changes every month. This factor limits the potential for therma storage in PCM ceilings.

An alternative method of "charging" ceiling PCM tiles can be by convection, with hot air from a wall collector flowing above the tiles, as in the Barra-Constantini system (see section 3). It seems that with appropriate details of a modified "Barra Ceiling" it may be possible to provide a high heat storage capacity without a risk of overheating.

Comparing "Containerized" and "Incorporated" PCM "

Containerized" PCM, like e.g. the MIT tiles, can have a higher volumetric heat capacity than PCM incorporated within conventional building materials. The total heat capacity is a function of the PCM fraction in the composite element. The PCM containers can have a high fraction of their volume (above 50%) filled with the "pure" PCM.

Impregnated building materials, e.g. a plasterboard, can contain less than 10% PCM.

On the other hand the potential cost of packaging the PCM within conventional materials may be much lower than the cost of the containers which have been applied to PCM elements up to now. If a large portion of the building surfaces could be PCM elemen then even with low volumetric fraction of PCM the total heat capacity could be higher than that of conventional building materials.

Adding PCM to Concrete

Concrete/PCM material can find applications only in passive solar systems. Different considerations may be relevant to different passive heating systems.

The effective heat capacity of concrete is the product of its specific heat (about 0.2 cal/gr.C) and density (about 2 gr/cc) times the average diurnal temperature swing of the material, which is different in various systems.

The effect of adding the PCM, with latent heat of about 40 cal/gr.C to concrete, depends on the temperature swing of the storage element. The larger the swing the smaller is the relativ contribution of the PCM. With this background the different ways of applications of the PCM to concrete can be evaluated. Some examples of such applications are discussed below.

Use of Concrete/PCM in Direct gain Buildings

In Direct Gain buildings the acceptable temperature swing can be assumed to be up to 5 oC. Thus the total effective heat capacity of the concrete by itself is about 2 cal/gr/day.

Adding 5% of PCM with latent heat of 40 (cal/gr) would increase the total heat capacity of the material to about 4 cal/gr/day (0.05*40+2), namely approximately doubling the heat capacity of the concrete element serving for thermal storage.

When the PCM is added to the wet mix of the concrete the increas in heat capacity should be weighted against the "penalty" of