NATIONAL APPLIED CONSTRUCTION PRODUCTS

# Sound Control Solutions

Sound Control

# When it comes to sound control, how you choose to filter out the noise can make a big difference.

When a builder, architect, contractor, specifier or homeowner identifies a flooring situation in need of a sound control system, additional factors should be considered prior to choosing a solution. Is the system waterproof, moisture and mold resistant? Does the system provide crack isolation protection and the ability to immediately and successfully install hard surface flooring?

Many products available on the market today do not address all of these important issues. This booklet is an educational reference guide designed to provide information related to the value and importance of these systems as well as some solutions to help you make more informed decisions when investing in a sound control system.

## What are the industry standards?

The industry standards are practices that define the installation of ceramic tile as well as the test methods and physical properties for ceramic tile installation material. The industry standards have been determined or are recognized by industry professionals including, ANSI (American National Standards Institute), ASTM (American Society for Testing & Materials), TCNA (Tile Council of North America), NTCA (National Tile Contractors Association) among others, to serve as a guideline for the tile industry.

ANSI Method A118.13 is the primary material standard for sound control. This method and some other important specifications are outlined in the “technical data & specifications” section in the back of this reference guide. Full copies of these standards and practices can be obtained through NAC Products by calling 800-633-4622.

## Who is responsible if the floor does not meet industry standards?

The contractor? The installer? The architect? The specifier? Standards for sound control involve more than just the level of sound reduction a product can achieve. It also includes the ability to protect the tile system from failure, such as cracked tile due to excessive loads, tile and thin-set delaminating from the sound control membrane and de-bonding of the membrane from the substrate.

All of these issues are addressed by ANSI test procedures and standards. See the “technical data & specifications” section in the back of this reference guide. A tile system that just accomplishes sound abatement but is inadequate for proper tile installations could result in legal issues.

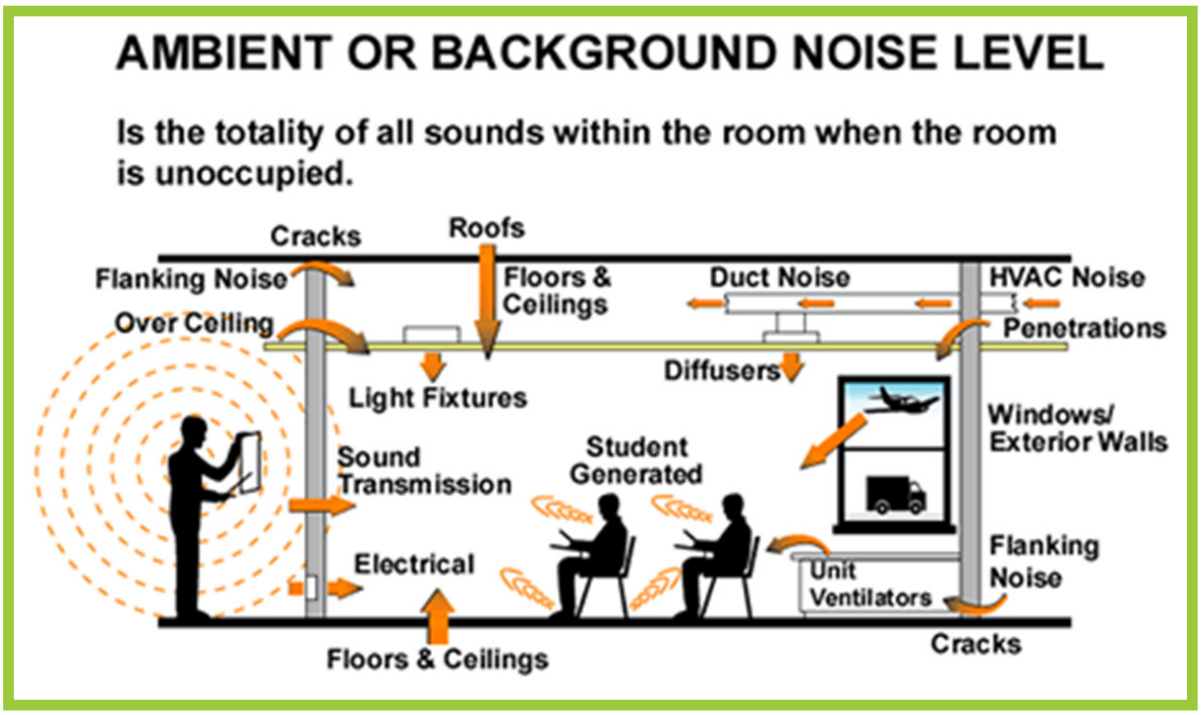
## Issues to consider when reviewing sound control solutions

- Owners do not want noise. The number ONE complaint to association/property management is the floor/ceiling noise issue.
- Building code requirements. Review to ensure conformance to International Building Code (IBC), Universal Building Code (UBC) and Local Building Codes.
- Legal and liability related issues. Protect yourself and your reputation. Know your rights and responsibilities under the law.
- Homeowners association requirements. Check with the association/property management to ensure compliance. Many associations have requirements much higher than the building code.

