Chilled Beam Cooling

American commercial buildings are usually cooled by air that is chilled in one location and then pushed through ducts to distant rooms. A more efficient cooling method is to pump chilled water through pipes in the ceilings. This method, often called "chilled beams," allows convection to transfer heat from the space rather than relying on radiation as does a forced air system. A one-inch diameter water pipe can transfer the same heat as an 18-inch square duct, and flow through the pipe is much easier to regulate.

Passive chilled beams are perforated boxes suspended near the ceiling that allow chilled water to be pumped through cooling coils with fins (See Figure 1.)

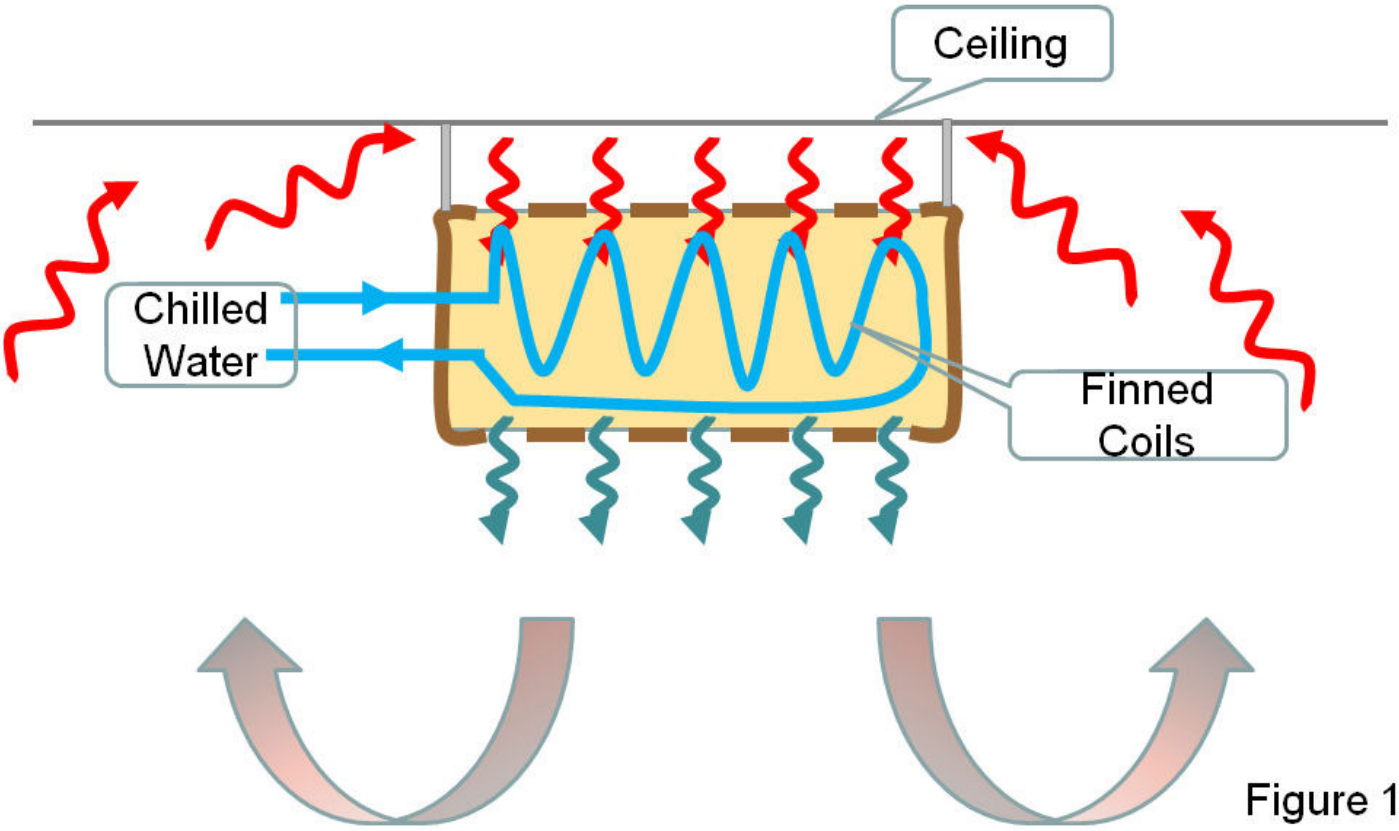

Figure 1

Chilled water is pumped through finned coils in a perforated box, or beam, suspended just below the ceiling. The coils cool air inside the beam, and convection causes it to sink toward the floor. This pushes warmer air upward and outward until convection causes it to rise above the cooler descending air. This return air is forced by natural currents into the bean where it is cooled. The cycle repeats.

Active chilled beams combine a small quantity forced cool air with the natural convective currents (See Figure 2.). The chilled air is usually make-up air from outside the building.

