

Understanding IIC & STC Sound Testing

Sound insulation between living areas in multi-family or single-family dwellings, is an important issue for the floor covering industry. When evaluating flooring underlayment for sound deadening characteristics; acoustical consultants, architects/specifiers and others rely on sound testing to define the performance of a floor/ceiling assemblies and determine how well they insulate against noise created by impact and by airborne vibration. The testing methods utilized in North America for sound evaluations and comparisons, and the values they generate, can be somewhat confusing and even, perhaps, misleading. The following is an effort to explain those sound test methods and their results.

There are two types of laboratory sound tests performed in a controlled environment recognized by the International Building Code (IBC) for sound vibration that travels from one living area to another: Impact Insulation Class (IIC) and Sound Transmission Class (STC). IIC tests the ability to block impact sound by measuring the resistance to transmission of impact noise or structure-borne noise (simulating footfalls, objects dropped on the floor, etc.). STC evaluates the ability of a specific construction assembly to reduce airborne sounds, such as voices, stereo systems, and TV. Both tests involve a standardized noise making apparatus in an upper chamber and a sound measuring system in a lower chamber. Decibel measurements are taken at various specified frequencies in the lower chamber. Those readings are then combined using a mathematical formula to create a whole number representation of the test, the higher the number, the higher the resistance. Ratings of 50 or above for both the IIC and STC sound tests will satisfy the minimum requirements of the International Building Code.

Non-laboratory, “field” tests for impact sound (FIIC) and for airborne sound (FSTC) are also recognized by the International Building Code. These sound tests utilize the same testing methods as IIC and STC but are conducted in an actual building after the floor installation is completed. The IBC suggests ratings of 45 or higher for FIIC and FSTC testing.

With the various types and combinations of building materials available to the industry, it is not surprising that the sound test results among different floor/ceiling assemblies may vary dramatically. One can imagine sound testing over a 6” concrete floor with a 12” suspended ceiling attached and filled with 8” of fiberglass insulation, as apposed to testing over just a 6” concrete slab. The more layers and thickness of materials usually means a higher sound test result.

It is important to note that IIC/FIIC and STC/FSTC tests are not single component tests, but an evaluation of the whole floor/ceiling assembly, from the surface of the floor covering material in the upper unit, to the ceiling in the lower unit. An integral part of a report for any of these sound tests is a detailed description of the floor/ceiling assembly used in the test. IIC/FIIC and STC/FSTC tests are essential tools for evaluating sound in multi-level dwellings. However, without

knowing and accounting for the whole floor/ceiling structure used in the test, the results are basically meaningless. Using IIC (FIIC) and STC (FSTC) results to represent the sound deadening ability of an underlayment without describing, in detail, the whole floor/ceiling assembly causes confusion at all levels of the marketplace and is ultimately misleading to the consumer.

The only way to accurately compare the sound deadening characteristics among underlayment materials using IIC/FIIC and STC/FSTC testing is to keep all other components in the test assembly constant, i.e., the same floor covering material, the same thickness and density of concrete (or composition of wood sub-floor), and the same suspended ceiling assembly. With everything else being equal, one can evaluate different underlayments as to their individual contributions to the sound insulating ability of that whole floor/ceiling structure.

Another test that more directly evaluates impact sound of underlayment materials is ASTM E-2179, also known as the “Delta” test. This test basically consists of two IIC tests conducted over the same concrete sub-floor (150mm ± 50mm thick). One test is over the bare concrete sub-floor (no flooring materials) and the other is over the concrete sub-floor with floor covering material and underlayment included. The measured IIC values are compared to the reference floor levels defined in the standard and adjusted to provide the IIC the covering would produce on the reference concrete floor. The Delta IIC or improvement of impact sound insulation is obtained by subtracting 28 (the value for the reference bare floor from the standard) from the adjusted IIC of the whole assembly. As long as the same floor covering material is used, one can conduct a series of Delta tests to evaluate among various underlayment materials.

For sound traveling from an upper living area to a lower living area, IIC/FIIC and STC/FSTC testing methods are important for evaluating whole floor/ceiling assemblies. For the accurate evaluation and comparison of the sound isolation characteristics of underlayment materials, the appropriate methods to use are either: 1) the ASTM E-2179 Delta test or 2) IIC/FIIC and/or STC/FSTC tests where the only variable in the floor/ceiling assembly is the underlayment material.