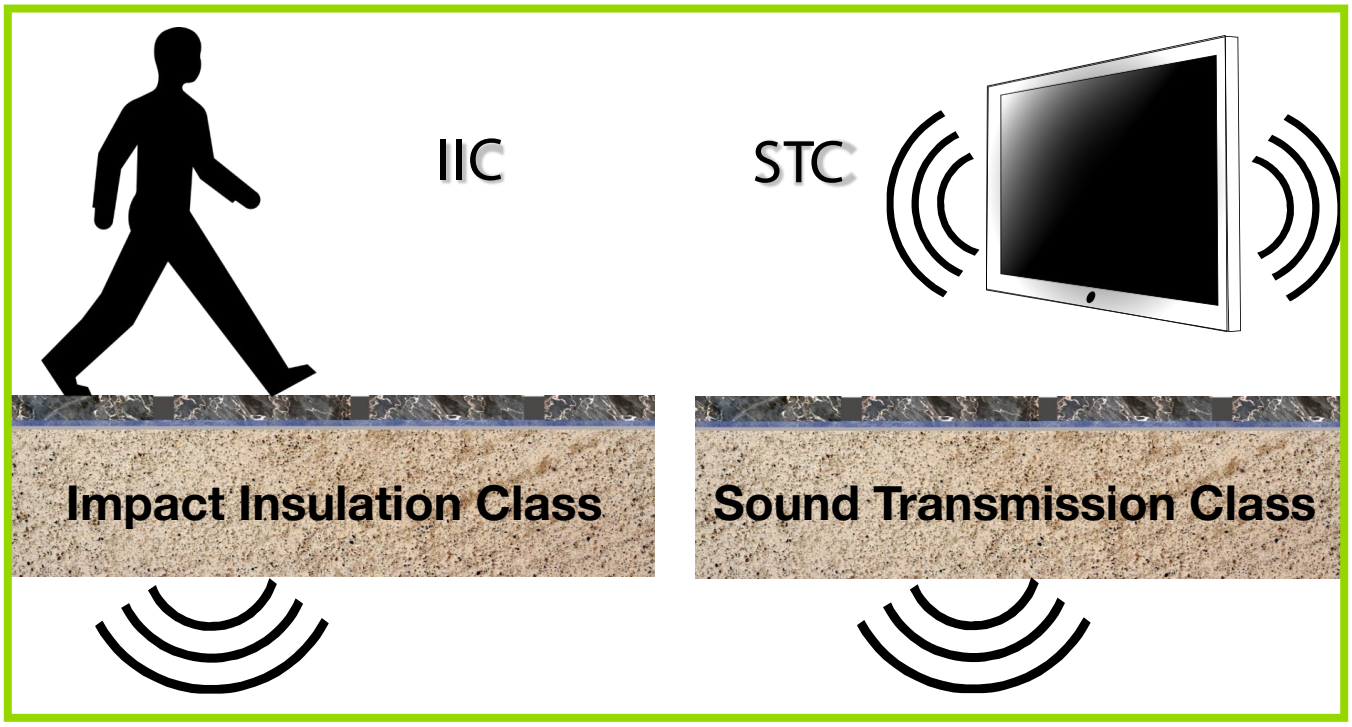
## How Does Sound Travel?

There are a wide variety of ways that sound vibrations travel. Airborne sounds such as traffic, voices, television, etc., can penetrate through walls, doors and other structural elements. Open windows, cracks around doors, heating and ventilation ducts, and other imperfectly sealed openings may also “leak” airborne noise.

Impact sounds are produced by falling objects, footfalls and mechanical impacts. Since the most annoying and critical impact sounds are transmitted through the floor, floor constructions are rated for impact noise reduction, as well as for airborne sound transmission.



# Noise Categories




## How is Sound Measured?

There are three types of laboratory tests used to measure sound vibrations; Sound Transmission Class or STC, Impact Insulation Class or IIC, and Delta IIC.

