ADDRESSING MAINTENANCE BACKLOGS FOR COMMERCIAL REGIONAL AIRPORTS IN SOUTHERN AFRICA

E Horak*, H Range*, J de Vos and E Barnes*****

*Ndodana Consulting Engineers (Pty) Ltd, Centurion, South Africa
** Namibia Airports Company, Windhoek, Namibia
*** Airports Company of South Africa, Upington, South Africa

ABSTRACT

Smaller regional airports in Southern Africa often have superfluous airside infrastructure and capacity. These airports are often included in the commercialised suite of airports due to their regional and national strategic importance. These airports also have associated regional developmental and economic importance. However, these airports normally have low passenger and aircraft movements. The latter is often smaller aircraft with runway lengths far in excess of the aircraft type needed with additional taxiways and apron areas provided for the aforementioned military functions in a gone-by era. The result is that such smaller airports often have to operate as "loss leaders". Recent involvement in the preventative and innovative maintenance interventions at a number of this type and size of airport in South Africa, under the management of the Airports Company of South Africa (ACSA), created opportunity to transfer such knowledge to similar airports under the auspices of Namibia Airports Company (NAC). The obvious backlog of maintenance and rehabilitation needs of these airports in Namibia offered the opportunity to determine the actual level of service needed for such airports linked to actual aircraft movements and their projected trends. Innovative solutions developed in SA involved discarding and mothballing of superfluous ex-military facilities. An analysis on the budget provisions regarding the current facilities compared to the reality driven down-sized facilities were also done in order to provide indicators for the associated budget provision for such sustainable facilities. Throughout the ACSA airports were used as benchmark for measures of commercial success and asset preservation and utilisation.

INTRODUCTION

A number of regional aerodromes in Namibia have military origins. These regional aerodromes have significant intrinsic asset value as well as regional, national, strategic and economic developmental value. The peace dividend after initial military activity often manifests in such ex-military aerodromes being handed over to civilian use and management. These aerodromes are currently managed by Namibian Airports Company (NAC) on a commercial basis. In some cases these aerodromes still have duel civil and military use while in most cases they have been fully commercialised as part of privatization and commercialization initiatives of government. The commercialisation of aerodromes by government organisations often has an emphasis on regional and national economic development goals. It often results in a suite of aerodromes with a mixture of commercial prospects which were tendered or negotiated for by airports operators and awarded on a concession basis. The end result is that such commercialised airport operator, NAC in this case, often land up with a number of aerodromes which are classified in commercial terms as "loss leaders" or "dogs" in their allocated suite of concession airports. That means that their suite of airports do have a few with real commercial potential which must act as their "cash cows". These "cash cows" invariably land up subsidising the loss leaders in their total suite of commercialised aerodromes. That implies that priority tends to be given to invest in and maintain the infrastructure of "cash cow" aerodromes initially after the concession is grated. It inevitably leads to delay or deferment of budget allocations within restricted budgets for the maintenance and investment in the "loss leader" aerodromes.

The total landside and airside infrastructure required or provided for during periods of military activity are often unbalanced in terms of the actual needs of commercial or civilian use. These regional airports often have low aircraft movements and associated low passenger volumes. This often leaves the commercial operator not only with the burden to subsidise such "loss leader"

aerodromes within their suite of concession airports, but they are additionally burdened with the oversupply of unusable airside facilities as well as inadequate landside infrastructure facilities.

The landside facilities are often not designed for any people friendliness or civilian use as the focus of the military was much more on military operational and tactical activities. Such ex-military airports typically have a number of hangers, but no terminal building or any facility which can be readily converted to a people friendly environment needed for a civilian aviation activity. Parking and ablution facilities are also mostly absent. Civilian airports also have more stringent requirements for proper commercial operations such as fire and rescue, passport control, customs and excise, landside parking, safety and security, etc. It quickly becomes clear that the overhead costs associated with such ex- military airports can burgeon to unacceptable levels with no medium to long term prospects of reaching break-even point, let alone being a commercial success.