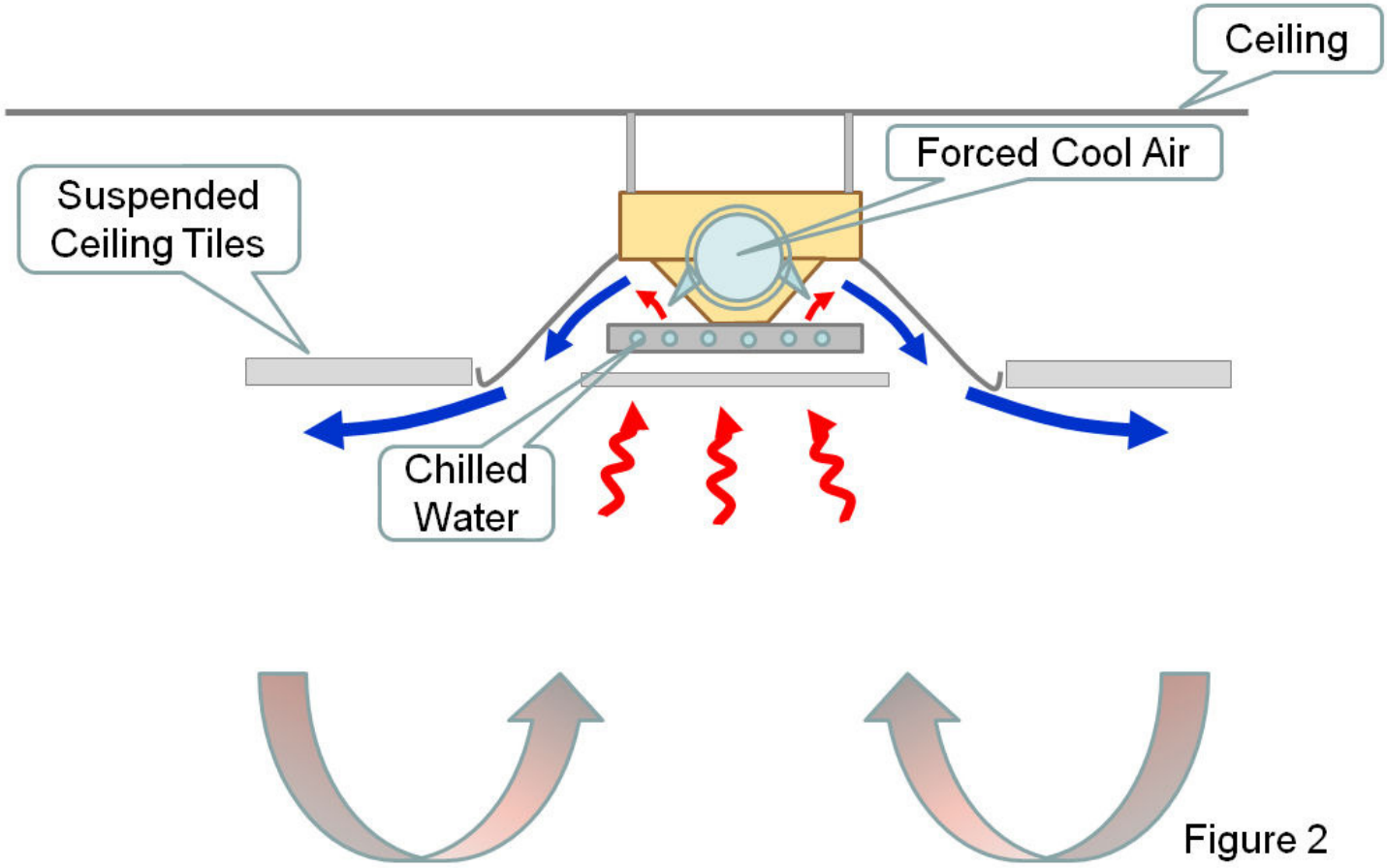

Figure 2

Chilled air is forced out of jets within the beam or perforated box. Rising warm air from the room enters the chamber and is cooled by the chilled water coils. The combined cooled return air mixes with the forced make-up air and is pushed outward. Convection causes the cooled air to sink toward the floor. People and equipment within the room add heat to the descending chilled air causing it to rise back into the beam. The natural convection is helped by the flow of forced air from the chilled air system. The cycle repeats.

Figure 2 shows a system above a suspended ceiling, but the system may be housed in a beam similar to Figure 1.

The Taco company, which specializes in chilled beam technology, has more than a dozen excellent white papers on radiant cooling on their website:
http://commercial.taco-hvac.com/products/index.html?action=file_list&category=382&type=35

As always, perform a life cycle cost analysis to determine which brand and which technology works best for your application. See http://www.al-solar.org/tech/ROI.pdf for an example of how to calculate a life-cycle cost analysis.