



Sloped Roofs

Why do roofers almost universally recommend sloped roofs?

The answer is simple - water runs down a slope by gravity, and will drain off at the edge of an outward sloped roof, or into a pipe if it is provided at the termination of intersecting inward sloping roof surfaces.

Why do roofers want water drained from roofs?

A completely continuous membrane of large area is extremely difficult to construct with normal practical materials and workmanship. It is even more difficult to maintain a membrane in a continuous condition in service where it is subjected to the normal variables of weather and temperature. Terminations of a membrane at roof edges, at parapets and against higher walls, and around stacks, vents and other penetrations, create conditions where perfection of detail and workmanship may be difficult to achieve. Even if perfection is achieved in all aspects of the roofing during construction, subsequent inevitable building movement can produce imperfections.

If there is any type of hole or break in the waterproofing layer and water lies on it, gravity or other forces such as capillary suction or air pressure differential will cause the water to penetrate. Water penetration will result in wetting of the membrane, wetting of the materials below the membrane or dripping into the building. If there is no water on the roof there is no problem.

There will almost certainly be some water on roof surfaces at some time from rain or from snow or ice melting. The amount that penetrates any unintentional holes in the roofing will depend on the length of time the holes remain covered with water. The object of roof drainage by sloping roof surfaces is to keep vulnerable areas at high points and encourage water to drain away from them. In this way the chances of penetration through any imperfections are reduced.

In all normal, practical and economical construction it is impossible to achieve a flat roof. Normal construction inaccuracies and structural deflections produce depressions between main structural supports. Water drains down these unintentional slopes to produce unintentional ponding, which often results in unintentional leaks through unintentional holes.

Some argue that workmanship and other factors cause more roofing failures than are caused by lack of intentional slope. There is no factual information to support such a weak argument and much to show that water ponding is a large factor in roofing failures. Common sense also would indicate the support of a basic principle that if there is no water there can be no water penetration.

One of the main arguments against the universal use of sloping roofs is the added cost of achieving slopes. There is no doubt that if a designer starts from the basic premise of a flat roof and then converts to a sloping roof that it will require added expense to achieve the slope. If a slope is introduced in the structure as a basic requirement of the design, for many buildings there will be no extra cost. Also, since this is generally considered around the world to be a technical functional requirement of a roof, cost should not generally be the only consideration.

There may be some instances where designers or owners of buildings are faced with the necessity of flooding a roof for some length of time, even though this is not a desirable approach in relation to the life of the roofing. It may be necessary in some areas to allow water to build up to some depth on a roof during flash storms, to be drained off at a controlled rate over a longer period. This may be necessary to avoid overloading storm sewers and the property damages that can be caused by flooding in such cases. Smaller drain piping and fewer drains usually result from such systems, making an overall cost reduction on the drainage and plumbing. Cost alone however should not be the only consideration, and where water is to be held on a roof for any length of time, attention needs to be given to the membrane quality and all details of the waterproofing.

Summary

A perfectly flat roof cannot be achieved in normal practical construction and slopes will inevitably develop as already noted. It is better therefore to build in slopes as required to control the flow of water to drains in order to offset flows into depressions that create ponding on a roof. Any slope is usually better than none, but a practical minimum accepted by most for the main roof areas is about 1/4 inch per foot. Sloping of the main roof areas is only one aspect of water control on roofs and complete control involves attention to a number of other details. Sizing and location of drains, placing vulnerable flashings at the higher areas, grouping of roof penetrations and sloping of all metal flashings are some of the items needing attention. When controlled flow drainage or evaporative cooling are required on roofs, a sloping roof is less hazardous than a flat roof with depressions, as far as the membrane is concerned, but the unbalanced loading resulting from the flooding for controlled flow drainage systems must be considered in relation to the structure. For protected membrane (upside down) type roofs the principal membrane at the deck should be sloped, continuous and sealed at all penetrations. The drainage of surfacing materials on roof gardens and terraces requires particular attention.