The airside facilities are often bigger and larger in area and number of facilities than required for civilian and commercial use due to smaller civilian aircraft being used, lower aircraft movements and lower passenger volumes. These ex-military aerodromes are also often handed over in a less than mint condition and therefore can place a significant drain on maintenance budget provisions from the start. These regional aerodromes generally have maintenance budget allocations based on formulas which use annual aircraft movements or annual passenger movements as input. That inevitably leaves an operational budget with a maintenance provision significantly lower than the actual requirement for the airside infrastructure for preservation, let alone any improvement.

It often happens that these airports show significant deterioration in their airside infrastructure due to a lack of maintenance provision. It is also known that airside facilities on aerodromes suffer more deterioration from environmental exposure than merely being expended due to trafficking of aircraft. In the case of significant reduction in aircraft movement authorities are often falsely lured to think less maintenance would be required as would be the case with a road pavement. The acceleration of the actual deterioration of airside infrastructure therefore tends to creep downwards unseen to the level where it is in accelerated deterioration decline.

A number of aerodromes in South Africa are managed under the auspices of the Airports Company of South Africa (ACSA) which are also ex-military regional aerodromes. ACSA took a proactive and preventative maintenance approach with regard to such smaller ex-military aerodromes. Recent maintenance interventions coupled with innovative technical and commercial solutions have enabled these ACSA airports to be more commercially viable. When a number of these Namibian small regional aerodromes developed obvious maintenance backlog problems the lessons learnt from the innovative technical and commercial solutions from ACSA could be transferred to these NAC aerodromes. It was learnt that the superfluous provision of particularly the airside facilities can cause a burden on the operations of such smaller aerodromes. Some of these NAC aerodromes were either recently investigated for special maintenance solutions or had to receive special maintenance and rehabilitation treatments. The innovative approaches followed in solving these backlogs of airside maintenance needs and right sizing some of these Namibian airports for fit for purpose use are discussed and illustrated. In a number of cases the ACSA aerodromes are used in a comparative manner to illustrate what could or should be done.

DESCRIPTION OF THE REGIONAL AIRPORTS

NAC has eight airports under its operational control in their suite of commercially operated airports in Namibia. Of these eight airports the five smaller regional airports are clear loss leaders. All five of these loss leader airports were recently investigated to quantify maintenance needs of the airside facilities, quantify the associated maintenance backlog and to provide innovative ways and means to execute special maintenance on these aerodrome airside facilities. Recent involvement in special maintenance and rehabilitation projects on three ACSA airports preceded this NAC involvement and proved to be a useful learning ground for such innovative solutions. All these smaller regional airports as well as one from the Gateway Airports Authority Limited (GAAL) are listed in Table 1 to follow, with an indication of military linkage in origin or their current operation. An initial indication of the airside infrastructure size description is also given with a brief current

operational “fit for Purpose” description. Not all of these airports have military origins, but those that have, invariably also tend to have superfluous airside infrastructure.

Table 1: Description of NAC, ACSA and GAAL regional airports.

Operator	Airport name	Military linkage	Commercial classification	Airside infrastructure “fit for purpose” comment
NAC	Katima Mulilo	Originally, none presently	Loss leader	Significant superfluous facilities
	Rundu	Originally, none presently	Loss leader	Significant superfluous facilities
	Ondangwa	Originally, none presently	Loss leader	Significant superfluous facilities
	Keetmanshoop	Previously identified as diversion airport for wide body aircraft which included military use	Loss leader	Superfluous facilities
	Luderitz	None	Loss leader	“fit for Purpose”
ACSA	Upington	Originally, none presently	Currently a loss leader	Significant superfluous facilities
	Kimberley	Originally, none presently	Break even reached in 2007	Limited superfluous and mostly “fit for Purpose”
	Bloemfontein	Originally, dual use at present	Commercially successful.	“fit for Purpose”
GAAL	Polokwane International	None	Loss leader	Superfluous facilities

