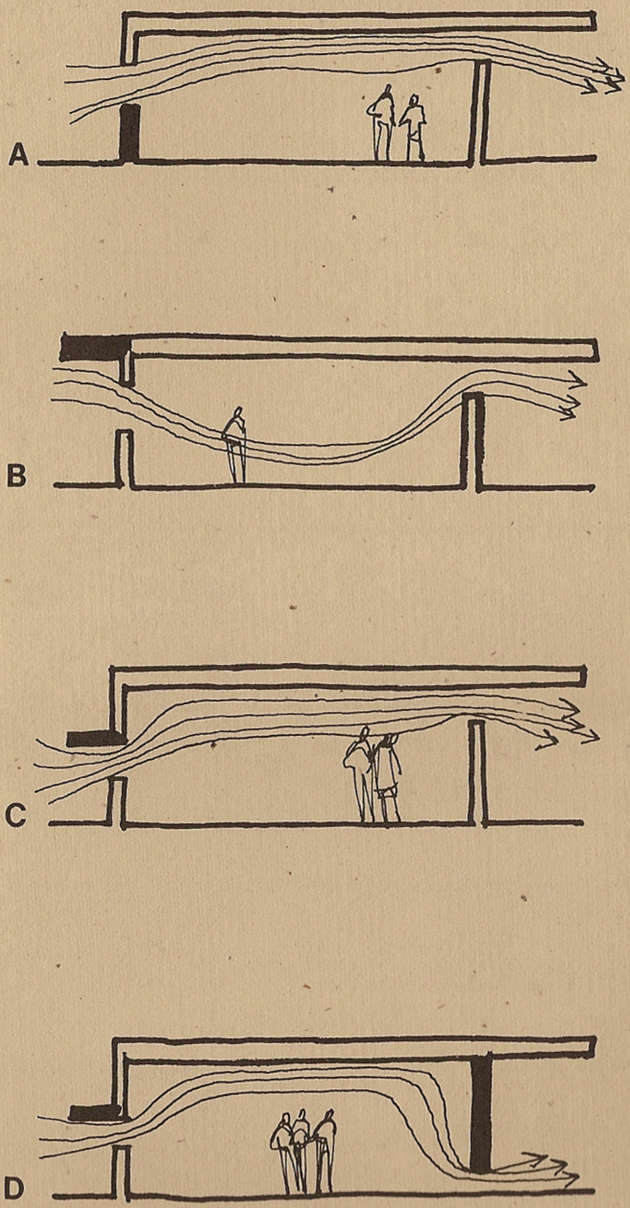
Cross ventilation was a common phrase a decade ago. Air conditioning just about erased it from our vocabulary. Why use the wind to cool when we had abundant cheap fuel? But now the wind is very popular. Certainly natural ventilation doesn't do as good a cooling job as air conditioning. But it uses no energy. In the 50's we learned a lot about:

How the wind behaves within a space.

We need now to review what we learned. How to conserve fuel. How to supplement air conditioning with natural ventilation. These sketches will give you a rough idea how air flow from the wind is affected by building form. What you see in Sketch A is a bilaterally vented envelope. The pattern of the air flow is upward, caused by the ground effect and the solid walls. That's a good way to take the heat off the ceiling, but air flows over people's heads. So it has minimum cooling effect. In Sketch B an overhang has been added which forces the air down and around people. Now refer to Sketch C. If the overhang is moved to the window head, the air will flow upward again. This kind of wind behavior surprises most people. It's nearly impossible to predetermine the exact pattern, mathematically. We use empirical judgment. Sometimes we use models. By relocating the window on the leeward wall, shown in Sketch D, the air still flows upward over the heads of people and down the wall. It would seem that the air would flow directly from one window to another, which isn't necessarily so. A window is like a nozzle that controls direction of the air. The size of the opening controls the velocity.

