



## USING THE LMC SUBBASE AS HAUL ROAD

The following questions were received from one of our Projects:

- 1 Have we extensively trafficked the subbase on previous projects?
- 2 Is this likely to cause additional cracking?
- 3 How do we monitor cracks when spray seal is down?
- 4 How much does compressive strength help to reduce the effects (ie if we waited until 10 MPa, would this alleviate some of RTAs concerns)?
- 5 How have RTA responded to Arvo's explanation of LMC cracking (ie have we had to R&R many slabs recently)?
- 6 Is it worth pushing the concept of using the subbase as haul road (for the sake of safety on the existing highway)?

As the responses to these overlap, the following is given as a general commentary.

### THE REQUIREMENT

#### RTA Specification DCM R82 Clause 4.3.8.4 – Trafficking of the Subbase

*Subbase must not be trafficked by either personnel or construction equipment ....., until the in-situ strength of the Subbase has reached 4.0 MPa. Thereafter, access to personnel will be acceptable, but only vehicles with gross mass less than 1.5 tonnes and construction equipment necessary for the following operations will be permitted to traffic the Subbase:*

- a surface debonding treatment and spall treatment;*
- b base paving and then only for a distance of up to 300 m immediately ahead of the paver, **except** as specifically provided in the Specification.*

### COMMENTS

- 1 In Pavement Information Note 4 (25 01 08) I provided examples where in US normal traffic is allowed on the pavement when a compressive strength of 8 MPa is reached. Note that they do not use LMC under bases, but either DGB or stabilised material.
- 2 In case of RCC, this can be trafficked immediately after compaction.
- 3 I am not aware of additional cracking due to construction traffic and there are many projects where this has been the norm. Chris Bryce has advised that M2, Jugiong, Ourimbah, Raymond Terrace, Y2C and parts of M7 all had traffic running on the subbase. What has occurred, however, is that in some instances the subbase has disintegrated at local construction traffic crossings and at exits from batch plants. This starts off with the crumbling of the unsupported pavement edge (ie no subgrade beam) and works itself forward on the same principle.

- 4 Where disintegration has occurred, these areas must be replaced (small areas of shallow ravelling may be patched with mortar and the primer seal restored). The reason is that in these situations, the subbase would have lost its even friction characteristics for the debond between the base and subbase. This is undesirable and generally unacceptable.
- 5 Closely spaced fine cracks are less prone to spalling than those of wider spacing. Spalling occurs because there will be a temperature gradient through the slab causing a variation in temperature shrinkage/expansion of the top and bottom faces of the subbase, which results in some warping, which in turn causes point loads at the shoulders of the cracks, which may then spall. The shorter the slab length the smaller the effect of warping. Wider spaced cracks are also wider and can tolerate more warping before the shoulders of the crack come in contact. Spalling can occur whether the slab is trafficked or not. There is no easy method of calculating non-spalling crack spacing for particular crack width.
- 6 Here it might be noted that this condition will be exacerbated when the (black) primer seal is applied. This would cause the top of the slab to become even hotter and hence a steeper temperature gradient through the slab. This in turn will cause more pronounced warping to take place and hence also the likelihood of spalling.
- 7 The cracks and the crack patterns are insignificant as far as the structural strength of the base is concerned. The most important aspect, however, is that the surface of the LMC is of even texture and smooth. Any steps at cracks must be milled before the base is placed. Cracks that reflect through the primer seal are of no concern. These usually amount to very few. Cracks that have reflected through and also spalled, must be repaired and the primer seal restored.
- 8 The amount of (shrinkage) cracking depends on the compressive strength of the concrete. The higher the strength, the more cracks of closer spacing will occur. The lower the strength, the more crumbling or disintegration at certain locations can occur. The problem is how to determine where the reasonable point of balance is? I believe that, regardless, we should aim at no more than 15 MPa in 28 days. This is the whole principle of having an unjointed LMC subbase.
- 9 The SMZ will always have some inherent deflection characteristic. If this is too high then the passage of wheel loads will also cause some deflection of the LMC subbase. The lower the concrete strength, the more "ductile" it is and the larger deflections it can tolerate. The corollary is that the stronger the concrete, the more "brittle" it will be and the less deflection can the subbase tolerate. I was party to the Specification allowance of <2 mm. This was because BB deflections are both CBR and m/c sensitive and would be more than adequate for a concrete pavement. Where we propose to use the subbase as a haul road, my assessment is that if the Benkelman Beam deflection of the SMZ is kept below <0.5 mm, no fatigue cracking of the subbase will occur.
- 10 Regarding my paper about the classical theory of formation of cracks in LMC, I did not send it to RTA nor have I heard any comments. Anyhow, there is nothing radical that can be disputed.

## **CONCLUSIONS**

- 1 I see no theoretical or structural reason why we cannot use the LMC subbase as a haul road in certain circumstances.
- 2 Where traffic has to cross the unsupported edges of the LMC, special precautions need to be taken.

- 3 If there are some high readings of the BB deflections on the SMZ, these should be examined and can usually be reduced by ripping, drying and recompacting the material.
- 4 Placement of the Trial Section could be undertaken as early as possible and put under the construction traffic to demonstrate to RTA that there are no ill effects.
- 5 A detailed Method Statement on repair of spalled cracks should be prepared and submitted to RTA with our proposal.
- 6 Where construction traffic has to cross the subbase or enter from the batch plant, the subbase should be covered with 300 mm of SMZ material.

Arvo Tinni  
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