The aircraft movements of Bloemfontein, Kimberley and Upington airports under ACSA control and an independent airport, Polokwane International Airport (PIA) are shown in Figure 1 and 2 to follow, for comparative purposes with the NAC ATM figures of the five regional airports. Figure 1 and 2 clearly shows that even with Upington airport having the lowest ATMs and passenger figures in the ACSA suite of airports (and close to the PIA figures), Upington ATMs and passenger figures are still significantly higher than the best of the NAC regional loss leader airports.

It is clear that the longer term trend, for the NAC aerodromes, is showing no growth and is rather showing a declining trend in general. However, the Upington airport and PIA ATMs and passenger figures do show an upward trend. This may be due to a number of initiatives regarding special maintenance as well as innovative measures to attract air traffic and sound commercial initiatives to attract aviation related business both on the landside as the airside.

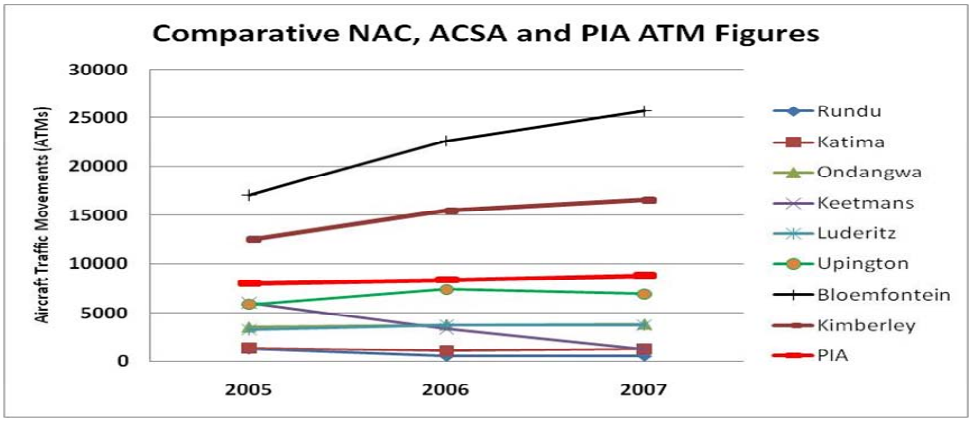


Figure 1: Total aircraft movements of loss leader airports (ACSA, 2008 and Booysens, 2008 and Gateway, 2008).

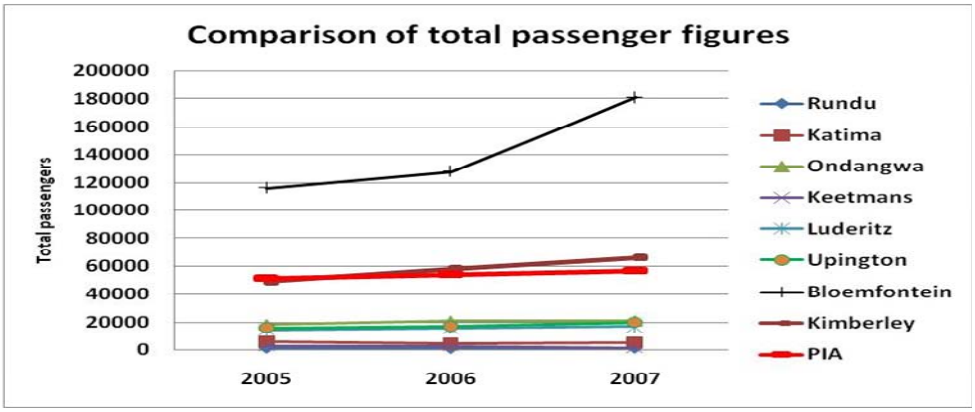


Figure 2: Passenger movement trends of loss leader small airports (ACSA, 2008 and Booysens, 2008 and Gateway, 2008).