1. **STC: Sound Transmission Class (Test Method ASTM E 90)**

   "The term STC refers to the single figure of evaluation used to quantify the transmission of airborne sound through building elements, such as walls or floor systems. These types of sounds would be the equivalent of voices, radio, or television in the context of a multi-family building". - *TCNA Handbook*

2. **IIC: Impact Insulation Class (Test Method ASTM E 492)**

"The term IIC refers to the statistical measurement standards used to quantify the transmission of impact sound energy through a floor/ceiling assembly system. These types of sounds would be the equivalent to foot traffic, dropped articles, or furniture moving in the context of a multi-family building". - *TCNA Handbook*

3. **ΔIIC: Delta Impact Insulation Class (Test Method ASTM E 2179)**

Delta IIC refers to the accurate evaluation of the underlayment system. This method measures the bare concrete slab first. The underlayment system is then installed on the concrete slab and retested. The Delta IIC rating is the performance gain between the first and second test. For example, a bare 8" concrete slab has an IIC value between 28 and 32. Super SAM® 125 has a Delta IIC of 22. This means the Super SAM would have an IIC value between 50 and 54.

## Testing for Sound Control

Sound testing can be done in an approved laboratory or in a field setting at the location, but there are significant differences between the tests.

**Lab Testing: (IIC, STC, ΔIIC)** Lab tests should be performed in an accredited laboratory. These test are typically more reliable because of the controlled environment in a lab setting providing a more accurate representation of how a system will perform in a different contruction settings.

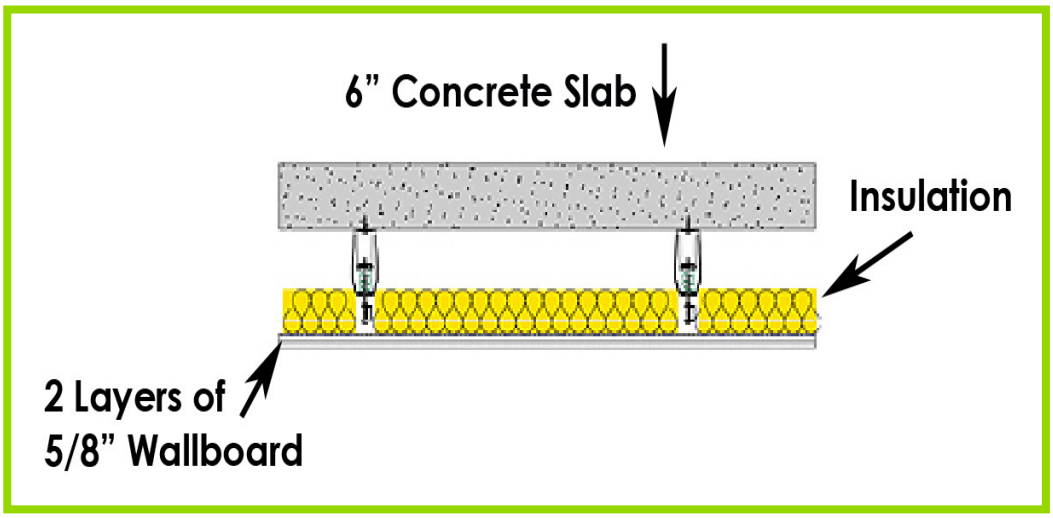
**Field Testing:** Field tests are generally recognized to only be valid in the exact building where the testing took place. There are a number of variables that can skew the results of field testing. Testing should be required before AND after installation because of these variables.

**Flanking:** Flanking is the leaking of sound through other building systems that can affect sound attenuation from one living space to the next. Flanking can reduce field test readings by as much as five points. Variables that can impact ratings include:

- Room sizes and furnishings in receiving room
- Street and other sources of exterior noise
- Elevators or other sources of noise in the building
- Building design including placement and amount of insulation, HVAC, plumbing and electrical outlets

# Sound Rated Ceiling Assemblies (SRCA)

A Sound Rated Ceiling Assembly is an elaborate system typically used between the floor and ceiling in residential and commercial buildings, that uses a spring hanger with insulation in the cavity and 2 layers of 5/8” wallboard to achieve very high STC & IIC values.




## Typical Range of IIC Ratings for Concrete Substrates

| Concrete Slab Thickness | No Sound Rated Ceiling Assembly | Sound Rated Ceiling Assembly* | In Lab IIC** | In Field IIC |
|---|---|---|---|---|
| 6” | X | | 26 to 30 | 24 to 32 |
| 8” | X | | 28 to 32 | 25 to 35 |
| 6” | | X | 45 to 52 | 33 to 48 |
| 8” | | X | 48 to 55 | 38 to 52 |

** Suspended Sound Rated ceiling composed of 7” plenum, 3” of insulation, resilient channels, 5/8” Type X gypsum wallboard panels.*

***Tests were conducted in several different labs. Hence, the range of values for each slab thickness shows the variance between labs, not a variance in the test results within a single lab.*

# How to Choose or Specify a Sound Control System

Beware of the “Numbers Game.” Be cautious of products claiming STC and IIC values in the high 60s or low 70s. These values are nearly impossible to achieve with hard surface flooring on a bare concrete slab without a very elaborate sound rated ceiling assembly (SRCA) or compromising the system as a whole.

