CRCA CANADIAN ROOFING CONTRACTORS ASSOCIATION

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Roof Joints

The effects of temperature, moisture, wind, seismic loads, and numerous other conditions can cause significant movement and dimensional changes in structures and their material components. If allowances for this movement are not made in the construction, warping, distortion and cracking may occur.

Expansion Joints

In roof decks, anticipated deformations and stresses are typically accommodated by the installation of expansion joints. When such joints are required, it is usual to make a separation completely through the building from the foundation through each floor, walls and roof. Flexible connections are provided across the joints and at exterior locations they must be designed to be completely watertight, airtight and free from heat loss to prevent leakage and condensation. For typical expansion joint details, please refer to the CRCA Roofing Specifications flashing guidelines FL15.

Although the size of the building may be the most important determinant of when and where expansion joints are required, it is not the only consideration. Roof splitting has been known to occur at changes in span direction, at the junction of different deck types, at the junction of wings of buildings, and over end joints of simply supported beams and deck units (Figure 1). Allowance, for movement at these locations may be necessary to prevent splitting of the roof membrane.

Membrane Control Joints

It has been suggested that even if expansion joints are not required, joints strategically positioned to control tensile forces in the built-up roofing membrane itself should be installed. These usually have consisted of a break in the membrane, covered by a strip of flexible flashing material. There is however, no sound evidence to support this practice. On the contrary, field experience has shown that the potential harm from membrane control joints is far greater than their benefits. Their use has been, for the most part, based on erroneous assumptions about the behaviour of traditional bituminous roofing membranes. The purpose of this bulletin is to provide factual information about the properties of conventional built-up roofing membranes, and the potential hazards of building "membrane control joints".

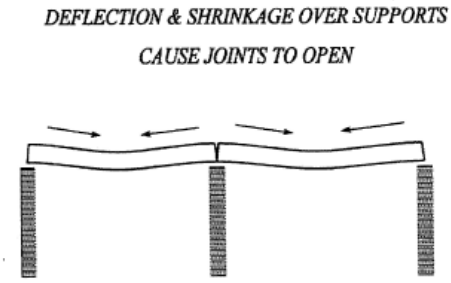

Figure 1

2430 Don Reid Drive, Suite 100, Ottawa, ON K1H 1E1
1-800-461-2722 | Tel: (613) 232-6724 | Fax: (613) 232-2893
Email: crca@roofingcanada.com | www.roofingcanada.com

Myth No. 1

Bituminous membrane behave elastically.

Bituminous membranes display visco-elastic properties, characterized by a change in mechanical behaviour from nearly elastic at low temperatures to a viscous fluid, at high temperature. Not all thermally induced movements are completely reversible. These membranes have the ability to relax, and stresses induced in the built-up membrane tend to dissipate whether or not the material deforms. Predicting the movement of an unrestrained membrane, therefore, is extremely difficult, although under cyclical temperature conditions they tend to shrink.

This shrinkage, may continue, similar to a ratcheting effect, if the membrane is not adequately secured.

Myth No. 2

Decreasing the surface area of the membrane by close spacing of control joints reduces shrinkage.

Tensile forces in a visco-elastic membrane are not necessarily proportional to size. In addition to those caused by changes in temperature, tensile forces resulting from areas of stress concentration, such as those produced from roof penetrations and re-entrant corners, are largely independent of the size of the membrane.

Myth No. 3

By providing an extensible cover material over the joint, stresses will be transmitted to the flexible flashing and relieve the stresses in the membrane.

Shrinkage of the membrane, due to poor adhesion will cause the joint to open. As the joint will continue to grow larger and larger, due to cyclical thermal loading, the flashing material will stretch up to the point where it may fail and leakage will occur. In addition, rupture at membrane flashings at adjoining walls can result from the diagonal stresses produced as the membrane migrates away from the joint.

In summary, control joints have not only been proven to be ineffective in relieving stresses imposed on bituminous membranes, but may adversely affect the performance of the roof assembly.

Roof Area Dividers

Roof area dividers, on the other hand, can serve several useful purposes. By breaking up irregular shaped roofs into smaller units, future servicing, repair and even reroofing becomes more manageable. By providing effective water cut-offs at the divider, problems can be limited to one roof section, and moisture can be prevented from contaminating adjacent areas. In addition, it has been shown that roof area dividers can be effective in eliminating the stresses associated with re-entrant corners (Figure 2) in irregularly shaped roofs, or those with large projections such as penthouses and monitors.

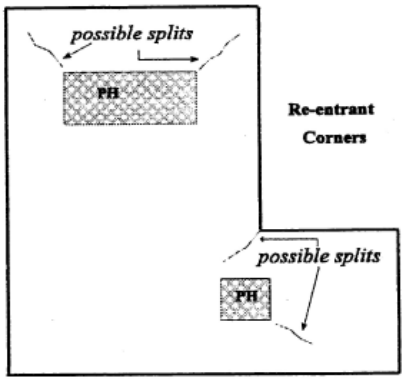

Figure 2

The separation provided by roof dividers should be as complete as possible, with wood nailers firmly attached to the deck and a curb of sufficient height to allow the installation of the membrane flashings. The air barrier should extend below the nailers, and water cut-offs installed on either side. Care must be taken to ensure that these joints do not impede drainage from the roofs. For typical details refer to CRCA flashing guidelines FL13 and FL14.

Numerous articles about roof joints are available from a variety of sources. This bulletin relies extensively on R.G. Turenne's "Joints in Conventional Bituminous Roofing Systems" (Canadian Building Digest - ISSN 0008-3097) and Roofs, by M.C. Baker (pgs. 104 - 108). For a more detailed discussion on the subject, please refer to these publications.