Kimberley airport, which have recently also reached break-even point managed to do so with good business procedures to increase the landside income stream, via actions like parking rental, advertising rental, rental cars and other restaurant and commercial space rental. This is over and above good discipline regarding landing fees and exploring other landside income streams. Upington airport is currently developing large areas of landside land to function as aircraft graveyards or aircraft "mothballing" areas which is another innovative income stream for a niche market for aerodromes in arid regions.

Commercial success or viability can also be expressed in terms of income generated per passenger. In Figure 4 the income per passenger for the five NAC loss leader airports are shown. Rundu airport is one of the few with limited airfreight movement and the income generated by the airfreight and this income is higher than that from passenger movements.

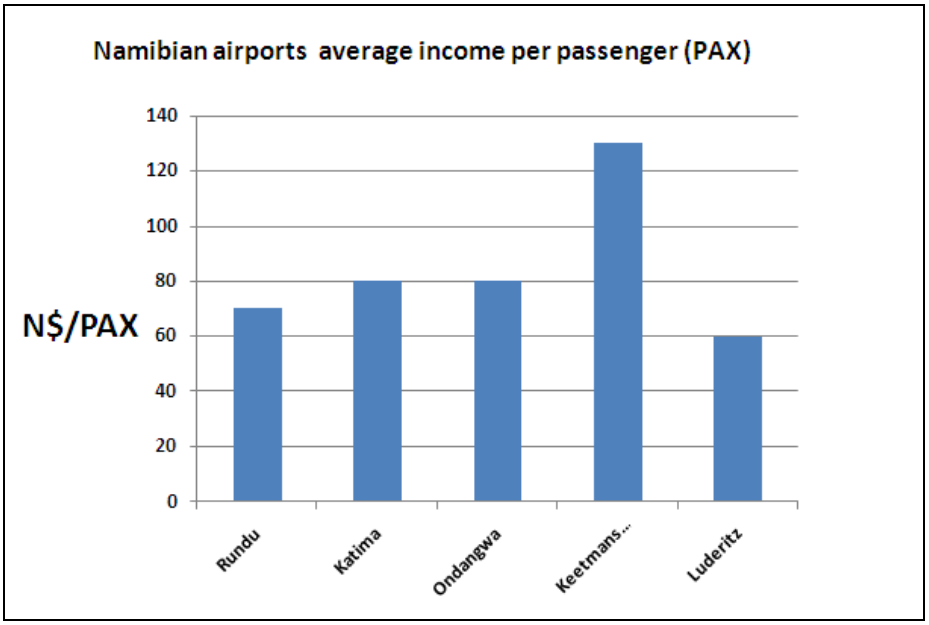


Figure 3: Income per passenger for the five NAC loss leader airports (Booysens, 2008).

INVENTORY AND CONDITION ASSESSMENT OF AIRPORTS

The basic inventory description of the five NAC regional airports and for comparison, three ACSA airports and one GAAL, are summarised in Table 2 to follow. The basic dimensions of the runway and taxiways, as well as an indication of the over supply of paved areas of the apron and additional taxiway links are described. The International Civil Aviation Organisation (ICAO, 2004) classification of the airports is shown as based on the basic dimensions of particularly the main paved runway length and width. All the NAC airports, except Keetmanshoop, classify as a Class 3 Aerodrome. Keetmanshoop classified as a Class 4 Aerodrome. Class 3 Aerodromes specify a

reference length of at least 1200 m runway length and up to, but not including, 1800 m (temperature and height above sea level will influence the actual length of runway required). These aerodromes also have widths of 30 m runway, while Keetmanshoop has a 45 m runway width.