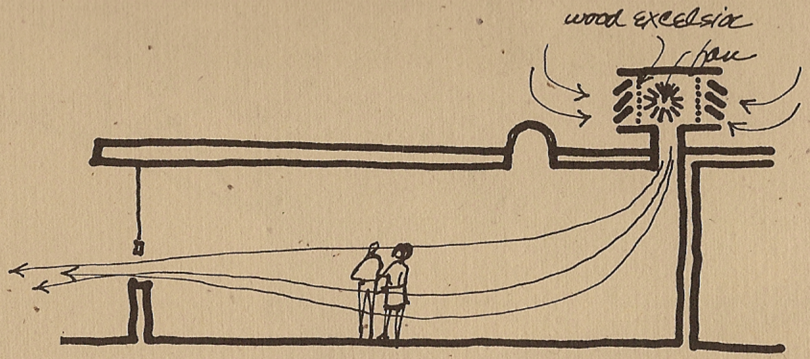


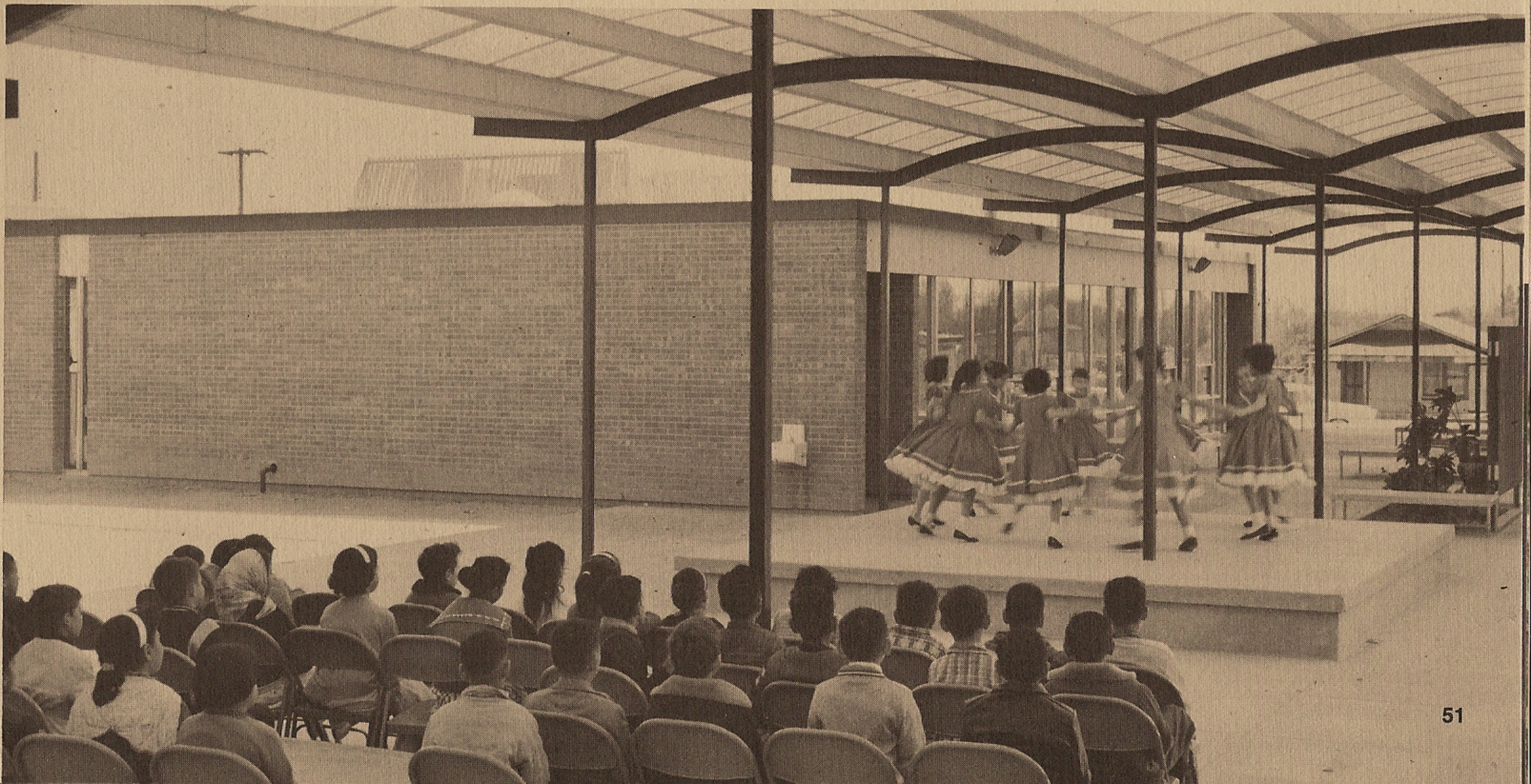
Evaporative coolers are often used to maintain a cool, dust-free atmosphere in hot, arid regions. The basic evaporative cooler unit—a poor man's air conditioner—is a container of absorbent wood excelsior which is kept moist. A fan draws outside air through the excelsior where dust is filtered out and the temperature is lowered. See sketch. The cool air forces the hot air out of the window vents. Although the temperature is not reduced greatly, the moisture in the air provides a sensation of coolness.

