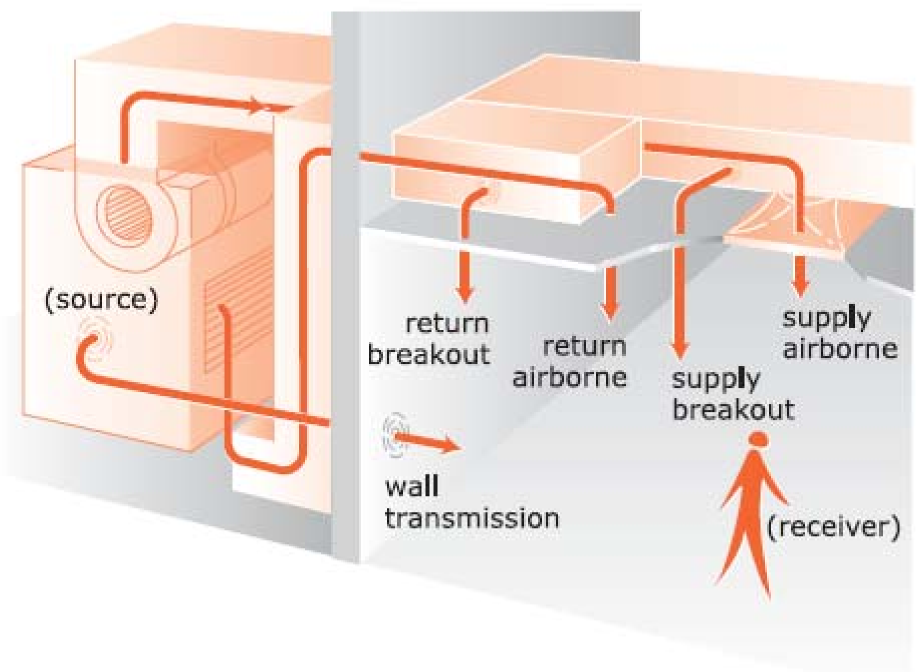
The Trane Acoustics Program (TAP™)

The Trane Acoustics Program (TAP™) is a powerful acoustical modeling tool that helps designers accurately predict how sound from HVAC equipment will impact tenants and neighbors. Acoustical modeling starts with the sound power level of a *source* (a fan or compressor, for example) and converts it to sound pressure level at the *receiver* (the occupant).

Converting a sound *power* level into a sound *pressure* level requires definition, in acoustical terms, of the environment between the sound source and the receiver location. Anything that affects the sound, between the points of origin and reception, is considered an *element* of the sound path.

Figure 1 illustrates that sound can travel between a single source and the receiver along one or more paths. TAP models each sound path individually and sums them together to find the total sound. This allows the designer to readily identify the impact of each sound path on the total and determine the critical path(s) that must be attenuated if the sound level at the receiver is too high.



• *Supply airborne,* fan sound travels through the supply ductwork and diffusers into the space
• *Supply breakout,* fan sound travels through the walls of the supply duct, then through the ceiling tile, into the space
• *Return airborne,* fan sound travels from the air-handler intake, through the return ductwork and grilles, and into the space
• *Return breakout,* fan sound travels through the walls of the return duct, then through the ceiling tile, and into the space
• *Wall transmission,* unit casing sound travels through the adjoining wall, and into the space