Some sound control products may have high STC or IIC ratings, but may have too much deflection for the direct bonding of hard surface flooring. These products can range from recycled rubber products to synthetic foam underlayment and cork.

Since cork is harvested as a natural material, its quality and performance can be inconsistent. Cork without effective sound control capabilities can be as much as 1/2” thick and thus becomes problematic when remodeling a condominium. The installation of appliances, door thresholds and trim work can be compromised and expensive to correct.

Referencing the Shear Bond test and Robinson Floor test data for hard surface, direct bonded systems should be considered prior to selection.

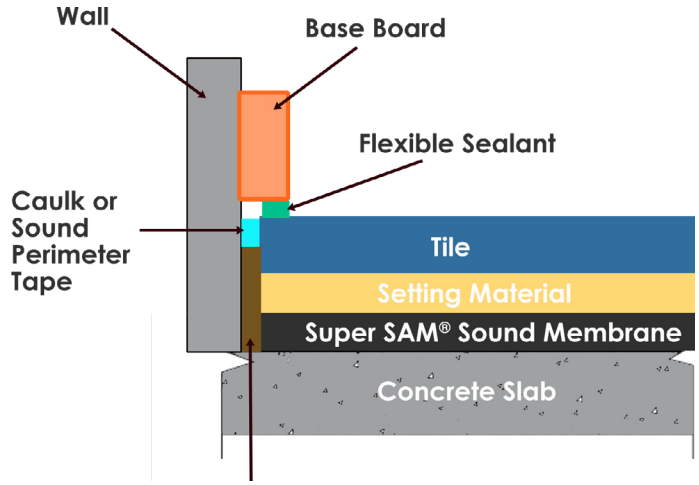
# Installation Guidelines

Understanding and following the manufacturers recommended installation instructions and procedures are essential to the installation since methods may vary depending on the membrane, substrate and finished flooring.

Architectural details and perimeter isolation are important details that shouold not be overlooked. Tile, hardwood and other hard surface flloring should NOT abut walls, cabinets, bathtubs or other fixed objects. Thin-set or grout joints should not fill this space, use a color matched, non-hardening acoustical sealant instead.

Wood base or shoe moldings should not be in contact with the hard flooring material. A minimum 1/16”-1/8” gap filled with a non-hardening acoustical sealant should be used.

Tile wall bases or mouldings should have no grout connections to the tile floor. This grout joint should be filled with a color matched non-hardening acoustical sealant.



# NAC Products Sound Control Solutions


## Super SAM® 125 Sound Control Membrane

Super SAM 125 is a thin, (approx.1/8" thick), self-adhering, self-healing, sound-deadening sheet membrane designed for use under floor surfaces that require impact and audible sound reduction. The peel-and-stick membrane is applied with an NAC primer and may be installed over substrates without a sound rated ceiling assembly (SRCA).

### How It Works

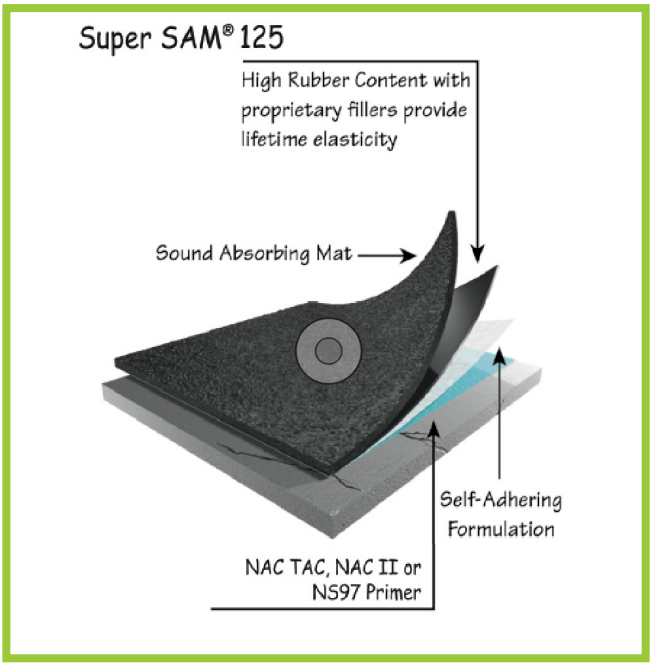
Composed of modified elastomers, sound deadening resins and reinforced woven fibers, Super SAM 125 is designed for floors requiring an IIC and STC ratings of not less than 50 as determined by ASTM Standards E90, E413 and E492.

