

DETERMINING THE BOND STRENGTH OF ADHESIVE MORTAR

The American National Standards Institute's (ANSI) test methods for adhesives and adhesive mortars include shear bond testing (lateral stress until failure) and tensile bond strength testing (vertical stress until failure). Each product method has minimum requirements for resistance to failure. Within the test methods, samples are allowed to dry/cure before testing or immersed or subjected to freeze-thaw cycling prior to breaking to simulate site conditions; see ANSI A118 Product Standards for values. The modes of failure are illustrated below for shear and tensile bond strength test setups. All values of the various mode failures are acceptable for meeting the standards as long as the value meets the ANSI requirements. (Note: BF for bond failure is typically due to a setup error and results are often eliminated from the series.)

These different modes of failure are acceptable because adhesives, mortars and tiles vary greatly in physical characteristics. A tile may be very strong and resist breaking. It may be very smooth and dense with low absorption, such as porcelain tile. The mortar may be very strong, but rigid with high levels of cement and low polymer levels, or with higher levels of polymer that increase adhesion but are less rigid. In each of these scenarios, the "weakest link" can change to a different spot in the assembly but this value determines the adhesive's classification for performance.

These adhesion strength tests can also be replicated on installed tile or stone flooring or wall veneers in situ. This requires qualified technicians and equipment to provide assurance that products are performing as specified, but results of adhered tiles are usually much lower due to substrate strengths, climatic conditions and test setups. For example, the shear bond strengths required on an exterior facade are ≥ 50 psi while in a laboratory setting, some mortars are expected to achieve over 400 psi in shear bond strength testing.

Unfortunately, some have considered using a chisel, pry bar or screwdriver along with a hammer to measure tile and/or mortar strengths. As these are recommended to demolish tile, it's no surprise that they more easily remove them. The impact and stress from a hammer to a screwdriver, chisel or pry bar creates unmeasurable bending forces combining shearing and tensile (vertical displacement) at the same time. They act as a lever

and a very old adage shows that these assemblies are no match:

"Give me a lever long enough and a fulcrum on which to place it, and I shall move the world."