The superfluous areas of aprons, taxiways, taxiway links and holding areas of most of these aerodromes are identified in Table 2. It is clear that the ex-military aerodromes have significant superfluous capacity in terms of large aprons, extra taxiways and taxiway links. If the excess lengths of all the main runways of these aerodromes, except Lüderitz airport, are added it clearly indicates that excessive but under utilised airside capacity is available on these aerodromes.

Table 2: Inventory description of NAC and ACSA smaller regional airports (ACSA, 2008 and Booysens, 2008).

Operator	Airport	ICAO Classification	Main runway dimensions	Secondary runway description	Taxiway description	Apron description
NAC	**Lüderitz**	3 Non-instrument. Lighting currently installed	1830 x 30m asphalt surfaced	1193 x 30m gravel	Short link and backtracking on main runway.	Small and virtually perfect "fit for Purpose".
	Keetmans-hoop	4 Non-instrument landing daylight only	2316 x 45m Asphalt surfaced	1434 x 30m Gravel	Main runway 25m wide. Widened holding areas before threshold areas on both threshold areas.	Larger than needed with large threshold holding areas.
	Rundu	3 C Non-instrument landing daylight only	3354 x 30m Asphalt surfaced	1193 x 30m gravel (now closed)	Full length of main runway 25m wide. Concrete threshold areas and three rapid exit taxiway links.	Superfluous with two additional asphalt holding areas linked to the runways.
	Ondangwa	3 C Non-instrument landing daylight only	2987 x 30m Asphalt surfaced	1434 x 30m gravel (now closed)	Full length of main runway 25m wide. Concrete threshold areas and four intermediate taxi-way links.	Superfluous with a mixture of concrete and asphalt holding areas and apron areas. Plus three additional standoff paved aprons.
	Katima Mulilo	3 Non-instrument landing daylight only	2292 x 30m Asphalt surfaced	None	Full length of main runway 25m wide. Concrete threshold areas and two intermediate taxi-way links.	Superfluous with holding areas and third taxiway incorporated in large apron area.
ACSA	**Upington**	3 C, Non-instrument landing, daylight and night, PAPI, VOR & VDF	4900 x 60m Asphalt surfaced	2400 x 45m Asphalt surfaced (recom - missioned) Also tertiary runway: 834 x 30m (currently displaced threshold)	Taxiways 30m wide, with loops at asphalt threshold areas and five intermediate taxi-way links.	Has cargo apron (concrete) and passenger apron (jointed concrete) "fit for Purpose".
	Kimberly	3 C Non-instrument landing daylight only, PAPI	3000 x 46m Asphalt surfaced	2439 x 46m Asphalt surfaced	Main runway 33m wide. Concrete threshold areas with two taxi-way links to apron.	Has passenger apron (concrete), "fit for Purpose".
	Bloem - fontein	4 C Non-instrument landing daylight and night, PAPI, VOR & VDF	2559 x 60m Asphalt surfaced	2195 x 46m Asphalt surfaced	Main runway 23m wide. Concrete threshold areas with asphalt overlays and six intermediate taxi-way links.	Has passenger apron (concrete), "fit for Purpose".
GAAL	**Polokwane Internat-ional**	3 C Non-instrument landing daylight only, PAPI	2560 x 45m Asphalt surfaced	2320 x 45m Asphalt surfaced	Taxiways 23m wide, concrete threshold areas and four intermediate taxi-way links.	Has passenger apron (concrete), "fit for Purpose".

A survey of the aircraft sizes regularly using these NAC airports is shown in Table 3 to follow. It indicates that all of these regional airports can in effect be operated at the minimum classification of a Class 3 aerodrome. In Table 3 the Pavement Classification Number (PCN) for each airport are shown. This is an empirical measure which is often used to indicate structural capacity to carry aircraft. All aircraft have Aircraft Classification Numbers (ACNs) which are compared with the PCNs of the specific airport. The PCN should preferably be higher than the regular or design aircraft ACN. In Table 3 a few aircraft and their ACN values for a medium subgrade condition are shown to compare with the PCN determined. In the last column an indication of the heaviest aircraft that can possibly visit the various airports are shown.