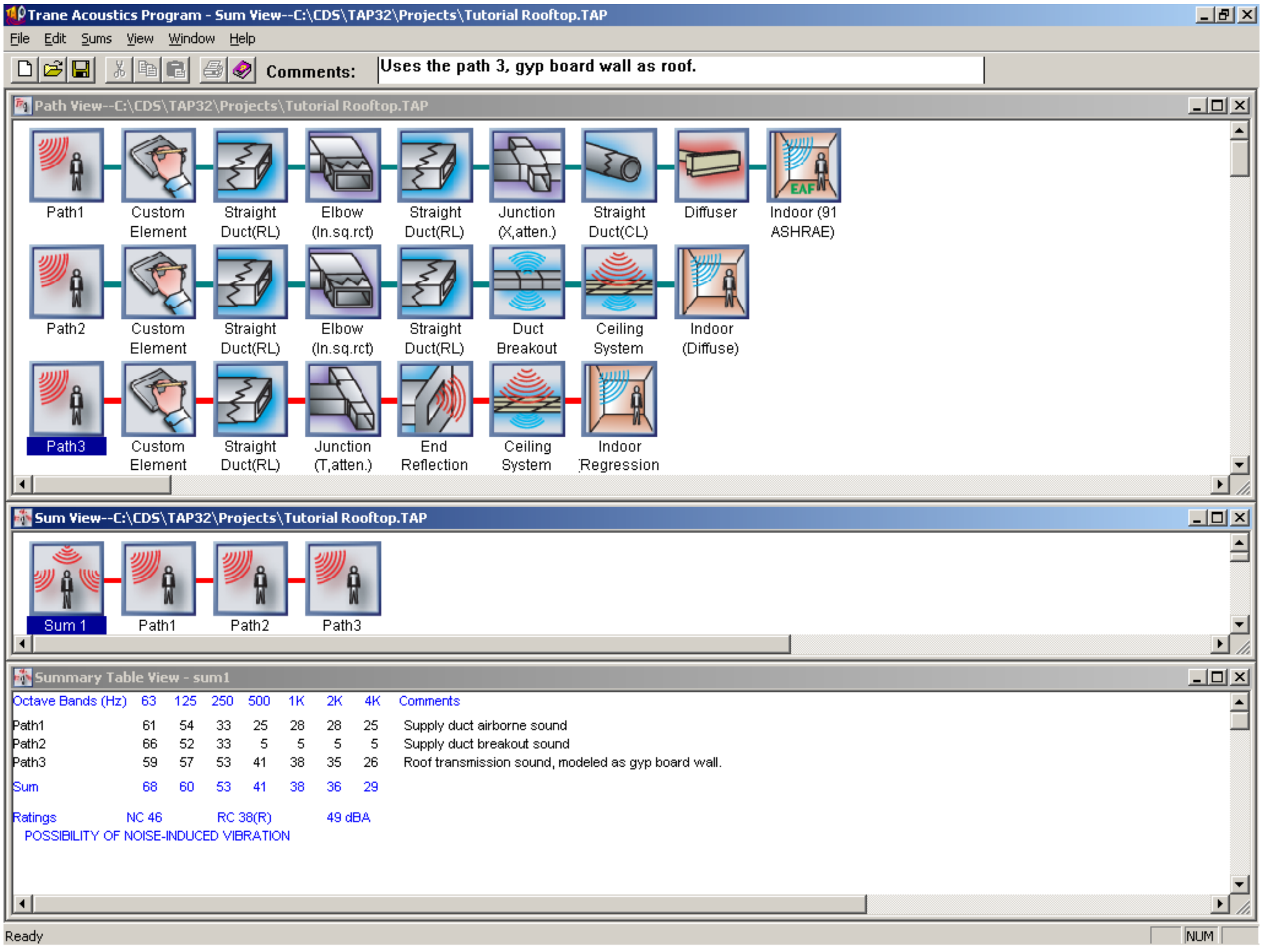
Prediction equations based on test data and experience aid the analysis of sound-path elements. TAP uses the algorithms collected and developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) to calculate the effect of path elements.

Solving prediction algorithms manually can be tedious, time-consuming, and iterative—especially when one or more paths need further attenuation. Fortunately, TAP performs these calculations quickly and accurately allowing a designer to rapidly create and refine the source–path–receiver model. Manipulation of the model is a tremendous benefit when designing a new system or troubleshooting an existing building. For example, with the help of TAP, you can quickly determine the effect of using a duct silencer, changing the construction of the equipment-room wall, adding absorptive materials to a ceiling, or placing an acoustical barrier between an outdoor sound source and the property line.

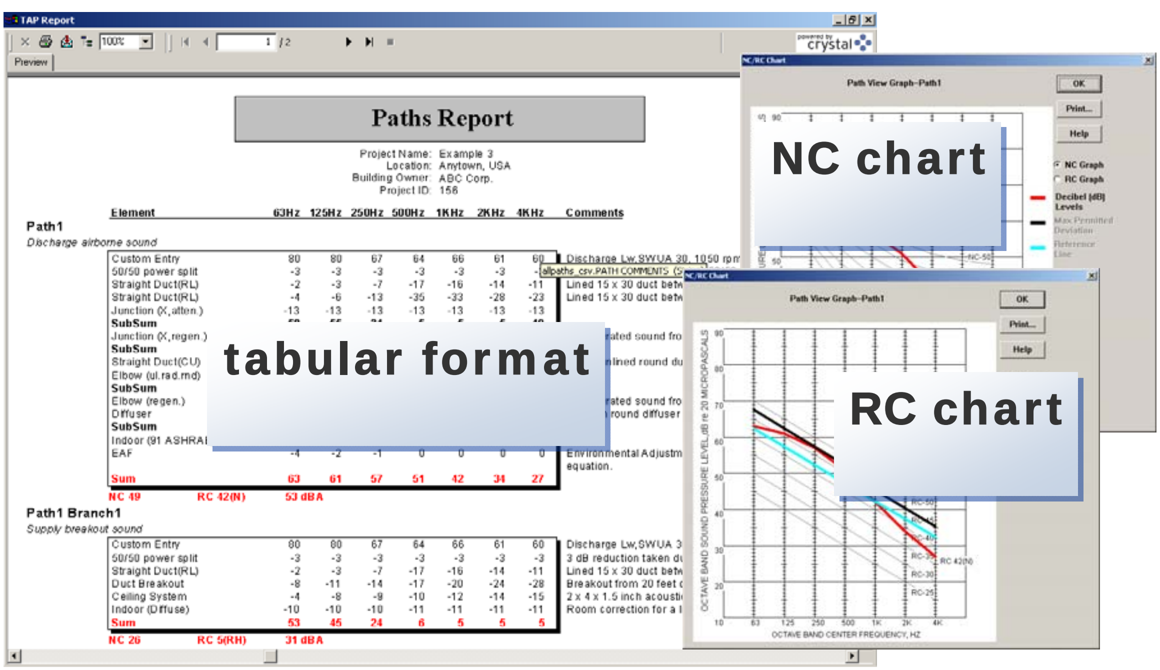
TAP “builds” and analyzes sound paths by allowing the user to choose specific equipment and building components that generate, attenuate, reduce or regenerate sound. Dialogbox entries let you further refine component attributes. As components are added, moved or deleted, the program dynamically recalculates the resulting sound pressure levels.Once the analysis is complete, view and print reports, detailed tables, NC or RC charts, or a combination of these formats.

