

TECHNICAL BULLETIN – TB073

MISCONCEPTIONS ABOUT MEMBRANE ELONGATION

21 JUNE 2013

INTRODUCTION & SCOPE

There is a wide misconception regarding the elongation properties of waterproof membranes and their ability to bridge cracks that form post membrane application.

This bulletin endeavours to clarify the real meaning of elongation and elasticity in relation to bridging properties

FLEXIBILITY & ELASTICITY

When a liquid membrane is applied to a concrete surface it is fully bonded to the substrate surface. Because of the elasticity and flexibility, the membrane has the ability to cope with broad span movements such as thermal expansion / contraction of the substrate as well as lateral flexing frequently experienced in construction projects.

Within a structure there are two basic types of movement underlying an installed membrane and these are principally handled by two different mechanisms within the membrane coating.

TYPE OF MOVEMENT

Free movement
Restricted movement

PRINCIPAL HANDLING MECHANISM

Flexibility
Elasticity

Free movement involves extensibility and deformability where the membrane is not restricted by being bonded to an area of substrate such as over a bondbreaker or bridging existing cracks.

Restricted movement involves extensibility where the membrane is restricted by being fully bonded to the substrate.

The membrane's flexibility also allows it to cope with movement of cracks existing prior to the application of the membrane and the ability to cope with significant movement can be built into the application, by properly treating the crack with a bond breaker that extends the gap, where the membrane remains un-bonded to the substrate.

A membrane's elasticity or elastic modulus allows it to cope with small cracks such as hairline cracks that form as a result of plastic shrinkage of the concrete. It should be noted that when hairline cracks form after the application of the membrane, the membrane copes by necking or reducing its film thickness over the crack. As the crack gets larger the membrane gets thinner to a stage where it becomes ineffective as a waterproof membrane and eventually shears or tears to break completely across the crack.



BULK MOVEMENTS & PRE-APPLICATION CRACKS

When the un-bonded gap at membrane installation is 2mm a membrane with 200% elongation will extend to 6mm, should this degree of movement occur. There will be minor necking of the membrane across the gap as the membrane is stretched and the membrane may lose some waterproofing efficiency, however as the gap reduces again the membrane will recover. In this example once the gap movement extends beyond the limits of the elongation the membrane will fracture and fail (refer Diagram #01).

When the same membrane is applied so that an un-bonded gap of 10mm exists by the installation of a bondbreaker to 5mm on either side of the crack, the membrane will extend to a 30mm gap with no damage.

As is evident the wider the section of membrane that is not bonded to the substrate the more absolute movement can be accommodated before the membrane suffers damage. This distance can be expanded by the installation of bondbreakers over cracks to provide for greater movement capacity (refer Diagram #02).

This movement is principally accommodated by the membranes elongation.

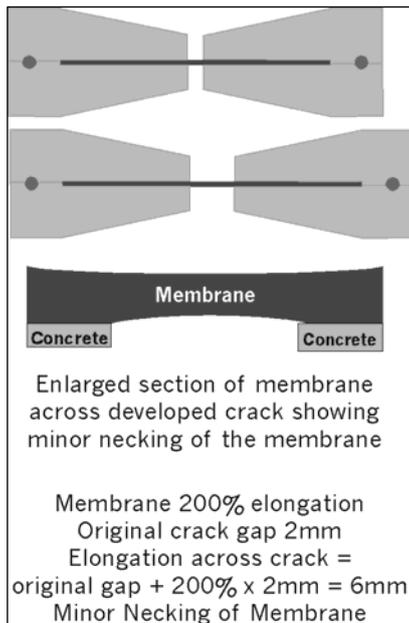


Diagram #01

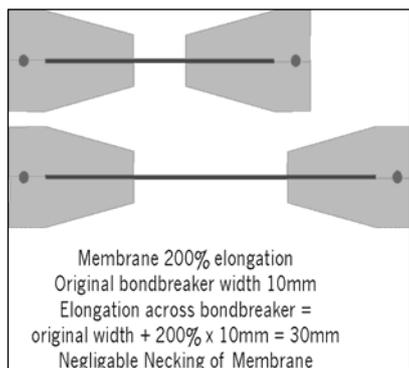


Diagram #02

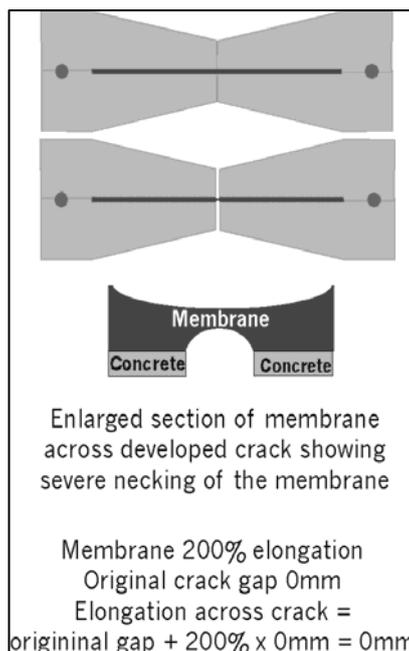


Diagram #03

POST APPLICATION CRACKS

Cracks that form in concrete following application of the membrane obviously have no membrane distance that is not bonded to the substrate. The original gap is non-existent or 0mm and regardless of the elongation properties of the membrane post application cracks will result in damage to the membrane. At 200% elongation – 200% of 0mm is 0mm; at 500% elongation – 500% of 0mm is 0mm (Refer Diagram #03).

When post application cracking occurs the membrane will extend but the result will be serious necking of the membrane across the newly formed gap. This will seriously impair the properties of the membrane and the membrane will tear with small movements.

Post membrane application cracks are only accommodated by the elastic modulus of the membrane. In accommodating this crack the membrane reduces film thickness and the extent to which it will stretch without becoming ineffective as a waterproof membrane is limited. Hairline cracking resulting from plastic shrinkage of the concrete can be accommodated, however more extensive cracking, such as structural building movement, will result in membrane fracture regardless of the elongation properties of the membrane.

CONCLUSION

To benefit from the elongation properties of a waterproof membrane the membrane should be applied such that it is not directly bonded over a crack, preferably with a bondbreaker to extend the free movement of the membrane over that crack. The width of un-bonded



section of the membrane where free movement can be achieved will govern the extent of movement that can be accommodated by the membrane.

Regardless of the flexibility or elongation properties of a membrane, its efficacy will be reduced or it will fracture with the development of cracks in the substrate subsequent to the application of the membrane. As the crack widens from zero the elasticity allows the membrane to remain continuous, albeit thinner and therefore less effective, until it reaches its elastic limit when fracture occurs.

IMPORTANT

This Technical Bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application / installation of the products described. Since each project potentially differs in exposure / condition specific recommendations may vary from the information contained herein. For recommendations about specific applications / installations contact your nearest Ardex Australia Office.

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REASON FOR REVISION

Review and update

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