TRACK21

VISIT BY PROFESSOR BUDDHIMA INDRARATNA, 28 May 2012

Points raised in discussion

WA1: Railway foundations. Presentation by Jeff Priest

Comment	Response
The pore pressures used in both the track sub-base and the embankment work seem quite high – higher than would occur in reality where there is nearly always a suction.	It was perhaps unclear from the slides that the cell pressure is also elevated, ie we are testing at what we believe is the right effective stress assuming that translation of axes applies.
When presenting the results of the HCA tests, consider what exactly you mean by "mobilised strength" (does it accord with what is conventionally meant) and also look at the classical definition of Cyclic Stress Ratio (eg Ishihara), relating it to the tendency for dilation	OK. We will address these matters
We are showing failures of the sub-base after 1500 cycles whereas in practice failure would not occur until after more than a million cycles. Are our stresses realistic? The capping layer takes quite a bit of load, so that the stresses going into the sub-base are quire small.	We will check this out

WA2: Ballast and sleepers. Presentation by Antonis Zervos

Comment	Response
The number of cycles you can reproduce in PFC2D or PFC3D is very small (500 is a lot). This is a major limitation. If you can overcome this you will doing very well.	We are not sure we will be able to do many more cycles, but the potential particle method is ~3x more efficient (computationally) than clumps of spheres.
What about the effects of particle breakage? This starts very quickly in reality	We had rather been looking at other aspects, and what might happen in addition to breakage of particles (take breakage out of the equation).
Refer to BI ASCE paper using CT scanning to characterise ballast particle shape (?)	
BI has not yet been able to match DEM and real data (over more than about 500 cycles?)	
Effective confining stresses in lab tests are high – 45 to 200 kPa. Field measurements by BI have shown vertical stresses up to	200 kPa was to simulate tamping. We will try out the stress cells and see if we can get any sensible data from them.

about 300 kPa below the sleeper base and lateral stresses of 20 kPa. These were measured using proprietary stress cells.	
The problem with scaling the particles is that the amount of breakage is reduced.	Is this a problem for us? We could use a different mineral?

WA3: Noise and vibration. Presentation by Sam Rushworth

Comment	Response
Suggest look at publications by Richard White and Kieth Tieuw (mech Eng., Wollongong Uni) and Paul Neehan, Queensland Uni, who have been developing tribology based noise models. Railcorp NSW has adopted the Wollongong noise model.	
BI has also done some work on ballast mats in reducing noise and ballast particle breakage – this has been accepted by *Geotechnique*. Ballast mats were used either between the sub-ballast and the underlying rock; or between the sleeper and the ballast where the underlying material was alluvial (soft).	

WA4/5: Critical zone improvements/system integration. Presentation by Jeff Priest

Comment	Response

WA6: Performance, environmental and economic modelling. Presentation by Simon Blainey

Comment	Response
Suggest cross-reference to other on-going work on whole life modelling.	

General comments

Comment	Response
Climate does not seem to be quite the same issue in Australia. The main climate related problem is rainfall-induced slides of severely desiccated clays. There does not seem to be the same problem as in the UK of seasonal shrinkage and swelling	
Chemical stabilisation of railway tracks is a	

big issue in Australia – lingo-sulphanates have superseded conventional lime or ballast owing to environmental concerns.	

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