— Archimedes c. 287 BC – c. 212 BC



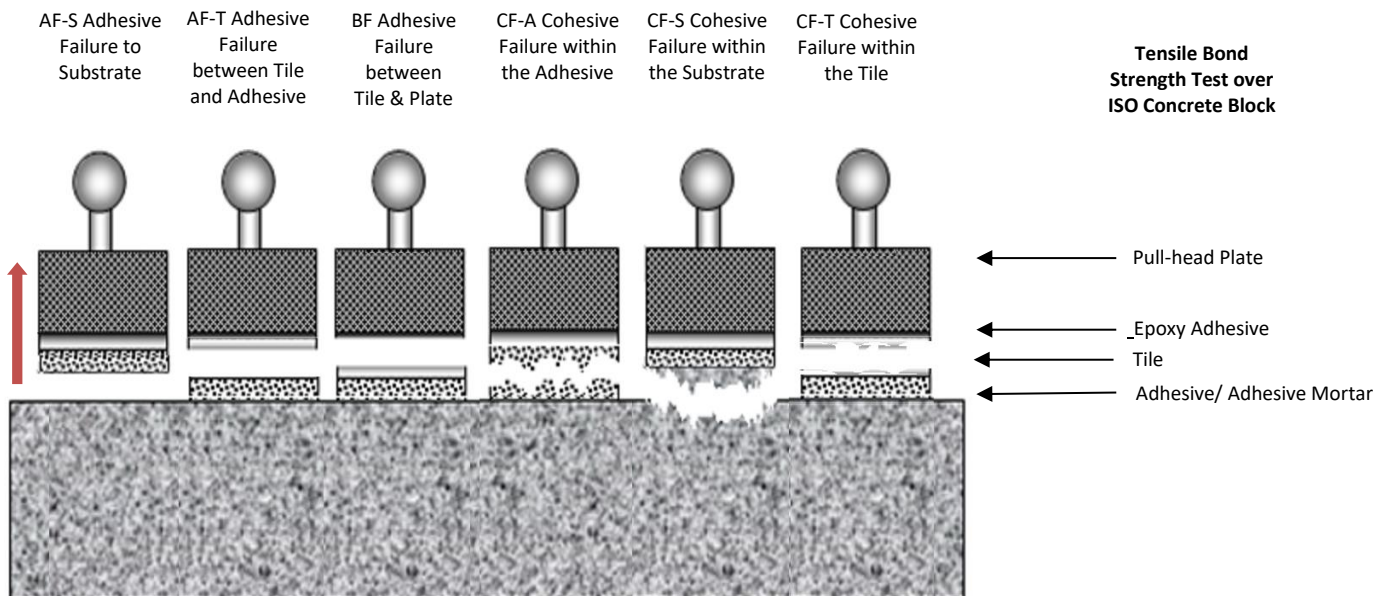
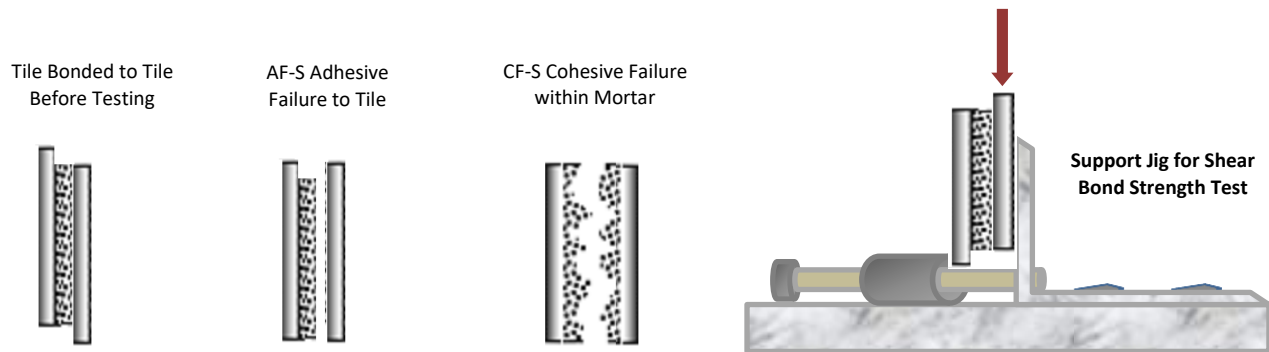
After performing these types of site tests, the results can be very misleading when not understood. The realities are described below:

- Failure between the adhesive mortar and tile reveals that the tile is physically strong and the mortar is also very dense and well adhered. Not a failure...
- Mortar failure within itself shows that it is bonding well to both the tile and substrate and the adhesion is stronger than the mortar. Not a failure...
- Mortar failure from the substrate shows that this is the weakest link. Often a thin layer of the substrate comes up with the mortar or a thin layer of mortar is still adhered. Not a failure either but it could reveal a lack of surface preparation or the substrate's lack of absorption.

In addition to above results, there are other factors that affect bonding where a professional consultant can assist with determining these other causes. These include substrate deflection and a lack of movement joints. Often due to these conditions, tile releases as if it was never bonded with only a slight slam of a hammer or using a screwdriver at a grout joint because the assembly has been under compression.

When assessing tile bond strengths, always look to the industry professionals for guidance. If you have additional questions, please contact your local CUSTOM Building Products Representative.

DETERMINING THE BOND STRENGTH OF ADHESIVE MORTAR



Disclaimer: The information and suggestions from Custom Building Products are provided above as a professional courtesy and are a broad overview of possible conditions that might occur. For specific recommendations on your project, you may choose to consult a professional for advice prior to action. Custom Building Products takes no responsibility for suitability of assessment or remediation methods taken as a result of providing information above.

The information in this bulletin is presented in good faith, but no warranty, express or implied, is given nor is freedom from any patent in as much as any assistance furnished by CUSTOM with reference to the safe use and disposal of its products provided without charge. Custom Building Products assumes no obligation or liability therefore, except to the extent that any such assistance shall be given in good faith.

TB101 4/21