Super SAM substantially reduces reflective cracking and delamination between the substrate and floor surface, protecting up to 3/8" lateral substrate movement. Once applied, flooring can be installed immediately, minimizing down time and labor cost.

### Contains Zero VOCs

Certified Clean Air GOLD, Super SAM contains no VOCs and conforms to the California Department of Public Health (CDPH) Standard Method v1.2 for private office, school classroom and single family residence. Super SAM is ideal for condominiums, classrooms, multi-family housing, hotels, high-rise office buildings, media rooms and any commercial or residential installations requiring sound control.

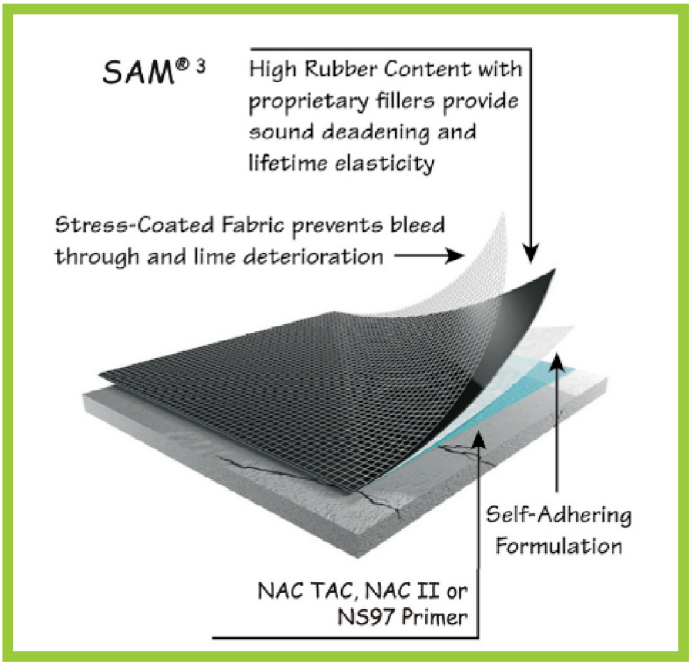
***(*Softer flooring like vinyl, VCT, SPC and others may require alternate installation. Contact NAC for instructions.)***




- IIC 51 STC 54 ΔIIC 22 on 6" slab with tile
- IIC 56 STC 61 over wood joist with tile
- IIC 51 STC 52 ΔIIC 23 on 6" concrete with hardwood
- Crack protection for up to 3/8" lateral movement
- Same day flooring installation
- Clean Air GOLD certified, No VOCs
- Serves as barrier to MVT
- Light Commercial/Residential load rating

# SAM® 3
# Sound Control Membrane

SAM 3 is a 90 mil (< 1/8”) thick, self-adhering, sheet-applied, elastomeric membrane designed for use under floor surfaces that require impact and audible sound reduction. The low profile, peel-and-stick membrane is applied with an NAC primer and may be installed over substrates with or without a sound rated ceiling assembly (SRCA).


- IIC 70 STC 67 on 8” slab with SRCA
- Crack protection for up to 3/8” of lateral movement
- Thin, low profile with superior flexibility
- Same day flooring installation
- Meets ANSI A118.13, A118.10, A118.12
- Provides MVT protection up to 10#/1000 SF/24HRS when used with NAC TAC or NS97 and 7#/1000SF/24HRS when used with NAC TAC II
- Residential load rating
- Clean Air GOLD certified, No VOCs

## How It Works

The 90 mil thick (< 1/8”) self adhering sound deadening sheet membrane, consists of a base layer of polymer modified elastomers permanently laminated to a unique “stress flex” fiber sheet to form a single, high performance, self-bonding membrane.

SAM 3 is designed for surfaces that require impact and audible sound reduction with an IIC rating and a STC rating of not less than 50 as determined by ASTM Standards E90, E413 and E492

## Contains Zero VOCs:

Certified Clean Air GOLD, SAM 3 contains no VOCs and conforms to the California Department of Public Health (CDPH) Standard Method v1.2 for private office, school classroom and single family residence. SAM 3 is the perfect solution for condominiums, classrooms, multi-family housing, hotels, high-rise office buildings, media rooms and any commercial or residential installations requiring sound control.

# ANSI A118.13 Specification for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation

## Introduction

This introduction is not a part of American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Tile Installation, A118.13.