Table 3: Pavement Classification Number (PCN) determination.

Airport	PCN for the best case subgrade condition	Current maximum typical aircraft visiting (with ACN value)	Comment on heaviest aircraft that can possibly visit
Katima Mulilo	21	C210 (3), C310 (4) and C402 (10) regularly. Occasional B1900D (4).	Ilyushin76 (27) can theoretically land here occasionally and the Cessna 750 (Citation X)(11) regularly
Lüderitz	24	Normally B1900D (4).	Ilyushin76 (27) can theoretically land here occasionally and the Cessna 750 (Citation X)(11) regularly
Keetmanshoop	55	Learjet (7) or Dassault Falcon (12) occasionally and C210 (3) or C310 (4) more regularly.	Theoretically B747-400 (66) can occasionally land here and a B737-400 (46) regularly.
Rundu	60	C210 (3), C310 (4), C402 (10) regularly, occasionally Ilyushin 76 (27) for freight transport.	Theoretically B747-400 (66) can occasionally land here and a B737-400 (46) regularly.
Ondangwa	63	Occasional Ilyushin76 (27) or B737 (46), but more regularly B1900D (4).	Theoretically B747-400 (66) can occasionally land here and a B737-400 (46) regularly.

If the minimum dimensions of a Class 3 aerodrome are considered as reference, with some additional length for variance in altitude, it is clear that all these aerodromes can function as a Class 3C (with more than the minimum 1800 m runway length and up to approximately 2000 m in length with a 30 m width).

Lüderitz airport is in effect an airport which is the best “fit for Purpose” airport out of the five smaller regional Namibian airports. It has a small apron area with a very short taxiway link, which allows aircraft to back track on the main runway with turning pads (circles) at the threshold areas. This is often referred to as an “island style” airport. It is possible to shorten some of the other airport runway lengths with displaced thresholds by using existing taxiway links as the new threshold area and to possibly convert such a taxiway link into a turning circle with minimum capital outlay.

CONDITION ASSESSMENT AND MAINTENANCE LEVELS

Detailed condition surveys were done on the three regional airports of ACSA in the recent past as part of appointments to either do special maintenance (Upington and Kimberley) or rehabilitation (Bloemfontein) on these aerodrome airside facilities. These maintenance and rehabilitation design involvements started in 2001 and stretched up to the present. It is the superfluous capacity of the extra length of the main runway as well as the full length of the secondary and tertiary runways at Upington airport which prompted the consideration to reduce the overall length and number of runways to match real functional requirements. This had to be done with a limited maintenance

budget which offered the opportunity to consider “mothballing” some of the runways and superfluous areas.

“Mothballing” of airside facilities is achieved by closing and discarding superfluous facilities while only the smaller remaining areas in use are maintained. In this way the functional areas needed for full operational functionality at the level of airport classification or operational need can be reduced and by means of additional special maintenance activity be kept up to the required standard. The airside facilities of Upington and Kimberley airports were in warning to severe conditions when initially surveyed in 2001. Over and above the “mothballing concept” described above their annual maintenance budget had to beefed up and spread or phased over a three to five year period in order to get them back to the required functional and operational standard. Both these aerodromes currently have runways, taxiways and apron areas which are in excellent condition while the mothballed areas are in a reasonable condition, but currently decommissioned.

This experience with Upington and Kimberley airports pointed the way for the approach needed on the five NAC regional airports. A visual survey was conducted on these airports in February 2008. The Technical Methods for Highways (TMH) 9 visual survey methodology was used whereby cracks and other surface distress are rated and recorded in terms of degree and extent. Degree of distress type (e.g. cracking, rutting, edge break, stripping, undulations and ravelling) was rated at three levels of expression as either; sound, warning or severe and extent of distress over the surveyed area is rated as one (small area) to five (occurring over the whole area). In Table 4 to follow, the overall condition of the airside facilities of these five regional NAC airports are summarised.

