Rehabilitation of the Pietermaritzburg Airport

Every day the next 300 m² resurfaced stretch of runway was feathered down to the old level over a distance of 2 m to allow for smooth landing

FINALIST – Technical Excellence Category

KEY PLAYERS

Client
Msunduzi Municipality

Professional team
Brava Engineers, Maccaferri Southern Africa

Main contractor
Elco Asphalters cc

Main sub-contractors
Phambili Road Surfacing, Cozzi Road Markings, SIA Solutions, Megaphase Roadmarking and Signage

INTRODUCTION

With Pietermaritzburg being the capital of the KwaZulu-Natal Province, it had become necessary to upgrade the city's airport. The airport had lost popularity over time due to growing dissatisfaction with the level of aircraft comfort, perceptions of unreliability, diversions to Durban and some fears about safety. The ailing airport experienced a 25% decline in passenger numbers from 2006 to 2009.

The upgrade (to the value of R40 million) of this Category 4 airport took place over a three-year period and was funded by the KZN Provincial Treasury. One of the major elements in this project was the rehabilitation of the airport's runway.

THE EXISTING RUNWAY

The existing runway was built more than 20 years ago and is 1 780 m long and 30 m wide. For approximately ten years the runway had undergone continuous and costly maintenance, using crack sealing and major patch repairs. It was eventually decided, as part of the upgrade, to consider resurfacing the runway.

In August 2009 the runway pavement was assessed using visual assessment, Dynamic Cone Penetrometer (DCP) survey and a Falling Weight Deflectometer (FWD) analysis. The runway presented structural weaknesses in the landing zone, probably due to the infiltration of water in the base course, caused by serious cracking on the existing asphalt layer. Continued loads along the centre line of the runway affected the cross falls on the runway and created further problems of water ponding on the surface. This was compounded by a blocked 900 mm diameter pipe culvert which carried stormwater under the runway. The ponding water posed a safety hazard for aeroplanes on take-off and landing.

The main problem was related to the ageing asphalt surface layer which no longer correctly functioned as an impermeable layer, due to extensive longitudinal and transverse crocodile cracking. Water was therefore seeping into the underlying layers causing major failures to the base course layers.

REHABILITATION

A two-stage rehabilitation process was proposed. The first stage commenced on 1 November 2010 and entailed crack sealing and extensive patching and base repairs. The second stage commenced on 16 February 2011 and comprised a rehabilitation exercise using fibreglass geogrids of 100 kN x 100 kN strength, overlaid by 50 mm of asphalt wearing course, followed by a 20 mm ultrathin latex modified (ULM) layer.

The design of the works was undertaken by Pietermaritzburg-based Brava Engineers, with design support from Maccaferri Southern Africa and their MacGrid AR grids. All work was undertaken at night, as the airport had to continue operating during the day.

Approximately 9 000 m of crack sealing was undertaken, and approximately 300 tonnes of bitumen-treated black-base course were used to correct the cross falls on the pavement. The repair work was followed by a tack coat upon which the 66 000 m² of 100 kN x 100 kN fibreglass grids were laid. The cold night temperatures prevented the adhesive from the fibreglass grid to become activated, resulting in the grid lifting up during placement. A 15 mm asphalt blinding layer was therefore placed over the glass grid immediately after placement to prevent movement and to activate the glue admixture, thereby allowing it to adhere to the existing surface. A 50 mm asphalt layer was thereafter placed at a cross fall of between 0.5% and 1%. The asphalt was topped with a 20 mm latex-modified ultra-thin surface which met the design requirements for friction and skid resistance.

The runway markings were painted with reflective paint containing glass beads to enhance visibility in all weather conditions. The drainage on either side of the runway was improved by constructing a system of open drains and gabion structures, and by clearing the blocked pipe culvert to allow stormwater to flow from one side of the runway to the other.

A NEW SOLUTION IN ASPHALT OVERLAY

As far as could be ascertained, the runway at the Pietermaritzburg Airport is probably the first runway in South Africa where this type of overlay solution has been adopted, i.e. the use of a geosynthetic asphalt reinforcement layer inserted in the pavement layer to increase the structural performance of the runway. Geosynthetics for reinforced asphalt must possess the following properties to comply with the requirement of a runway:

- High-tensile strength and tensile modulus, in order to provide consistent tensile forces with minimum elongation.
- Very low viscous elongation (creep), to resist the formation of incremental plastic deformation of asphalt over a long time.
- Capacity of lateral confinement of aggregates for limiting the lateral deformations, hence open-grid structure and not plain solid surface.
- High flexibility and drape-ability, in order to lie flat on the asphalt surface without generating waves and without creating voids; sheets must lie flat on the supporting layer, without requiring nailing or pre-tensioning. Moreover, sheets must not be resilient, in order to avoid the spring effect, which would produce undesirable stresses in the asphalt.
- Resistance to high temperatures so as to avoid the formation of waving and shrinkage, which would produce further cracks in the asphalt.
- Capacity to keep the bond between the upper and lower asphalt layers, granted by the tack coat, without creating a separation between the two layers.

Placement of glassgrid had to be done at night

CONSTRUCTION

The rehabilitation works were undertaken by Pietermaritzburg-based Elco Asphalters. The work commenced in November 2010 and was completed in June 2011. The fact that the airport could not be closed during the construction period posed a major challenge to the construction team.

Work on the runway therefore had to be undertaken at night. A stretch of runway 100 m x 30 m was resurfaced daily, including the placement of the MacGrid. The newly laid surface was feathered down to the old level over a distance of 2 m to allow a smooth transitional surface for landing aircraft. The 2 m section was then milled to the original level before continuing the pavement placement on the following day. The runway was thereafter thoroughly cleaned to remove loose stones which could be picked up by aircraft and could affect their engines. The ultra-thin layer followed in similar fashion.

CONCLUSION

The rehabilitated surface has undoubtedly resulted in a vast improvement to the runway – the new surface has fewer bumps and therefore a much smoother riding surface, resulting in less stress to the aircraft. The reflective beads, which had been incorporated into the painted markings, have markedly improved visibility, even in misty conditions.

The new Pietermaritzburg Airport is indeed putting the town back on the map. The total number of passengers increased from 59 000 in 2010 to 96 000 in 2011, and the 2012 passenger numbers are projected to exceed 100 000. □

Runway after placement of MacGrid

Source:
http://www.saice.org.za/downloads/monthly_publications/2012/2012-Civil_Engineering-December.pdf