TAP provides the functions necessary to create and present acoustical models for HVAC equipment. The models can be used to show the need for design changes or to validate the design. A practical example of the need for design verification is the LEED rating system. *LEED® for Schools for New Construction and Major Renovations Version 2007* contains both a prerequisite for classroom acoustics and the potential for earning up to two credits for improved acoustical design. Both the credits and the prerequisite allow compliance by following the methodology in either *ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools*, or in the *2003 HVAC Applications ASHRAE Handbook*, Chapter 47 on Sound and Vibration Control. TAP can be used to meet both the prerequisite and earn the credits.

Program features include:
• Trane acoustics program uses the latest available ASHRAE algorithms for modeling acoustical elements such as duct lagging, outdoor barriers and duct silencers.
• Visual modeling of equipment (fans, diffusers, etc.) and building components (ceilings, walls, ductwork, etc.) in each sound path.
• The most complete, current library of sound data available for Trane products plus a “custom element” to model equipment not found in the library.
• Multiple-path analysis—e.g. discharge airborne, discharge breakout and unit-radiated sound (a timesaving feature that lets you focus on other aspects of project design).
• Calculates NC, RC, and dBA ratings for each path and sum.
• “On-the-fly” calculation and display of sound path summations.
• Comprehensive, professional reports including output to NC and RC graphs.
• Enables a quick comparison of calculated sound levels with the desired NC value, an invaluable troubleshooting tool to isolate potential problems in an existing system.



Trane Acoustics Program - Sum View--C:\CDS\TAP32\Projects\Tutorial Rooftop.TAP
File Edit Sums View Window Help
Comments:
Uses the path 3, gyp board wall as roof.
Path View--C:\CDS\TAP32\Projects\Tutorial Rooftop.TAP
Path1
Custom Element
Straight Duct(RL)
Elbow (In.sq.rct)
Straight Duct(RL)
Junction (X,atten.)
Straight Duct(CL)
Diffuser
Indoor (91 ASHRAE)
EAF
Path2
Custom Element
Straight Duct(RL)
Elbow (In.sq.rct)
Straight Duct(RL)
Duct Breakout
Ceiling System
Indoor (Diffuse)
Path3
Custom Element
Straight Duct(RL)
Junction (T,atten.)
End Reflection
Ceiling System
Indoor Regression
Sum View--C:\CDS\TAP32\Projects\Tutorial Rooftop.TAP
Sum 1
Path1
Path2
Path3
Summary Table View - sum1
Octave Bands (Hz) 63 125 250 500 1K 2K 4K Comments
Path1 61 54 33 25 28 28 25 Supply duct airborne sound
Path2 66 52 33 5 5 5 5 Supply duct breakout sound
Path3 59 57 53 41 38 35 26 Roof transmission sound, modeled as gyp board wall.
Sum 68 60 53 41 38 36 29
Ratings NC 46 RC 38(R) 49 dBA
POSSIBILITY OF NOISE-INDUCED VIBRATION
Ready
NUM



TAP Report
100%
1 /2
Preview
powered by crystal
Paths Report
Project Name: Example 3
Location: Anytown, USA
Building Owner: ABC Corp.
Project ID: 158
Element 63Hz 125Hz 250Hz 500Hz 1KHz 2KHz 4KHz Comments
Path1
Discharge airborne sound
Custom Entry
50/50 power split
Straight Duct(RL)
Straight Duct(RL)
Junction (X,atten.)
SubSum
Junction (X,regen.)
SubSum
Straight Duct(CU)
Elbow (ul.rad.rnd)
SubSum
Elbow (regen.)
Diffuser
SubSum
EAF
Sum 63 61 57 51 42 34 27
NC 49 RC 42(N) 53 dBA
Path1 Branch1
Supply breakout sound
Custom Entry
50/50 power split
Straight Duct(RL)
Duct Breakout
Ceiling System
Indoor (Diffuse)
Sum 53 45 24 6 5 5 5
NC 26 RC 5(RH) 31 dBA
tabular format
NC/RC Chart
Path View Graph-Path1
OK
Print...
Help
NC Graph
RC Graph
NC chart
RC chart
OCTAVE BAND CENTER FREQUENCY, HZ