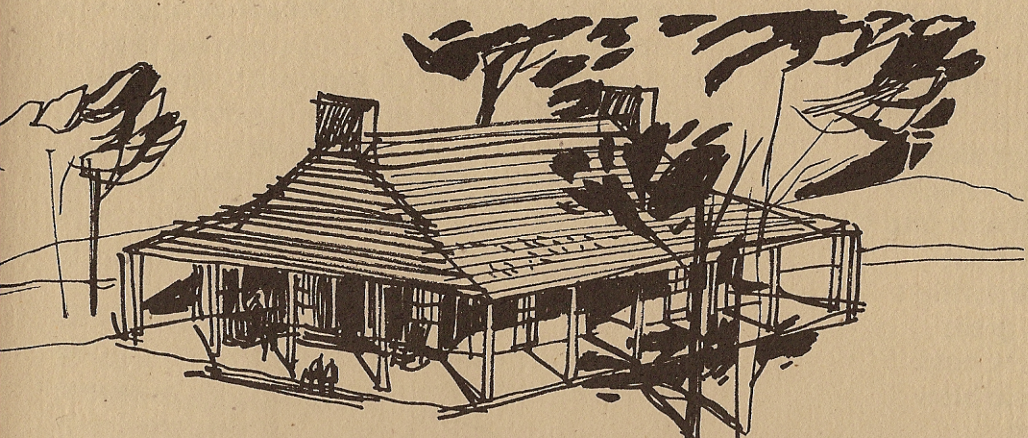
Before air conditioning, evaporative coolers were very popular.

We may see more of them in the future because they use very little energy.

This is a little school in Laredo, Texas, on the Mexican border. Natural ventilation is not appropriate there because the summer winds are too hot. Air conditioning is preferred over evaporative coolers, of course, but cooling with moisture and filtering out the dust is better than nothing at all.

