



## Green Buildings: TEAMS, ADPI, and LEED Indoor Environmental Quality Credit 7.1, Thermal Comfort - Design

In LEED v2.2, the Indoor Environmental Quality Credit 7.1, Thermal Comfort - Design, requires that the building comply with ASHRAE Standard 55-2004, for thermal comfort standards. Although engineers are designing for thermal comfort, only about 65% of LEED certified buildings achieve this credit. Many engineers are unsure of how to show the documentation to achieve this credit.

ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy specifies the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space. The environmental factors addressed in the standard are temperature, thermal radiation, humidity,

and air speed; the personal factors are those of activity and clothing.

It has been shown that individual comfort is maintained when the following conditions are maintained in a space:

- Air temperature maintained between 73-77°F
- Relative humidity maintained between 25-60%
- Maximum air motion in the occupied zone
- 50 fpm in cooling
- 30 fpm in heating
- Floor to 6-foot level, 5-6°F maximum temperature gradient

Air Diffusion Performance Index (ADPI) is the best way of assuring that a space will meet the ASHRAE Standard 55 requirement for 5-6°F maximum

temperature gradient during cooling. To meet the temperature gradient requirement during heating, (1) select a linear slot diffuser that can be adjusted to provide 50% air across the ceiling and 50% air down the glass. (2) The air down the glass should project to a terminal velocity of 150 fpm at a level of 4' – 5' above the floor. (3) As recommended by ASHRAE, the maximum heating supply air discharge temperature should be no greater than 15° above the room heating design temperature. (4.) Or select a seasonal change over diffuser such as "DynaFuser" for the perimeter.

ADPI is a single-number means of relating temperatures and velocities in an occupied zone to occupants' thermal comfort. To calculate the ADPI of a space, you need to measure the temperature and velocities at points

throughout the occupied space. The occupied space is defined by ASHRAE as being the area from the floor to the six foot height, one foot from the walls. The effective draft temperature is then calculated for each point.

The effective draft temperature ( $\Theta$ ) is equal to the room temperature ( $t_x$ ) minus the local temperature ( $t_c$ ) minus 0.07 times the local velocity ( $V_x$ ) minus 30.

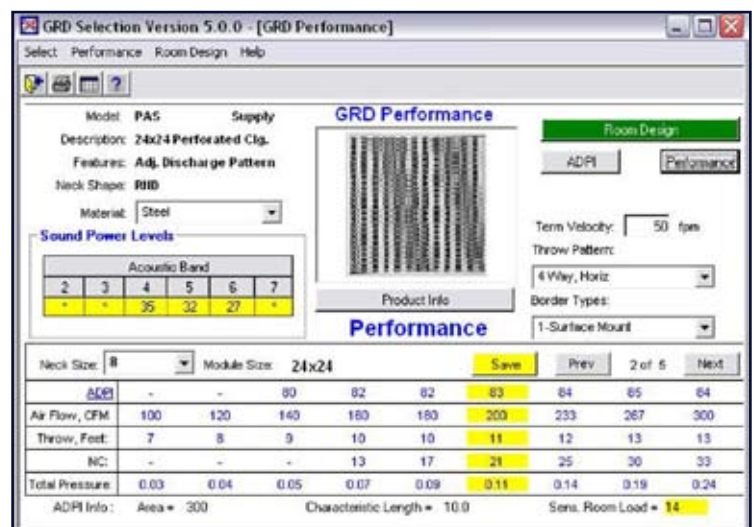
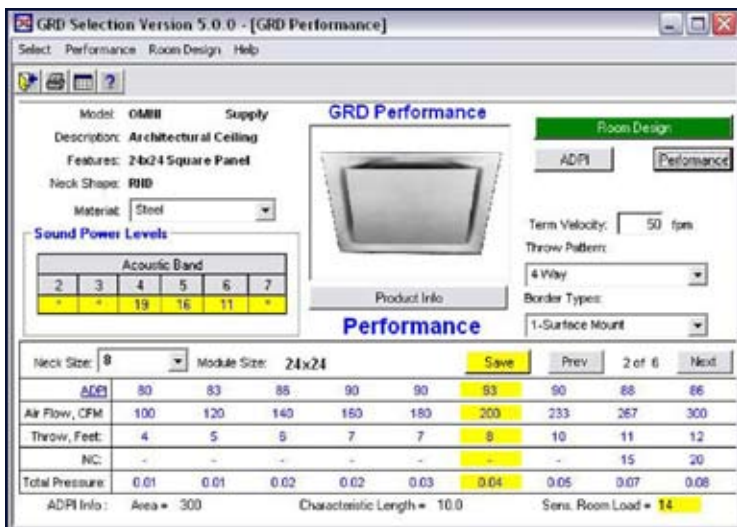
$$\Theta = (t_x - t_c) - 0.07(V_x - 30)$$

effective draft temperature to calculate ADPI, the software does it for you. The example shows two selections, the OMNI and the PAS. By using the ADPI calculator in TEAMS, the software will change the line that normally displays velocity to display ADPI. Selecting the Performance button, you can enter a CFM, in this case 200 CFM. The CFM shows up in the data in yellow.

This is especially important in VAV systems. In a VAV system, the VAV box

the OMNI still has an acceptable ADPI of 80 while the PAS at the same 100 CFM has dropped below 80. You can also use the TEAMS selection to determine the best airflow range for given diffuser. The PAS in our example would have better performance above 140 CFM.

To achieve the LEED IEQ Credit 7.1 for Thermal Comfort Design, an engineer must show that they designed the building to meet ASHRAE Standard 55-2004. Including the TEAMS ADPI



The ADPI value is the percentage of the points where  $\Theta$  is between -3 and +2 F inclusive, with a room velocity of 70 fpm or less. ASHRAE guidelines state that the ADPI of greater than or equal to 80 is considered acceptable.

With the TEAMS GRD selection program, you don't need to measure points in the occupied space and calculate the

only runs at full flow at full load, which is typically only on the hottest days of the year. Most of the time the VAV box will be at turn down, so to have a comfortable space, the diffuser ADPI must be 80 or greater throughout the airflow range of the VAV box.

You can see that the OMNI maintains an acceptable ADPI at a lower CFM than the PAS. In this example, at 100 CFM

screens in the supporting documentation for the credit will help the engineer show that they designed to ASHRAE Standard 55-2004.

