Making the Connection Between Low Budgets and Pavement Maintenance Needs for Small Regional Airports In Southern Africa

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The Wright Stuff

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## Recent work on major airports by KUBU as specialists

<table>
<thead>
<tr>
<th>Airports</th>
<th>Involvement</th>
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<tbody>
<tr>
<td>Bloemfontein</td>
<td>Runway rehab and mothballing 2nd runway</td>
</tr>
<tr>
<td>Waterkloof</td>
<td>Reconstruct/Rehab dolomitic problems</td>
</tr>
<tr>
<td>Cape Town</td>
<td>New taxiways and apron</td>
</tr>
<tr>
<td>ORTIA</td>
<td>RET, holding area, rehab on main runway</td>
</tr>
<tr>
<td>Jebel Ali</td>
<td>New runway design and construction</td>
</tr>
<tr>
<td>Macau</td>
<td>ICAO compliance, 2nd runway planning, rehab existing runway, new apron</td>
</tr>
<tr>
<td>Broome</td>
<td>Terminal upgrade and re-modelling &amp; MP</td>
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<tr>
<td>Walvisbay</td>
<td>ICAO compliance and design alternatives for salt problems</td>
</tr>
<tr>
<td>Hosea Kutako</td>
<td>Runway asphalt durability investigation and rehabilitation</td>
</tr>
<tr>
<td>Perth</td>
<td>Runway rehabilitation</td>
</tr>
<tr>
<td>Sydney</td>
<td>Asphalt overlay/ Rapid construction trials</td>
</tr>
</tbody>
</table>
Regional airports in the western part of southern Africa
The 5 regional NAC airports
### Suitability vs Condition Matrix (Abbott and Mc Duling, 2000)

<table>
<thead>
<tr>
<th>MAINTAIN</th>
<th>Upgrade</th>
<th>Dispose</th>
<th>CONDITION</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
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<tr>
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<td>As new</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Marginal repairs</td>
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<td></td>
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<td>Serious repairs</td>
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<td>Critical repairs</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Condemn/Replace</td>
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<table>
<thead>
<tr>
<th>Condition</th>
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<tbody>
<tr>
<td>5</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
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</table>

<table>
<thead>
<tr>
<th>Ideal</th>
<th>Acceptable</th>
<th>Tolerable</th>
<th>Hardly Tolerable</th>
<th>Intolerable</th>
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</table>

**Principles involved in Building Management Systems**
Most of these airports suffer from maintenance backlogs. Their functionality must be restored via “mothballing” of superfluous facilities and minimum prioritised emergency repairs and maintenance.

Plug the bottom holes!
Maintenance and mothballing plan for Upington Airport
Reduced capacity meeting user demands
• These airports has significant regional economic and strategic value
• These “loss leader” airports are clearly in need of regular routine and periodic maintenance.
• No chance that any of these airports will generate sufficient funds to be commercially viable or to self fund required maintenance needs.
## Position, elevation and ICAO classification

<table>
<thead>
<tr>
<th>Airport</th>
<th>ICAO Classification</th>
<th>Elevation (m above sea)</th>
<th>Position Coordinates</th>
<th>Main runway</th>
<th>Secondary runway</th>
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</thead>
<tbody>
<tr>
<td>Lüderitz</td>
<td>3 Non instrument landing. New lighting currently installed.</td>
<td>139</td>
<td>26° 41’ 07” S 15° 14’ 44” E</td>
<td>04/22</td>
<td>12/30</td>
</tr>
<tr>
<td>Keetmanshoop</td>
<td>4. Non-instrument landing with only daylight approach</td>
<td>1069</td>
<td>26° 32’ 20” S 18° 06’ 42” E</td>
<td>04/22</td>
<td>18/36</td>
</tr>
<tr>
<td>Rundu</td>
<td>3c. Non instrument landing with only daylight approach</td>
<td>1105</td>
<td>17° 57’ 22” S 19° 43’ 14” E</td>
<td>08/26</td>
<td>Closed</td>
</tr>
<tr>
<td>Ondangwa</td>
<td>3c. Non instrument landing with only daylight approach</td>
<td>1097</td>
<td>17° 52’ 38” S 15° 57’ 00” E</td>
<td>08/26</td>
<td>Closed</td>
</tr>
<tr>
<td>Katima Mulilo</td>
<td>3. Non instrument landing with only daylight approach</td>
<td>958.2</td>
<td>17° 38’ 03” S 24° 10’ 36” E</td>
<td>09/27</td>
<td>None</td>
</tr>
</tbody>
</table>
The “Island style” airport needed
Main runway,
short taxiway link
2nd runway optional
LA 10: Sand deposit in “wind shade” of hanger on back taxiway.