Bonded Sound Reduction membranes for thin-set ceramic tile installation lower the transmission of sound from one room to the room below. Membranes covered by this specification are bonded to a variety of manufacturer-approved substrates covered by ANSI specifications. Products within the scope of this specification are applied below ceramic tiles by traditional methods and materials. Dimension stone is a product of nature with a wide variety of inherent characteristics including veins, fissures, starts, and dry-seams. These characteristics may make the stone tile relatively fragile and susceptible to cracking and chipping when exposed to traffic. This susceptibility can be even more predominating when stone is placed on sound reduction materials, which are almost always resilient or compressible by nature. This standard was specifically created for ceramic tile. If used for dimension stone for tests in section 5.1, 5.2, and 5.3, the type of stone, facial dimensions, and thickness should be identified and replicated to a specific field application.

This standard applies to trowel applied, liquid, and flexible sheet membranes.

These membranes provide the lowest profile (elevation) of the tile installation incorporating a bonded sound reduction membrane.

Consult individual manufacturers for specific instructions, application, performance levels, and limitations concerning their materials. Follow the individual manufacturer's written instructions precisely.

This standard was developed to provide specifiers and installers with the minimum criteria necessary for a material to function as a bonded sound reduction membrane when used with ceramic tile. Additional tests, which are not a requirement of this specification, may be run when requested for a particular project, using the exact materials for that project.

Additional general information is also available in the current TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.

## End of Introduction

### 1.0 Scope

This specification describes the test methods and minimum requirements for sound reduction membranes for thin-set ceramic tile installation. It should be noted that while sound reduction membranes are intended to minimize the transfer of sound from one room to the room below, it is only a part of the overall system.

Substrates, flooring material, ceiling assemblies, etc., will all affect the overall values. It is important when dealing with a sound reduction membrane that the perimeter joints are properly located and filled as per the manufacturer's instructions. The individual manufacturers, project engineers, and architects should be consulted, per Tile Council of North America (TCNA), regarding their requirements for expansion and control joint material and placement.

## 2.0 Definitions

### 2.1 Latex Portland cement mortar

A modified dry-set Portland cement mortar for the bonding of ceramic tile into which a polymer has been incorporated either in latex form or as a redispersible powder. When added in latex form it is added as a replacement for part or all of the gauging water. The setting bed, after the tile is embedded, shall be nominally between 3/32" and 1/4" in thickness. The setting bed is the thickness of the thin bed mortar between the substrate and the plane of the back of the tile module. Modified dry-set mortars are designed as direct bond adhesives and are not intended to be used in truing or leveling underlying substrates or the work of others.

### 2.2 Acoustical joint

A joint with the primary function of to achieving and maintaining the specific sound value of the system with a non-drying, non-hardening, rubber like seal. Acoustical joints are required at the perimeter of the floor area being treated, and all penetrations and retaining surfaces. Sealants are to be acoustically rated and installed per ASTM C919-08.

### 2.3 Movement joints

**2.3.1 Construction joint:** The surface where two successive placements of concrete meet, across which it may be desirable to achieve bond, and through which reinforcement may be continuous.

**2.3.2 Contraction joint:** Formed, sawed or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting from the dimensional change of different parts of the structure.

**2.3.3 Control joint:** See contraction joint.

**2.3.4 Expansion joint:** (1) A separation provided between adjoining parts of a structure to allow movement where expansion is likely to exceed contraction; (2) a separation between pavement slabs on grade, filled with a compressible filler material; (3) an isolation joint intended to allow independent movement between adjoining parts.

**2.3.5 Isolation joint:** A separation between adjoining parts of a concrete structure, usually a vertical plane, at a designated location such as to interfere least with performance of the structure, yet such as to allow relative movement in three directions and avoid formation of cracks elsewhere in the concrete and through which all or part of the bonded reinforcement is interrupted.

### 2.4 Ceramic tile

Ceramic tile referred to in this standard is as defined in ANSI A137.1. The tile for tests in this standard are to be dry and clean as obtained from manufacturers undamaged cartons. Water absorption of tile is determined by ASTM C373. Tile for tests in this standard include the following:

**Designation Description**

**Type A -** *Glazed wall tile, 4 1/4" x 4 1/4" (108 mm x 108 mm), having a nominal thickness of 5/16" (8 mm), water absorption of 13%-15%.

**Type X -** 4" x 4" x 5/16" (102 mm x 102 mm x 8 mm) nominal unglazed paver tile with a water absorption of 0%-0.5%. The smooth face is used as the bonding surface. (May be saw cut to size from a larger tile.)

**Type X-3 -** 12" x 12" x 5/16" (304 mm x 304 mm x 8 mm) nominal unglazed porcelain tile with water absorption not exceeding 0.5%.

