of limestone, marble and most granite. Therefore, the expected failure in service would only be by fracturing the stone surface.

The consideration for long term durability must then be limited to the erosion resistance of the stone surface. The stone most susceptible to this, of all those we have produced to date, is Indiana Limestone. The Indiana Limestone panels with a ¼" thick stone (average) would allow for a serviceable life of some 300 years. A granite surface would far exceed this life expectancy.

I.C.C. approves **Stone**Lite® for Class 1 (unlimited height) structures. We have never had any failure (delamination or otherwise) of **Stone**Lite® panels. Neither should we, considering the strengths achieved.

## ATTACHMENT SYSTEMS

The weakest point of a cladding system is normally its attachment system.

A typical 3-4 cm system has kerf cut into its edges, leaving a short tab of stone approximately 3/8 inch to a ½ inch thick set onto the anchors. These tabs cover about 1% of the panel area and must resist the total wind load on the full panel. In this situation the tab is subjected to combined bending and shear stresses, which exposes the weakest property of the stone. When combined with the micro-cracking common in all stones and the action of the freeze-thaw cycling, it is easy to understand the benefits of the **Stone**Lite® panel system.

Compare this attachment system to the full surface bond coverage using high strength adhesive and factory set inserts that may be designed to meet any wind load requirement. (Test Reports Available)

## WEATHERPROOF

Natural stone absorbs moisture, some to a greater extent than others. Water will pass through travertine and limestone in a matter of minutes, sometimes seconds. Polished granites, the best performers, will take longer, but will eventually weep.

Moisture in stone has two potentially harmful effects on the solid stone system. The moisture-laden stone under freezing conditions can seriously weaken the structural integrity of the solid stone, particularly significant around the attachment areas. The weepage through the stone into the cavity can lead to mold and can build to significant quantities potentially causing water ingress into the building interior.

**Stone**Lite® has a totally impervious moisture barrier between the stone 'veneer' and the aluminum honeycomb 'substrate' which prevents all of the above problems. Independent testing coupled with 'on the wall' performance has proven this many times.

**Stone**Lite® has traditionally been installed in the U.S. as a 'barrier' wall (sealed joints). Many of our projects are in Europe where **Stone**Lite® has been successfully used in many 'open joint' applications. **Stone**Lite® panels are also excellent for 'glazing' into systems by others (IE curtain wall and store front).

**EXPERIENCE**

One of the most common misconceptions is that this is a "new" product as compared to solid stone. The fact is we have been producing these panels for close to forty years and they have been used as cladding for the exterior of buildings in the U.S. for over 25 years. The new "tradition" of 3-4 cm (1 1/8 – 1 ½ in) thick non load bearing veneers have actually only been common for about 40 years, and have been plagued with problems and Failures.

As stated previously, consider this technology application in the aircraft industry. Since the 1950's aircraft have used epoxy resins to bond their assemblies. Every commercial and military aircraft built in North America and Europe utilize honeycomb and epoxy resins for their control surfaces (flaps, ailerons etc.). The Stealth fighters and bombers are totally built from fiber-reinforced composites (honeycomb and resins). Helicopter rotor blades are now normally similarly structured.

Aircraft are DYNAMIC structures and subjected to enormous forces. A plane leaving a desert airstrip may have surface temperatures around 200°F which will change to minus 60/70°F within minutes when it reaches 30,000 feet coupled with experiencing 500 to 1500 m.p.h. wind loads, plus tremendous vibration. The design life of an airliner is normally 20 years but many are in service much longer. How many buildings are subject to CONSTANT wind loads over 500 M.P.H.?

At an independent test laboratory we were attempting to test **Stone**Lite® panels to destruction. We blew out the test chamber at 413 lbs/ft2 (equivalent to a wind speed over 400 m.p.h.) and the panel did not fail.

At the same time a test for a 30mm system failed at 46 lbs/ft2 (135 m.p.h. wind) by the stone breaking away from its kerfs, plus its EPOXY SET dowel anchors added when it first failed at a lower pressure. The second redesign with added fasteners allowed it to just meet the esign criteria of 60 lbs/ft2 (155 m.p.h.)