LA 13: Small bush and shrubs on runway edge causing minor sand deposits due to “wind shadow”. These shrubs are to be removed.
LA 5: Localised construction joint at main runway 04 end in need of repair via crack filling.
LA 7: Joint opening up due to movement of slab on passenger apron.
<table>
<thead>
<tr>
<th>Airport</th>
<th>Condition rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lüderitz</td>
<td>Sound</td>
</tr>
</tbody>
</table>

**Moth Balling Options**

None possible or needed. Optimum for 3C class

**Proposed maintenance actions**

Minor patch and crack repairs. Plus routine maintenance needed
Katima Mulilo
KMA : Potholes in front of passenger terminal
KMA 3: Cracked and potholed area at refuelling apron next to small concrete apron area in foreground.
KMA 8: Shoulder at the 27 end showing ant activity, vegetation intrusion, longitudinal cracking on the shoulder and extreme map cracking on the paved area. Faint and fading line marking are also shown.
KMA 11: extent of ant activity on paved shoulder area.

KMA 14: Large anthill on 27 end with ant activity on left.
KMA 15: Current taxiway link with previous rejuvenation showing extensive potholing, cracking and aging. Suggested shorter taxi strive line (red dotted left) to cut out areas in need of rehabilitation as it will traverse over relatively sound areas.
Apron and taxiway area sketch of Katima Mulilo airport

- Refuelling installation
- Small hangar
- Refuelling apron area
- Small concrete apron area
- Alternative refuelling area
- New access road
- Passenger terminal
- Taxiway
- Alternative refuelling area
- Proposed taxi strive line

*Taxiway*
<table>
<thead>
<tr>
<th>Airport</th>
<th>Condition rating</th>
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<tbody>
<tr>
<td>Katima Mulilo</td>
<td>Severe</td>
</tr>
</tbody>
</table>

**Moth Balling Options**

- Close taxiways, reduce apron area.
- Close portion of 09 runway with a turning circle at approximately 2000m.
- Displace threshold accordingly.
- Change position of refuelling apron or repair.

**Proposed maintenance actions**

- Crack seal runway and limited resultant shortened taxiway lane and apron followed with rejuvenator spray.
- Back track on runway.
- Follow up with new bitumen rubber seal within 5 years.
RA 1: Apron area in front of terminal building and hangar. Evidence of ponding seen in the foreground. Area under tree to the right was flooded during the subsequent rain storm.
RA 3: Intrusion and break up of shoulder asphalt area due to vegetation and high grass on shoulder blocking side drainage.
RA 12: Potholes and loose gravel extent plus extreme cracking on refuelling apron area directly after rain storm.

RA 4: Badly distressed area in front of refuelling area. Area has loose stones and potholes everywhere and is a FOD hazard. Mobile fuel pump in right hand side.
RA 6: Set-out of closure marking on secondary runway end. Discarded paved parking area is seen on the left hand side.
Figure RA 7: Sheet flow over main runway at RET and secondary runway intersection.

RA 10: RET on 26 end showing some ponding and longitudinal cracks in the foreground on the main runway
RA 8: Extent of step at 26 end due to erosion as well as vegetation

RA 9: Height of uncut grass on the shoulder edge.
Layout sketch of Rundu airport apron and taxiway facilities

- Intersection with 2nd runway
- REF used to taxi
- Taxi strive line
- Refuelling apron
- Proposed refuelling apron
- Current refuelling installation
- Freight Hanger
- Proposed alternative fuel installation
- Passenger Terminal

Freight
Hanger
Rundu airport layout sketch plan

- Proposed mothballed areas
- Proposed rejuvenated and operational areas
- Main runway
- Apron area
- Mothballed RET
- Retained RET
- Proposed fillet for turning circle
- Closed 2\textsuperscript{nd} runway

\textbf{Directions:}

- North (N)

\textbf{Runways:}

- Main runway
- 2\textsuperscript{nd} runway

\textbf{Areas:}

- Apron area
- Proposed areas
- Retained areas

\textbf{Other Markings:}

- Proposed fillet for turning circle
- Retained RET
Moth Balling Options

• Close 2\textsuperscript{nd} runway.
• Mothball most of taxiway.
• Use RET on 08 end as runway displaced end for runway length result of 2220m.
• Do fillet infill to provide turning circle.
• Change position of refuelling apron or repair.