*In order to obtain comparable results, the tile selected shall be Standard Grade, of one glaze color, obtained from one manufacturer. Bonding surface must be cleaned of dust produced by cutting. Brush wet and flush with plain water.

**3.0 Sampling and testing procedures**

**3.1 Sample**
Obtain a sufficient quantity of membrane, setting materials and admixtures for a minimum 100 sq. ft. installation based on the manufacturer's recommended coverage. All materials shall be in the manufacturer's sealed packaging and from commercial lots of recent manufacture.

**3.1.1 Sample preparation:** Prepare trowel applied, liquid, or sheet membrane samples according to the manufacturer's recommended application procedures. For some tests, an unbonded sample of membrane is required. In these tests, liquid or trowel applied materials shall be applied to a non-bondable material (such as polyethylene film or Teflon), cured according to the manufacturer's instructions, peeled, and cut if necessary to obtain a suitable sample. All other system components shall be mixed and applied as directed by their manufacturer's written instructions.

**3.2 Temperature**
Unless otherwise stated in a particular test, curing, conditioning and all tests are to be run at standard conditions of 70°F-77°F (21°C-25°C) and a relative humidity of 45%-55%.

Components (latex, mortar, tile, etc.) used in performing all tests shall be stored in the original sealed packaging at the standard conditions specified for each test for a minimum of 12 hours prior to use. Material temperatures shall be verified before proceeding.

**3.3 Recording test values**
In any of the following tests, which require more than one sample or specimen, record each individual test value and determine the mean of the multiple values for comparison with the test requirement. Values which do not reflect a normal distribution of shear strengths shall be discarded when they satisfy the Dixon test for extreme values as follows:

If X2 -X1 ≥ 0.765 then the lowest value shall be discarded X4 -X1

If X4 -X3 **≥** 0.765 then the highest value shall be discarded X4 -X1

where X1, X2, X3, X4, are the observed shear strength values from lowest to highest.

**4.0 Tests for material properties**

**4.1 Fungus and microorganism resistance (required for products intended for use in wet areas)**
Test for mold growth: The organism used for this test shall be Aspergillus Niger. The stock cultures shall be stored in a refrigerator at 37.4°F-50°F (3°C-10°C) prior to use. Stock cultures stored for more than four months shall not be used. The culture medium shall be potato dextrose agar from Difco Products, Inc. Detroit, Michigan – or its equivalent. Dissolve 39 grams of the agar in one liter of water, using heat. Autoclave the medium and two 1" (25mm) square pieces of Type A tile at 15 psi (1.1 kg/cm2) for 15 minutes. Apply a section of membrane to the tile following the manufacturer's recommended installation procedures at the minimum required thickness. Place the coated tile with the membrane side up in a sterile Petri dish and pour sterile agar into the dish until the surface of the agar is level with the edge of the membrane. Inoculate with the organism.

**4.1.1** For control purposes, one petri dish containing only the agar medium and the other piece of tile shall be inoculated with the test organism to determine the viability of the inoculum.

**4.1.2** Place the petri dishes in an incubator at 82.4°F-86°F (28°C-30°C) and a relative humidity of 85%-95%. After 14 days of incubation, examine to ascertain whether the membrane supports mold growth. (At the end of the inoculation period, the control shall demonstrate visible evidence of mold growth.) Requirement: The membrane shall not support mold growth.

**5.0 Tests for system performance**

**5.1 Shear strength to ceramic tile and cement mortar**

**5.1.1 Preparation of mortar blocks:** Prepare 12 mortar blocks as specified in ASTM C482 Section 9.1.2. Blocks shall be stored for 25 additional days at the conditions specified in Section 3.2 above prior to use.

**5.1.2 Preparation of shear bond assemblies:** Follow the manufacturer's instructions and apply the membrane to the entire face of the mortar blocks described in 5.1.1. Allow the membrane and or adhesive to cure for 24 hours. Apply a Type X tile to the membrane, offset 1/4", using the manufacturer's recommended adhesive system and application rate, including bonding material thickness after beat in of the tile. Cylindrical metal spacers approximately 1" long, or 1/8" (3mm) T-bar spacers, or other suitable spacers, shall be placed between the tile and membrane to insure a proper and uniform thickness of the bonding material. The spacers shall be removed after scraping the excess bonding material from the edges of the tile and membrane. Allow the bonded assemblies to cure for seven days at 70°F-77°F and 45%-55% relative humidity. Measure the bonded area to the nearest 1/2 sq. inch.

**5.1.3 Seven day shear strength:** Shear four assemblies to failure immediately after the seven day cure in 5.1.2 using the method described in ASTM C482 Section 9.8. Record the stress at failure.