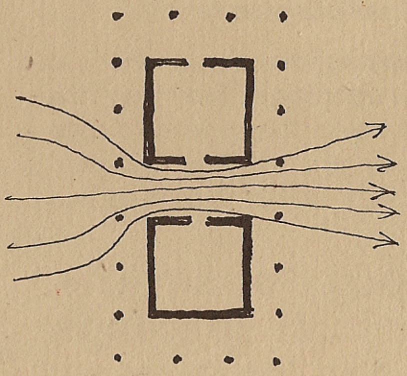


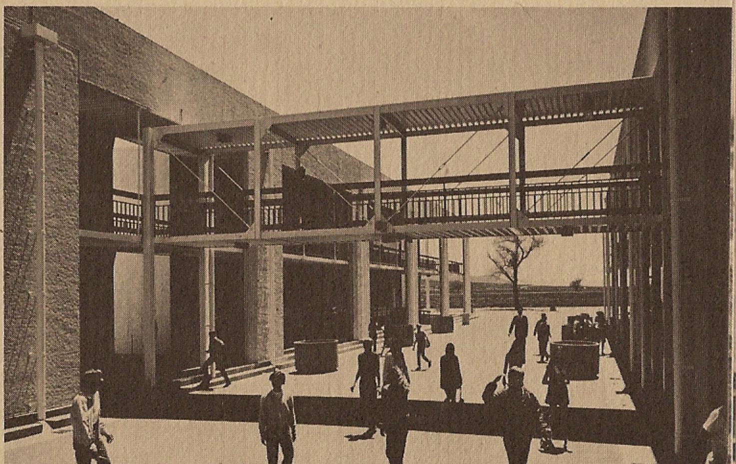




There is nothing quite like a porch

When the wind is bad, it's bad. When it's good it's good. It can be quite good at times in the summer. That's why someone way back there invented the porch. That's why the old possum run or dog trot houses in the south and southwest still provide comfort. On a recent trip to the warm region of Russia, we saw some dog trot houses with a breezeway that funnels and accelerates the wind. It is still a good idea. No air conditioning system has yet been able to duplicate the effect of a fresh breeze.





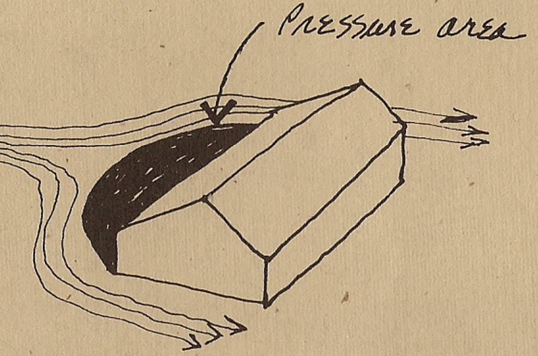
Here's how the wind flows over and through a building. When it blows against a building (A), it creates a high pressure area. As it blows over and around the building there is created on the leeward side a low pressure (B) area often referred to as a wind shadow. If openings were made in both the windward and leeward walls, it would have a push-pull effect, forcing the air into the building from one side and sucking it out from the other (C). Air, of course, flows from high pressure to low pressure areas. This is great when you want the cool breeze. But in the cold weather, when you don't want the wind to blow on you, it can be quite comfortable even outdoors sitting in a sunny wind shadow. Nature knew what it was doing. In most regions the wind direction is reversed from summer to winter — permitting the sun to shine in the wind shadows. That's why courts are feasible year round.

Most people have the wrong idea about where to locate and size window openings. They think the large openings should be on the windward side to scoop the air in. Quite wrong. That is if you want substantial airflow. It will just dam up on the inside.

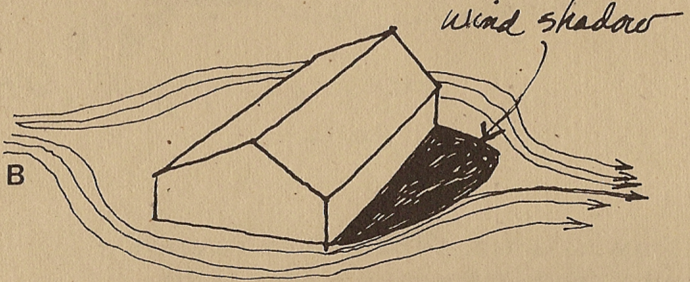
Maximum velocity of airflow occurs when small openings are windward and large openings are leeward.

With this arrangement the airflow will have a greater velocity than the wind itself.

