

**The refurbishment and upgrade of the Kyalami Grand Prix Circuit has entered its sixth month. The final layers of asphalt are now all laid as work continues on various other elements of the project.**

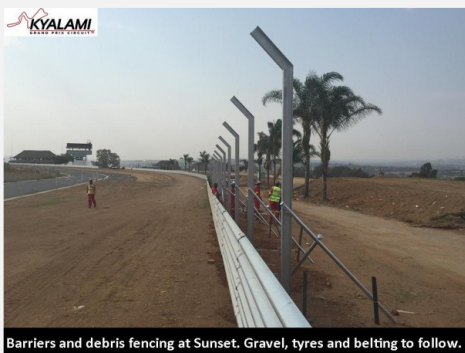
The focus is now on the completion of the various circuit safety upgrades including the installation of barriers, debris fencing, gravel traps and the placement of over 40 000 tyres around the circuit. Progress has also been made on the shaping of the new spectator areas, the spectator fencing and service roads. Specialist FIA / FIM approved non slip paint supplied by Italian company Colorificio Sammarinese has been shipped and the painting of the circuit lines and kerbs will commence in November. The upgrade of the 4 x 4 facility is also expected to commence by mid November.



Saw tooth kerb, ACO drain, grass blocks and asphalt run-off at Crowthorne



Gravel Trap material being placed at Cheetah.



Barriers and debris fencing at Sunset. Gravel, tyres and belting to follow.



New debris fence and cables being installed on back straight.



The versatile Kyalami Manitou offloading another load of fence poles.



Work continues at the main entrance. New underpass visible.



Palm tree located at the paddock bridge entrance being carefully loaded for relocation to area on "boma road".



The view of the extended main straight from race control area of building.

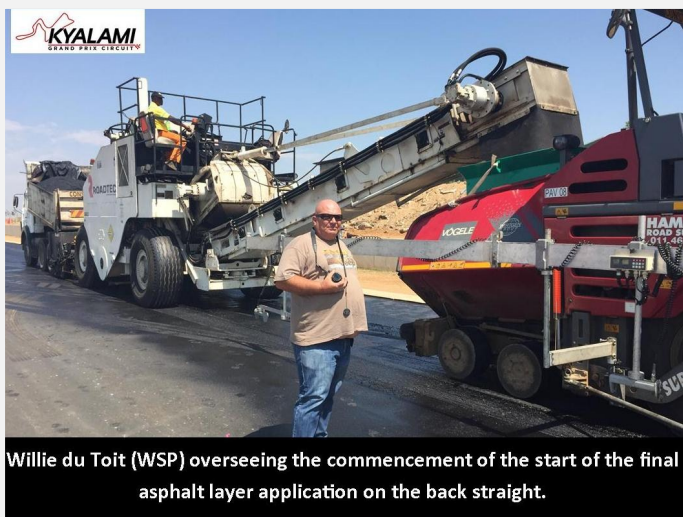
## A milestone achieved - Kyalami has its new asphalt surface



A milestone in the circuit refurbishment project was reached on the 16th October 2016 when the first lap of the new circuit was completed.

The final layers of new asphalt were laid only hours before the first official lap was completed.

The first layers of asphalt were placed on the track in mid September. During the 30 day period of the project over 10 000 tons of asphalt was placed by the team led by Willie du Toit from WSP. Work on the new asphalt run-off area at Ingwe corner and the surrounding service roads are also now completed.



Willie du Toit (WSP) overseeing the commencement of the start of the final asphalt layer application on the back straight.



## The Kyalami Pit Building Project

An updated artist's impression of the new Kyalami International Convention Centre and Pit Building has been issued. The scale of the multi levelled structure which houses 42 pit garages, a large open paddock area, various conference and board rooms, viewing decks and kitchens and ablution areas is clearly evident. Work has commenced on phase 1 of the erection of the structural steel.



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## How the structural problems at Ingwe were solved.

Remedial works were necessary for the 12m-high retaining structure at the start of the pit straight at the Kyalami Grand Prix Circuit in Midrand, Johannesburg. ARQ Consulting Engineers was approached and requested to investigate the problem and propose a solution. A site visit was conducted, and cracking of the shotcrete was observed at the corner of the retaining wall, with the crack pattern generally indicating that the corner portion appears to be moving outward.