Proposed maintenance actions

• Crack seal runway and limited resultant shortened taxiway lane and apron followed with rejuvenator spray.
• Back track on runway.
• Follow up with new bitumen rubber seal on runway within 5 years.

<table>
<thead>
<tr>
<th>Airport</th>
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</thead>
<tbody>
<tr>
<td>Rundu</td>
<td>Warning to severe</td>
</tr>
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</table>
Ondangwa Airport
OA 2: Extent of ponding in front of modular refuelling units on area B. Extent of aging, ravelling and cracking in the foreground.
OA 3: Aircraft parked in front of modular refuelling units in water pond. Passengers disembarking and walking towards passenger terminal directly ahead. Shallow trench dug in left corner managed to drain the ponding.
OA 12: DCP sounding to be done in bird baths one day after the rain at intersection with secondary runway. In back ground set-out of closure cross on secondary runway in progress. Observe extent of crack sealing.
OA 14: Loose geo-fabric at 2007 crack sealing on shoulder. Extent of previous crack sealing and aged surface can also be seen.
OA 22: Badly potholed and ravelling area A linking newly constructed refuel apron with area in front of large hangers. V type drain functioning in foreground.
Ondangwa apron area layout sketch

- Area A: 41mx 121m
- Area B (new): 41mx107m
- Area C: 41mx 130m
- Area D: 90m x 40m
- Area E: 45m X 121m
- Area F: 45m X 107
- Area G: 45m X 130m
- Area H: 60m x 60m
- Area I: 30m x 330m
- Area J: Old concrete apron 30m x 270m
- Area K: 150m x 40m
- Area L: 70m x 150m
- Area M: 30m x 330m

Taxiway
Sketch plan layout of Ondangwa airport

- Closed and discarded 2\textsuperscript{nd} runway
- Maintained areas
- Mothballed areas
- Discarded parking area
- Area where large bird baths occur
- Apron areas

*Sketch plan layout of Ondangwa airport*
Moth Balling Options

- Close 2\textsuperscript{nd} runway.
- Mothball most of taxiway.
- Use last taxiway link on 26 end as runway displaced threshold position for runway length result of 2270m.
- Change position of modular refuelling apron.

Proposed maintenance actions

- Limited crack seal runway, taxiway lane and apron
- Urgently follow up with new bitumen rubber seal on runway.
- Rejuvenator spray on reduced taxiway lanes and apron areas.
KA 3: Longitudinal cracking and localised repair on shoulder.

KA 6: Longitudinal cracking with vegetation in old construction joint on shoulder of main runway.
KA 11: Localised pothole on secondary taxiway.

Moth Balling Options

Reduce runway width from 45m to 30m with paved shoulders. Mothball large holding areas at thresholds on taxiway.

Proposed maintenance actions

Crack filling of longitudinal cracks, minor patching and rejuvenation in medium term.
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<td>Severe</td>
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## Summary budget requirement for five airports

<table>
<thead>
<tr>
<th>Term</th>
<th>Amount (N$)</th>
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<tbody>
<tr>
<td>Short (1 to 2 years)</td>
<td>5 054 408</td>
</tr>
<tr>
<td>Medium (2 to 5 years)</td>
<td>3 526 950</td>
</tr>
<tr>
<td>Long (5 to 10 years)</td>
<td>10 346 100</td>
</tr>
<tr>
<td>Total over ten years</td>
<td>18 927 458</td>
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</tbody>
</table>
Maintenance expenditure spread over 10 years

N$
NAC maintenance costs scenarios
• Regional economic and strategic value prevent discarding or closure.

• These airports are “loss leaders” Not commercially viable

• These “loss leader” airports will be in need of subsidy from the other larger NAC profitable airports.

• Grant from Government?