A



B



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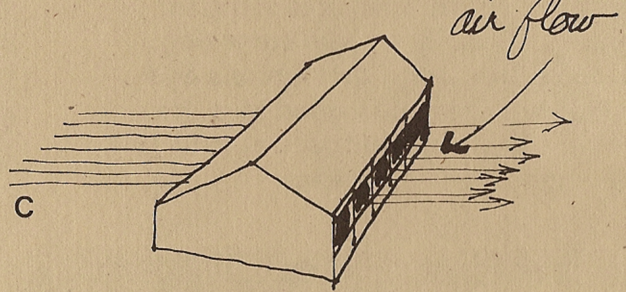
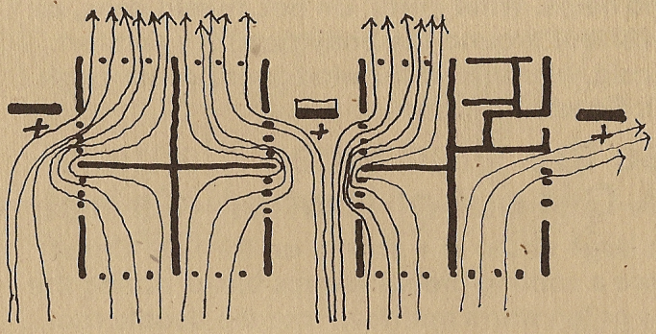


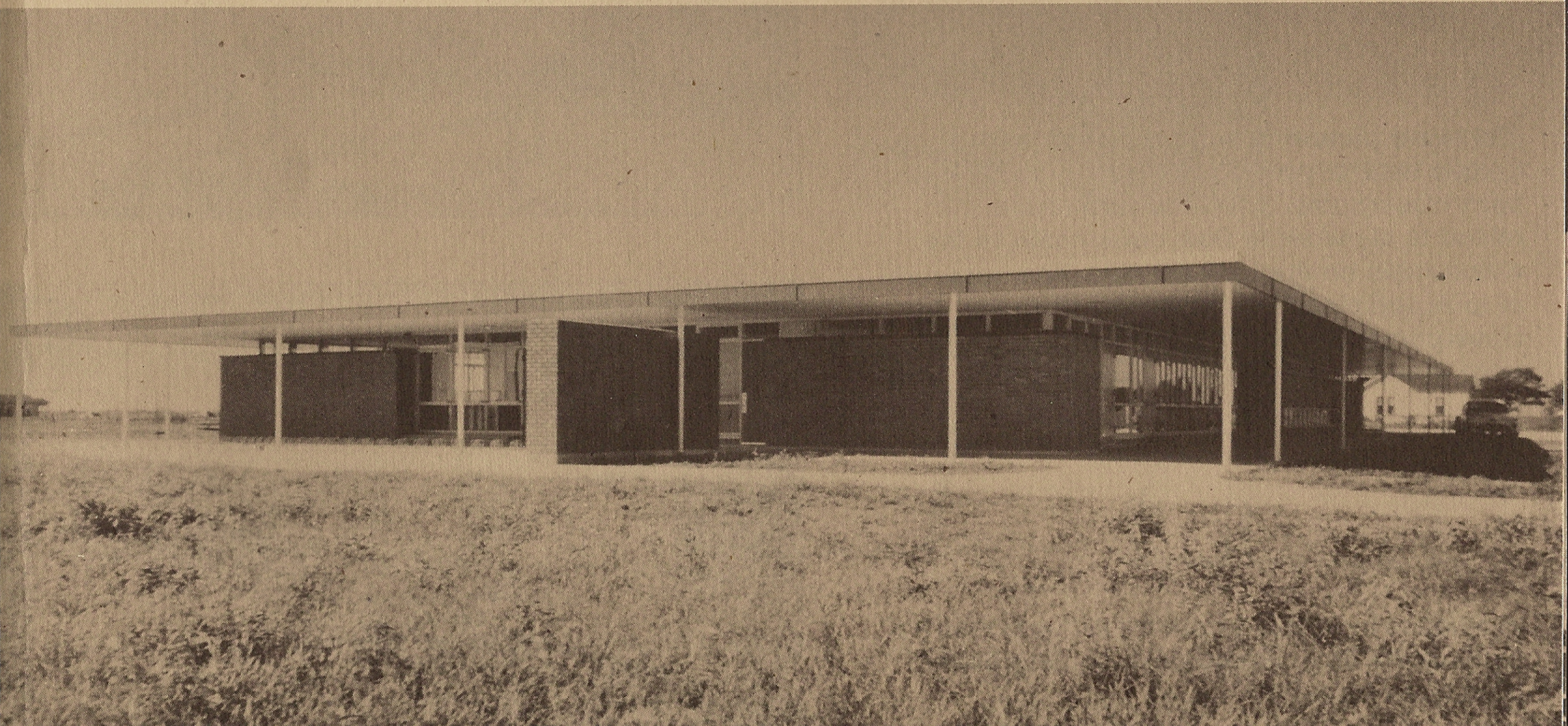
The Gulf Coast region is particularly adaptable to natural ventilation. During the hot months there is generally a breeze. When this breeze blows around the body on hot humid days, there is a sensation of coolness. This little school is unique in that by the use of pressure walls the back-to-back classroom will have adequate air flow.