**Requirement:** Average shear strength greater than 50 psi.

**5.1.4 Seven day water immersion shear strength (required for products intended for use in wet areas):** Immediately after the seven day cure outlined in 5.1.2, immerse four samples prepared in 5.1.1 in water for seven days. Shear the assemblies to failure within 10 minutes of removal from water, recording stress at failure.

**Requirement:** Average shear strength greater than 50 psi.

**5.1.5 Four week shear strength:** Cure four specimens prepared in 5.1.2 for an additional three weeks at the specified conditions and shear to failure. Record the stress at failure.

**Requirement**: Average shear strength greater than 50 psi.

**5.2 Robinson floor test**

The methods outlined in ASTM C627 shall be followed, and the test assembly shall consist of a concrete test substrate, sound reduction membrane installed per manufacturer's instructions, TCNA 118.4 High Performance Thin-Set Mortar[1] (or equivalent), ANSI A118.6 compliant grout with 1/4" joints, and Type X-3 tiles. If any alternative assembly (including but not limited to a different tile type, tile size, adhesive type, grout type, joint size, and/or subfloor assembly) is tested, ALL COMPONENTS USED IN THE TEST MUST BE DISCLOSED.

**Requirement**[2]: At minimum, the test assembly shall complete cycles one through three without evidence of failure and achieve a "Residential" rating according to the TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.

### 5.3 Sound transmission reduction test

**5.3.1 Test room:** Two vertically adjacent rooms shall be constructed as described in ASTM E 492.

[1]TCNA 118.4 high performance thin-set mortar is a standardized ANSI A118.4 compliant latex modified thin-set mortar that has been identified by the Tile Council of North America Grout and Mortar Subcommittee as being capable of achieving a 28 day impervious mosaic tile shear bond strength greater than 450 psi.

[2]Although this specification requires a minimum service rating of "Residential", individual projects may require a higher service rating based on the expected traffic. Refer to the Floor Tiling Installation Guide in the TCNA Handbook for Ceramic, Glass, and Stone Tile Installation for more information on service requirements.

**5.3.2 Test substrate:** A standard concrete floor shall be constructed between the two rooms as described in section 7 of ASTM E 2179. The surface shall be prepared as required by the membrane manufacturer's instructions.

**5.3.3 Membrane:** Apply the membrane to the concrete floor substrate according to the manufacturer's instructions. Cure bonding adhesive and membrane according to membrane manufacturer's instructions.

**5.3.4 Tile:** Use a tile adhesive recommended by the membrane manufacturer to bond a sufficient quantity of Type X-3 tiles, such that the entire test floor is covered. Follow the tile adhesive manufacturer's instructions for mixing, application, and cure time prior to grouting.

**5.3.5 Grout:** Grout joint width shall be 1/4". Use a grout recommended by the membrane manufacturer. Follow grout manufacturer's instructions for mixing, application, and clean up.

**5.3.6 Curing:** Allow a minimum of 28 days curing from the time the tile was set on the membrane, at standard conditions described in 3.2 above.

**5.3.7 Test apparatus:** A standard tapping machine meeting the requirements of ASTM E 492 shall be installed atop the finished floor of the upper level room. The frequency response of the electrical system in the room below, including the filter or filters in the source or microphone systems, shall satisfy the specifications given in ANSI Specification S1.11 for a 1/3 octave band filter set, order three or higher, Type 1.

**5.3.8 Testing:** Testing shall be performed according to section 4 of ASTM E 2179. Differences in normalized impact sound pressure levels between the finished floor and the bare standard concrete floor shall be subtracted from the levels defined for a reference concrete floor, and an Impact Insulation Class (IIC) rating shall be calculated as per ASTM E 2179, sections 13.1 through 13.3. The improvement in impact insulation class due to the floor covering, ΔIIC, shall be calculated as per section 13.4 of ASTM E 2179.

**Requirement**[3]: The floor assembly shall obtain a ΔIIC rating of 10 or greater.

**End of ANSI A118.13**

[3]Although this specification requires a minimum laboratory ΔIIC rating of 10, it is possible that your construction detail could require a higher level of ΔIIC sound attenuation than the 10 ΔIIC minimum in this standard to produce a code compliant installation. Consult with an architect, acoustical engineer or a building code official to ensure that the system you plan to install complies with local code requirements. Also, it is possible for field installed systems utilizing the same sound reduction membrane as tested in this specification to yield either more or less effective sound reduction values. Field installation variables such as slab thickness; slab density and porosity; ceiling heights and assemblies; floor penetrations; tile type and size; adhesive type; grout type and joint width; room size; atmospheric pressure; framing member type and arrangement; fastener locations; and other factors can have profound effect on field Impact (FIIC) sound transmission measurements.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