



## Construction Conditions and Construction Water

Considerable information and thought are required to design a proper roofing systems. Despite adequate and careful planning by the designer, a project may still not be successful unless the general contractor and the roofing contractor are also familiar with all facets of roof design and application.

Good workmanship is usually obtained through the art and skill of workmen or craftsmen. If art and skill are lacking, satisfactory application of building materials and systems is unlikely to occur except by chance. Problems are seldom due to a deliberate attempt to produce poor work, but rather to a lack of appreciation of all the factors involved. An understanding of the functions of building elements, the properties of materials, the necessity of certain procedures, is required by all parties concerned with design and construction.

No materials used in construction are ever completely dry, and even essentially dry materials contain some moisture. All materials have an equilibrium moisture content at any specific relative humidity, and will, if stored, tend to reach the equilibrium moisture content. Unless the materials are stored for some time in a very humid atmosphere, or allowed to get wet before or during construction, the initial moisture does not usually cause any trouble even when the materials are used in sealed systems. However organic materials, which are hygroscopic, can more easily pick up water than can inorganic and many undergo large dimensional changes as a result of changes in moisture content. Proper protection must be considered from the design stage to completion of the roof application.

Most specifications will say that roofing should only be placed when there is no precipitation whatever, at a temperature above freezing, on a deck surface clear of water, dew, snow, frost or ice and containing relatively low moisture content. All parties know that these conditions may be difficult or impossible to obtain unless roofing is done under shelter. All parties should also face up to the fact that an inferior roof may result if the conditions are not met, and in the worst conditions be prepared to specify temporary roofing or protection as for other elements in the building.

When winter enclosures are used to enclose the walls, it is important to realise the implications for the roof of wet finishing operations such as concreting and plastering inside the building. Most people have little or no idea that the quantities of water involved in these operations are very large as indicated below.

### Evaporation for Curing

Concrete	1 ton (200 gals) per 100 sq. feet of 4" slab
Gypsum concrete	2.7 tons (540 gals) per 1000 sq. feet of 2" slab
Gypsum plaster	0.8 tons (160 gals) per 1000 sq. feet of 1" thickness

Heating is usually provided for such enclosures but often ventilation is neglected. Heat by itself may dry out the floors or walls, but it does not dry out the building unless air changes are included. If the moisture is forced to dry out through the construction by air leakage large quantities of water may be left in the walls and roofs to cause later damage.

It may also be a surprise to some that the fuels burned in heaters to accelerate curing produce quite large quantities of water as shown below. A visual demonstration of this fact is given by the condensation trails left behind the burners of jet aircraft.

### **Moisture From Heating Devices**

Oil heaters                      1 gal for each gal of oil burned  
Propane gas heaters        30 gals for each 200 pound tank of propane

Roof decks exposed to the weather are subjected to moisture pick-up during construction. Allowance should be made for drainage and drying or for the moisture to dry out after construction. It is easy to estimate the quantities that are possible from this source. If two inches of water is taken as the precipitation for a month, and in some areas this amount can fall in a single rainstorm, it represents 10.5 pounds or slightly more than a gallon per square foot of flat roof. It is extremely unlikely that all the precipitation that falls will be completely absorbed into a roof deck. Much rain would run off a sloping deck, snow would blow off or remain unmelted, and some evaporation to the air would occur. But even if a small fraction, say one tenth, were retained and absorbed, it would represent a considerable increase in moisture for most materials. If you know the density of the material this is easily calculated. On roof decks that tend to pond water the simple expedient of puncturing the deck with drainage holes, left open until the roofing is completed, may help considerably in limited the moisture pick-up.

If it were not for the harmful effect of water in the wrong places, the construction of durable buildings might be greatly simplified. The success of a roof depends on how well the design and the roofing contractor are able to allow for moisture control during and after construction. This control of moisture from all sources should be constantly kept in mind.