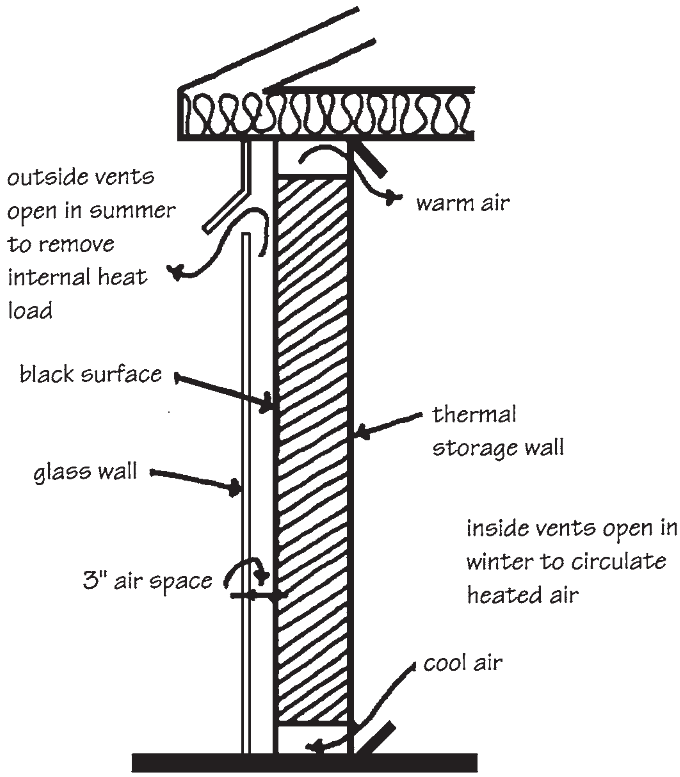

Figure 8-42 Schematic detail of vented thermal storage wall components. (*From S. V. Szokolay,* Solar Energy and Building.)

external vents are opened and the internal vents are closed. Venting the wall to the interior reduces temperature fluctuations and increases the maximum temperature reached in the living space.

The best thermal performance is obtained by combining the direct-gain and thermal storage wall systems. One of the most common applications is a sun room or solarium on the south side of a building. A south-facing wall can also be designed with sections of brick or solid concrete masonry alternating with windows protected from summer radiation by overhangs or shading devices. This combination (1) permits some direct sunlight to enter and warm the interior floor and wall elements, (2) achieves higher interior temperatures than the thermal storage wall alone, (3) provides less temperature fluctuation than the direct-gain system alone, and (4) provides better distribution of natural light.

8.7.5 Hybrid Systems

Fans and blowers can be used in passive solar designs to help the natural flow of thermal energy. These mechanically assisted passive systems are often referred to as hybrid designs. One hybrid design circulates heated air by passing it through the cores of concrete block or 8-in. hollow brick to store and distribute the heat. The primary benefit is that the thermal mass can be located anywhere in the building, regardless of where the heat is collected.

One example is a floor system that uses hollow units placed on their sides with the cores aligned. The solar-heated air is blown through the cores, heating the masonry and the room above. The units should be laid on rigid insulation to prevent heat loss to the soil. Another example is a vertical plenum wall. It passes air through the hollow vertical cores which store heat during the day for later use at night. Sheet metal ducts supply and remove air from the wall.

Hollow-core systems are also effective in cooling. Venting the wall at night by blowing cooler air through the cores lowers the masonry temperature so that it can absorb daytime heat from interior spaces. For commercial buildings which require cooling even in winter because of internal heat generation, outside winter air and the thermal mass of the masonry can be used to cool different zones of the building.

Determining the performance and efficiency of passive solar designs is complex. Computer programs can make the job easier by calculating solar loads, capacity of thermal mass, proper proportions of glass to storage wall areas, heating and cooling requirements, and overall thermal performance. Performance can even be calculated for site-specific weather and solar data. Further analysis can show how combining different energy conservation techniques, passive solar design, and natural cooling strategies can improve total building performance.

8.8 ACOUSTICAL PROPERTIES

Environmental comfort in multi-family housing, hotels, office buildings, and private residences can be related as much to acoustical factors as to heating and cooling. Increased technology produces more and more noise sources at the same time when human perception of the need for privacy and quiet has become acute. Interior noise sources such as furnace fans, television sets, vacuum cleaners, video games, and washing machines combine with exterior street traffic, construction equipment, power mowers, and airplanes to create high levels of obtrusive sound. Noise generated by other people is also very aggravating to residents or tenants who can overhear conversation in adjoining rooms or apartments.

For noise that cannot be either eliminated or reduced, steps can be taken to absorb the sound or prevent its transmission through walls, floors, and ceilings. Some building codes cover acoustical characteristics of construction assemblies. Clay and concrete masonry partitions have been tested and found to provide good sound insulation.

Noise is transmitted in several ways: (1) as airborne sound through open windows or doors, through cracks around doors, windows, water pipes, or conduits, or through ventilating ducts; (2) as airborne sound through walls and partitions; and (3) by vibration of the structure. Acoustical control includes absorbing the sound hitting a wall so that it will not reverberate, and preventing sound transmission through walls into adjoining spaces.

Sound absorption involves reducing the sound emanating from a source within a room by diminishing the sound level and changing its characteristics. Sound is absorbed through dissipation of the sound-wave energy. The extent of control depends on the efficiency of the room surfaces in absorbing rather than reflecting these energy waves. *Sound transmission* deals with sound traveling through barriers from one space into another. To prevent sound transmission, walls must have enough density to stop the energy waves. With insufficient mass, the sound energy will penetrate the wall and be heard beyond it.