Pressure walls create high and low pressure areas.

Since air flows from high pressure to low pressure, we create our own micro climate, our own inside wind.

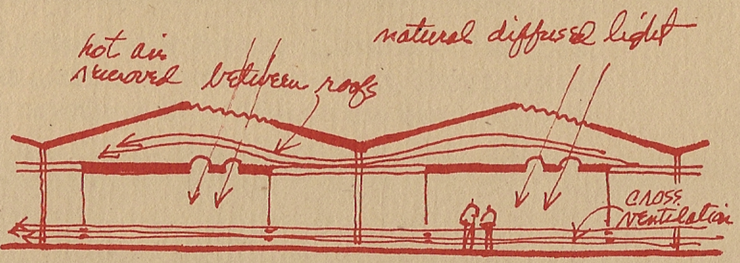
The pressure walls, as indicated in the plan diagram, divert and force the air to flow into and through the leeward classrooms. There is an esthetic quality about these freestanding walls that is reminiscent of Mies van der Rohe's Barcelona Pavilion. Natural ventilation gives logic to form.



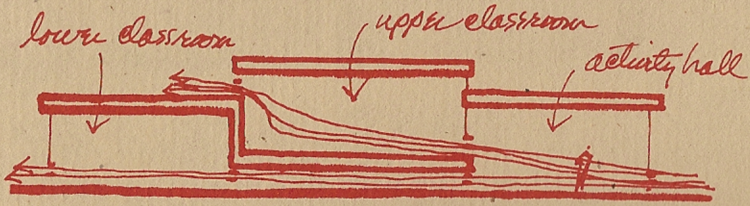
Wind helps. Wind hurts. On hot, humid days, air movement around the body provides comfort. On cold, windy days, the wind goes right through you. So what we want to do is:

Use the wind when it's needed. Get out of it when it's not.

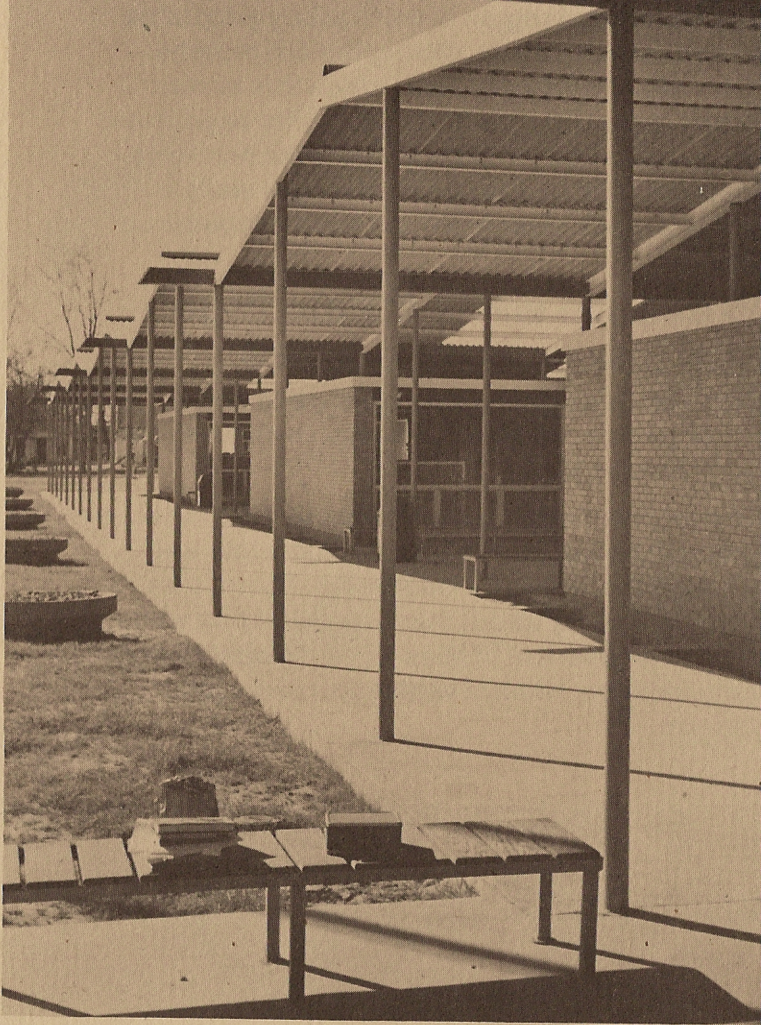
The large photo is a school on the Gulf Coast where a cooling breeze always blows during the nine or ten warm months. Note the double roof. The upper roof is an umbrella, protecting the buildings and children from rain and hot sun. The breeze flowing between the two roofs removes hot air. The hot sun rarely reaches the walls and never reaches the second roof. Louvered windows near the floor line provide cross ventilation. Classrooms are daylighted. We used the free energy from both the sky and the wind.



