Technical Bulletin

Thermal Cracking of Concrete

Other than the rare earthquake or settling of an older structure, the overwhelming majority of cracking in concrete roof decks is caused by thermal cracking. The daily fluctuation in ambient temperatures results in a warm portion of the concrete and a cool portion of the concrete. Cool concrete contracts and warm concrete does not contract and actually expands. If you have one portion of the concrete contracting and another portion not contracting or expanding, it will result in tensile stresses and once those tensile stresses exceed the in-place concrete tensile strength, the concrete will crack.

The reason why concrete doesn't crack in half on day one when there are extreme changes in weather conditions is due to the fortunate fact that concrete does not expand and contract all that much. The length changes are very small and the coefficient of the thermal expansion (CTE) which are the measure of expansion and contraction, are expressed in microstrains, (the unit of deformation extended or compressed as compared to an undeformed state expressed in millionths), per unit of temperature change. In fact a microstrain unit is as little as 10^{-5}/C° and is around 8-12 units for concrete which is surprisingly small when you consider steel is around 12 units.

While this movement is minimal, over time you will develop surface cracks when you have a differential of 20° C or more on a consistent basis as it exceeds the in- place tensile strength over time. With the hot Mexican sun in the day and the rapid cooling at night, concrete temperatures can vary 50° C or more. Over a period of time, this will and does cause the cracking you see on concrete roofs.

When coated with EPOX-Z NRG, the roof no longer has cool sections and warm sections. The differential will be significantly less than the 20° C , (which as noted above could cause sufficiency of the CTE to cause cracking), and therefore there will be no cracking of the concrete. With its tremendous adhesion, reflectivity, absence of degradation as there is virtually no chalking or deterioration by ponding water, there is virtually no thermal flux. Consequently there is no expansion and contraction over time and therefore there are no thermal cracks on EPOX-Z coated roofs.