We're not suggesting that anyone needs a 2,000:1 safety factor but it is very comforting.

**TESTING**
Consider the project test requirements for **Stone**Lite® panels and the 3-5 cm veneer systems.

3-5 cm - Leading construction consultants recommend some 20 separate tests using over 150 specimens plus full scale (2-stories by one bay) mock up and wind tunnel tests (proposed building plus surrounding structures) for each project. This test program is necessary due to the highly variable physical qualities of stone. These tests may take many months prior to construction, plus the expense is not insignificant. However, compared to the cost of a failure it is obvious it should not be avoided.

**Stone**Lite® - The strength of the stone has no effect on the **Stone**Lite® panel system making almost all of the recommended tests irrelevant. All of our tests carried out to date have proved the **Stone**Lite® systems strength and serviceability.

The sealant compatibility test should be run for the particular stone and sealant to be used for the project. The only other test with any relevance and not already tested, is the wind tunnel test. Applying the appropriate building code standard and considering the safety factors with the **Stone**Lite® system can normally avoid this.

In 1995 we conducted the Acid Freeze – Thaw test devised by Wiss, Janney, Elstner Assoc. Inc. (W.J.E.) to establish the relative life expectancy of granites, marbles and lime stones in a harsh environment. This test is extremely severe and no marble and few lime stones have ever passed. The material is submerged halfway (stone face down) in a bath of dilute sulfuric acid (4ph). It is rapidly cycled 100 times from -13°F to + 173° F in a 6-hour cycle, using an aircraft-conditioning chamber. Flexural strengths are taken before and after.

3 to 5cm (1 ¼ - 2”) polished granite loses 25% flexural strength in this test, flamed granite 45% and marbles average 70% loss. **Stone**Lite® panels lost an average of 13.6%. They started with a flexural strength of 24 times greater than solid granite and ended 67 times that of solid marble.

WJE Engineers are trying to have ASTM adopt this test as a standard. If they are successful, the only marble less than 4 to 6 inches that would pass is a **Stone**Lite® panel.

Following Hurricane Andrew, the South Florida building code was modified to add another test due to the massive devastation created by flying debris. In the test, the cladding material is subjected to a 90 p.s.f. cyclic wind loading 1,342 times then taken to a maximum of 135 p.s.f.. A 2” x 4” x 8’ timber stud is fired several times at the panel at 50 ft/sec. This simulates a house stud being thrown in a 100 m.p.h. wind following wind cycles of 190 m.p.h. with gusts up to 230 m.p.h.

**Stone**Lite® panels easily pass this test, but the stud passes straight through 1 ¼” (3cm) thick granite at less than 10% of the force. The stud is barely slowed on its way into the 3cm granite clad building. Blast Mitigation testing is underway and given the performance (current test results) with regards to flexure and attachments, we feel confident at success.

**Stone**Lite® has European Approval through both the U.K.’s British Board of Agrement and the French Avis Technique, something no other stone cladding product can claim (let alone a lightweight one).

***(ALL TEST REPORTS ARE AVAILABLE ON REQUEST)***

**COST**
The installed cost of the **Stone**Lite® system is typically less than that of a well engineered 3cm to 5cm system. The 80% reduction in weight using **Stone**Lite® translates into savings in the cost of back up structure along with rapid installation without the need for expensive heavy duty mechanical handling equipment. Couple this with the life cycle of **Stone**Lite® vs. 3cm to 5cm stone

**COLOR**
Another distinct advantage of **Stone**Lite® is in the area of color control. All stones, by nature, vary in color. The manufacture of **Stone**Lite® panels only require about 1/3 the amount of stone used by a 3cm project. This provides greater color consistency for the building. However, it is very easy in most cases to pre-determine the layout of the panels and colors, and blend them prior to fabrication/installation to achieve the desired aesthetic result.

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