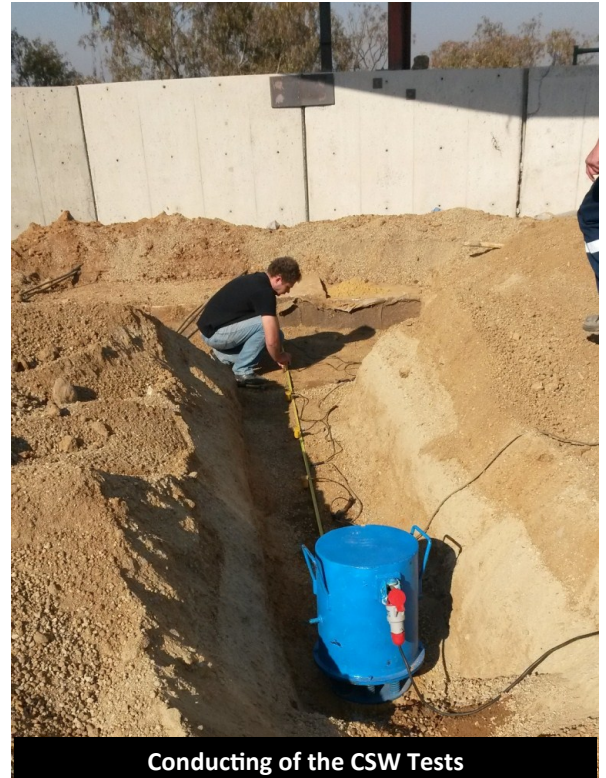
It was initially postulated that the cause of the movement was due to weaker zones within the fill material. In order to confirm this, continuous surface wave (CSW) tests were conducted. These are non-invasive in situ tests that measure the stiffness of the underlying soil layers by inducing vibrations in the soil and measuring the resulting shear wave velocities passing through the various layers. It is possible to reach depths of up to 20m, if required. The CSW tests confirmed the presence of soft spots, although these were generally limited to the upper layers.

Using the soil profile determined from the CSW tests, it was possible to construct a typical cross-section of the wall with representative soil properties, and perform a detailed Finite Element Analysis (FEA) using RocScience's Phase<sup>2</sup> software. A preliminary analysis revealed that some 24mm of horizontal movement would occur with the current design. This is considered reasonable as it appears to correspond to the size of the cracks actually observed in the wall. Furthermore, the current design was found to be unsuitable for the long-term condition.

The following remedial measures were proposed, and were carried out by Ground Engineering Limited (GEL):

Install R32S self-drilling anchors (SDA) as micro-piles with a 90mm f ES drill bit spaced 2.0m apart to a depth of some 15m. An SDA system comprises a hollow threaded steel bar with an attached sacrificial drill bit that performs both drilling and grouting in a single operation,

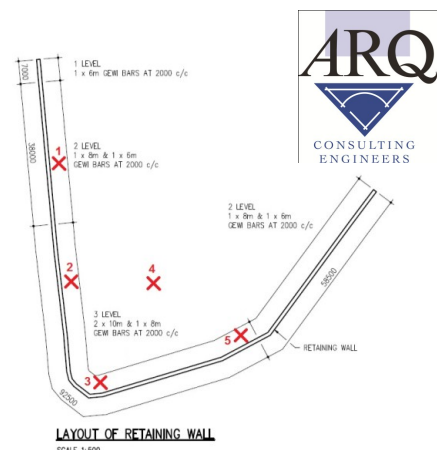
These were installed along the critical perimeter of the retaining wall, offset so that they did not intersect the soil nails already in place, also installed at 2.0m c/c. A total of 53 no. micro-piles were required,



Conducting of the CSW Tests



Preparation for anchor installation.



## How the structural problems at Ingwe were solved. (cont.)

The pile top was connected with a 300 x 300mm capping beam installed such that the top was approximately 300mm below road/arrester level. This capping beam is typically reinforced with 100kg of steel per cubic metre of concrete, and was tied into the foundation of the existing side wall via dowel bars.

SDAs are suitable for difficult ground conditions, but more importantly are relatively fast to install since drilling, placing and grouting are performed in a single operation. This was a major advantage for this project where time was considered critical and a fast but reliable solution was required.

Following a detailed assessment, the proposed solution was considered appropriate as the margins of safety for various load conditions were determined to be sufficient, with all necessary checks exceeding the required minimums. Horizontal movements of some 1mm are anticipated following the implementation of the remedial measures. In order to check this, a detailed survey of the wall was conducted prior to construction. This will then serve as a benchmark for a future survey to be conducted after construction, but only at the end of the next rainy season. This will likely be performed in March/April 2016.

***Thanks to Gareth Harper from ARQ For the supply of the article and images***



Installation of self drilling anchors



Installation of capping beam.



Final layers of asphalt being applied at Ingwe corner run-off.