TMC	TMC – Tinni Management Consulting **PAVEMENT INFORMATION NOTE**	**Issue No. 64**
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The following information has been provided as an explanation for the need for detailed design of the locations of the longitudinal joints in full width concrete paving. (Unfortunately RTA has many actual examples where the joints have not been located where the maximum stress conditions occur.

For paving widths of more than 8.6 m, two longitudinal contraction joints will be required. It should be mandatory for the Consultants to supply detailed designs to support their pavement designs.

BACKGROUND TO PAVEMENT STRESSES AND CRACKING

a) Restraint stresses in pavement slabs are due to prevention of movements due to expansion, contraction and rotation. At pavement edges and ends, restraint stresses increase from zero towards the middle of the slab.

b) At slab ends (where no restraint occurs), uniform axial movements are recognized as slab end expansion/contraction movements. Bending occurs due to temperature gradients through the slab and this is known as slab "curling".

c) Where bending results from a moisture gradient, i.e. uneven drying out of the slab, it is then called "warping".

d) Early age cracking is due to axial contraction and bending deformation restraint stresses occurring after the initial set of concrete.

e) Axial movements are attributed to concrete temperature changes and drying shrinkage as the concrete sets. As the concrete hydrates, the slab heats to above 50°C. This heating is uniform and the slab "expands" generally setting up compressive stresses. As the hydration is nearing completion, the slab starts to cool and contract, setting up tensile stresses.

Upward bending (or tendency to bend) occurs because of the non-uniform concrete temperature gradient (and possibly drying) between the top and bottom of the slab.

f) Curing compounds prevent the surface water evaporation which tends to maintain even moisture content and thus warping stresses are generally not an issue. More importantly, however, curing compounds prevent surface water evaporation and hence reduce the rate of surface cooling and thus the temperature gradient. (It is interesting to note that this deleterious fact is overlooked when wet curing is specified!).

g) Axial contraction restraint stresses are due to friction resistance between the bottom of the base slab and the top of the subbase. Stresses increase from zero at slab ends to a maximum value when the restraint stresses due to friction resistance build up to equate to the full restraint stress (for a particular co-efficient of friction) attributable to uniform slab cross-section temperature change. The slab "end length" involved in end movement can be calculated for both longitudinal and transverse conditions. From then on the axial restraint stress is constant.

h) Full bending restraint stresses are due to differences between the slab surface and bottom temperatures. When the stress can no longer be relieved by curling deformations cracking will result. The resultant maximum stress occurs at a "critical" distance in from the slab edges.

RTA standards provide that for longitudinal induced joints the saw cut depth should be D/3. This means that whatever stresses are present in the slab, after saw cutting the stresses in the remaining concrete cross-section will be 50% greater.

i) If stress relief through cracking is going to occur, then it will occur where the stresses are the highest. The locations of the induced joints must be such that the stresses after saw cutting are greatest at these locations.