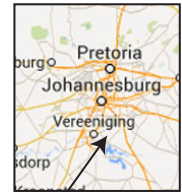


Accelerated Road Testing using GE-NANO

In January this year, the Council for Scientific and Industrial Research (CSIR) completed accelerated road testing using a Heavy Vehicle Simulator (HVS) on road D1884 near Vereeniging.



Gauteng Province:
GPDRT.
Heidelberg West:
Road D1884 -
Rehabilitation of
rural road.
~3.0 MESA

Location of rehabilitated road.

The design traffic loading over a 20 year period for this road would be in the order of 3 million standard 8 ton axels. The challenge was that primary distress was in the existing base and subbase layers. The existing base now classified as a G8 quality material and the subbase now classified as a G7 quality material in terms of Technical Recommendations for Highways (TRH 14.). The challenge was to rehabilitate the road pavement in a cost effective manner.

The solution was to reuse the existing materials, which would typically be considered of marginal to unacceptable quality for reuse within the upper (base and subbase) road layers. Both the base and subbase layers were stabilised with 0,7% GE-Nano, a nano-modified emulsion (NME) containing nano-polymers for strength and nano-silanes for improved water resistance. The rehabilitated pavement therefore comprised two 150mm thick NME stabilised layers with a double seal surfacing.

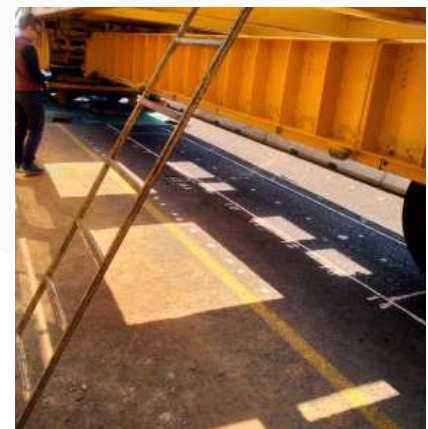
A portion of this rehabilitated road was then used as a test section for the accelerated HVS testing.



Drilling of core on prepared HVS section.



Drilled core showing the double seal, 150mm NME 4 base-layer (1.5% NME) and 150mm sub-base layer (1.0% NME). (NB: NO CEMENT!)



HVS test 3 days in progress.

HVS testing was stopped after applying in excess of 7 million standard 8 ton axel loads with less than 10mm of rut depth being recorded and with no failure of either the base or subbase layers.

Water was added continuously to the HVS section to a depth of 500mm during simulated traffic loading from December 2018 until the end of the testing on 17 January 2019. No water penetrated the base or subbase and the water had no visible effect on the behaviour/performance of the road under the simulated HVS traffic loading.



HVS testing.



(26 November 2018) Wheel load at 80 kN (double normal). No deformation or damage to base or sub-base (seal pushed aside due to spillage of hydraulic oil from a burst pipe on the HVS) – 3 Million E80s applied to test section.



(8 January 2019) Testing at a dual wheel load of 80 kN with water applied continuously on the surfacing and to a depth of 500 mm through holes next to the test section.

This is a very exciting result for us, since the rehabilitation design was initially cost-effective as the existing road materials were reused and there is scope to make design even more cost effective in future given the excellent performance of the road under accelerated HVS testing even under saturated conditions.



(17 January 2019) Cores drilled in the middle of the HVS test section after removal of the HVS at the end of the test after applying in excess of 7 Million E80s (more than double the design traffic loading).



(17 January 2019) HVS test site after removal of the HVS showing less than 10 mm rut depth.



Condition of the exposed base-layer at the end of the test after removal of the surfacing with a hammer and chisel.

Section 2 North Bound Lane: Material Properties

Base-layer	Sub-base layer	Upper selected
2018	2018	2018
15/01/2018	14/03/2018	14/03/2018

Mix Design
0 - 170

Atterberg Limits	LL%	24	23	21
	PI	7	4	3
	LS%	3.5	2.1	1.4
GM		2.09	1.85	1.10
mod-AAHTO	OMC%	7.2	11.4	9.1
	MDD	2170	2030	1967
CBR	Comp MC	7.0	11.2	8.8
	% Swell	0.16	0.29	0.52
CBR @ Density	100%	27	32	20
	98%	22	28	15
	97%	19	26	13
	95%	15	23	9
	93%	12	20	7
	90%	9	16	4

Classification	TRH14	G8	G7	G10
Pavement Design:		Base	Sub-base	Sub-grade
		150mm	150mm	Compacted to 93% mod AASHTO
		NME ₄	NME ₄	
Surfacing:	20/7 Double seal			



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