

PROGRESS REPORT BITUMEN STABILISED MATERIALS LABORATORY DESIGN

18 January 2008

General

These Eskom power-cuts have not been taken into account and they concern me enormously. Our hydraulic materials testing system, used for triaxial tests, uses 3 Phase power supply and does not have an auxiliary power source.

Also permanent deformation tests, for example, can take one week per test, so there is no chance of completing a test without interruption and we can't continue to repeat specimen preparation and testing, hence. alternative power sources are being investigated.

Task schedule

Simple Triaxial Test (Task 2):

The results of the questionnaire survey sent to 16 SANAS accredited civil engineering laboratories in South Africa seem to indicate that very few frames in the country could accommodate an apparatus larger than 300mm high. Unfortunately, the responses are unclear as to the cause for height limitations and, hence, the ease with which the frames could be extended to, say, a 400mm gap.

The design of the selected geometry of the "simple triaxial" setup is currently being finalised with drawings being generated for the setup. The next step is manufacture of a trial setup in February followed by preliminary testing.

The services of Stef Bredenhann have been incorporated to give guidance and impetus to this project. It is expected that a test protocol would be available by June 2008. Sabita funding would terminate end March 2008, after which the project would be financed out of academic programmes.

Advanced Classification System (Task 6):

This task is partially complete with the long term permanent deformation triaxial tests now scheduled to commence. The preparation of new specimens, (compaction, curing and testing) was scheduled to begin in late January and is scheduled for completion

by the end of June 2008 to tie in with the drawing up final report and guideline document.

Curing Investigation #1 (Task 7):

The triaxial testing of laboratory foamed and emulsion mixes of graded crushed stone is complete and the results are currently being interpreted to propose of a preferred accelerated curing procedure. This task is currently being written up as part of the Masters Degree thesis.

Curing Investigation #2 (Task 8):

Data from the two moisture buttons have been retrieved from the full-scale pavement have been downloaded and is currently being processed.

Measurements of the Resilient Modulus of the bitumen stabilised layer on the N7 have been made on site using Gautrans' PSPA, with the kind assistance of the CSIR. These results are being used in the assessment of the relationship between in situ moisture and stiffness. The change in moisture and Resilient Modulus on site is a primary guiding factor in establishing the laboratory curing protocol.

Tasks 7 and 8 are on schedule for completion towards the end of February 2008 as reflected in the revised programme.

Moisture Sensitivity: Laboratory Simulation (Task 9)¹:

Trials on the MIST (Moisture Induction Simulation Test) device have indicated that the device has the potential to provide better understanding on the mechanism of the moisture damage on the mixture. The influence of the percentage saturation on M_r , C and ϕ will give guidance to the full matrix of testing.

Activities covered by this task are the production of latex membranes for triaxial and permeability testing, maintenance of the laboratory foam plant, repairs to the hydraulic component of the MTS, the functioning of which is critical for timely completion of Task 9.

Trial tests on the permeability device for testing triaxial specimens (150mm diameter x 300mm high) were conducted, however the device still needs some improvement due to a little air leak to the specimen on the clamping areas. Permeability test is in critical path

¹ Previously termed "Durability"

for the completion of Task 9. If the difficulties persist, alternative solutions e.g. testing outside Stellenbosch laboratory, will have to be considered. Testing on this Task will effectively start beginning of February until the end of March 2008.

Moisture Sensitivity : Accelerated Simulation (Task 10):

Notwithstanding some apparent anomalies in the presentation of the rut development data, it was evident that the rutting under MMLS of specimens subjected to accelerated, medium-term curing, was significantly higher than that which occurred on specimens cured for more than 1 year. Analysis was required.

It is anticipated that the progress on this tasks will run in parallel with the MIST testing. Two more specimens will be compacted during production of the seven specimens being prepared for the MIST testing. Completion of Task 10 is planned for the end of May.

Durability In Terms Of Binder Ageing (Task 11)

Rheological tests (Penetration, Softening point, and Dynamic Viscosity at 60°C and 135°C) have been carried out on binder extracted from 18 field cores, 8 of which were from Saudi Arabia and 10 from Grassy Park in Cape Town. All the Saudi cores and 6 of the Grassy Park cores represented foamed bitumen recycled base and 4 of Grassy Park cores represented a bitumen emulsion stabilised base layer.

The results indicated that, although binder quantities used for the BSM is usually low, the binder in both foam and emulsion treated layers aged significantly in 1-5 years depending on the environmental conditions.

FTIR testing is being investigated as a tool to gain insight into oxidative hardening of the binder.

Bitumen samples to be used for the ageing simulation - 60/70 and 80/100 from CALREF, and 60/70 and 80/100 from NATREF - have been delivered to Stellenbosch. And the rheological tests will be completed end of January 2008, after which it is envisaged that FITR will follow.

It is estimated that 50 % of the Task 11 will be completed by mid-February. The other 50% which will include coring and testing of specimens from N7 section and P243 of the GP will commence mid

April. Analysis and writing of the report will continue up to end of June or early July 2008.

Compaction Investigation (Task 12):

Since the previous report the following activities have been completed:

Emulsion mixes:

- Temperature variation experiments (5°C, 15°C and 35°C)
- Compaction of N7 material at room temperature to determine relation between field compaction and laboratory compaction.
- A dry density vs. moisture content plot has been done and compared to Mod. AASHTO curve

Foam mixes:

Due to the necessary maintenance of the foam plant, no experiments were performed during the past six weeks.

Repairs to the plant appears to be near completion and experimentation will continue forthwith.

The project was expected to be completed and written up by February 2008, but clearly this estimate needs to be revised.

Concluding remarks

1. An interim comprehensive project report would be submitted end March with an indication of provisions to be made in the preparation of the proposed revised manual for outcomes that may only materialise after June 2008.
2. There was concern regarding the outcomes of Task 10 and indicated that this aspect requires attention in the process of developing a laboratory curing protocol.
3. The significance of the observed binder ageing in bitumen stabilised materials needs to be examined.
4. The ongoing commitment (of R340 000) by Gautrans to finance the preparation and production of the guideline document needs to be established.