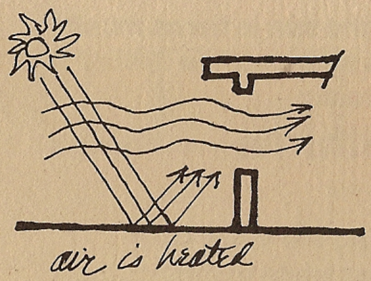
The lower picture is another school with a unique natural ventilation system for back-to-back classrooms. The windward rooms are raised to allow air to flow underneath to the classrooms on the leeward side. The upper set of louvered air inlets serves the front row of classrooms, and the lower set serves the leeward rooms. We goofed a bit by providing cross

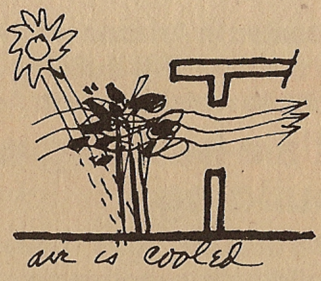


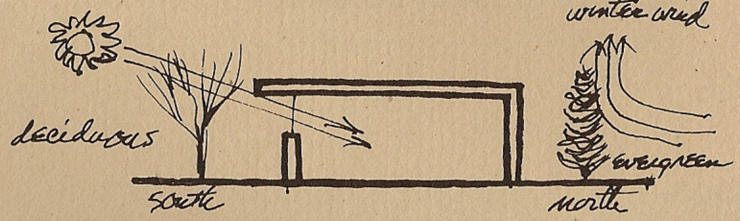
ventilation in an area where the winds are too hot most of the time. Evaporative cooling might have been better.



Ventilation is affected by plant materials. Air crossing hard reflective or absorptive surfaces like parking lots and sidewalks is warmed, but air passing through trees and plants will be cooled. The winter wind can be blocked by plant material, especially evergreens and plants with heavy foliage. CRS often designs planting with deciduous trees on the south which cool the air in summer and drop their leaves to let in precious sunlight in winter. We use thicker evergreen types on northern exposures to break the cold wind.







Different climates require different designs.

The school children in the photo are comfortable on a relatively cold day, sitting in the sun protected by a free-standing wind break. In hot dry climates, it is best to keep the wind out of the inside spaces. Moisture is needed for a cooling sensation. But in warm humid situations, the air movement provided by ventilation makes us feel cool. In cold weather, winds are unwanted. Buildings do well to turn their backs to the wind in northern areas. Energy is saved by respecting the climate.