Table 4: Summary of conditional rating of NAC regional airports.

Airport	Overall airside facility conditional rating
Lüderitz	Sound
Keetmanshoop	Sound to warning
Katimo Mulilo	Severe
Rundu	Warning to severe
Ondangwa	Severe

It is clear that the NAC airports have suffered from maintenance neglect and in some cases (e.g. Katima Mulilo airport) this condition can be classified as severe and in need of critical repairs. Suitability of such an aerodrome airside facilities can be classified as tolerable to hardly tolerable. Questions are currently being raised as to whether some of these airports have not progressed so far down the trend of deterioration that it might have to be discarded. In Figure 4 to follow, the generic classification of an infrastructure facility in terms of condition rating versus suitability as developed for buildings are shown (McDulling et al, 2004). It can be seen that some of the NAC airports with severe condition ratings could easily come close to being classified as to be condemned or to be totally discarded. As the definition and rating in terms of suitability of these airports were not done in a structured manner, such a classification cannot yet be done. However, such luxury of discarding such a “loss leader” airport will in any case not be allowed, as the NAC’s responsibility is to maintain such aerodrome facilities for broader regional and strategic reasons. Therefore, in most cases, these NAC regional aerodromes will have to receive considerable repair and maintenance activities to prevent further deterioration and possible loss of facilities with a limited maintenance budget.

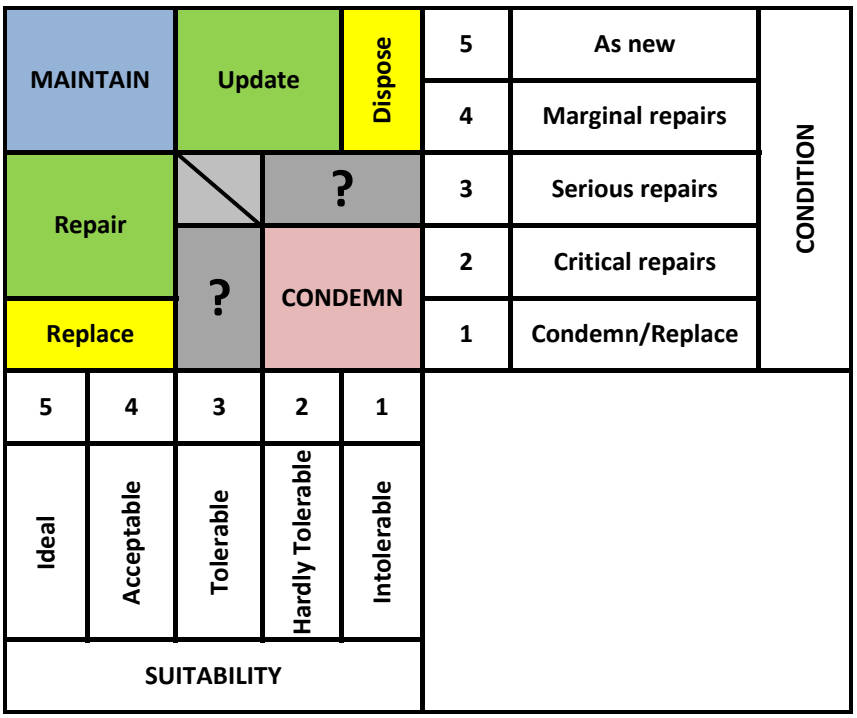


Figure 4: Suitability versus condition rating for built systems (McDulling et al, 2004).

In Figure 5 to follow, the annual budget allocation for the NAC and ACSA airports are shown in bar chart format expressed as a ratio of budget allocation to their respective Annual Traffic Movements (ATMs) (Namibian $=SA Rand for 2007).

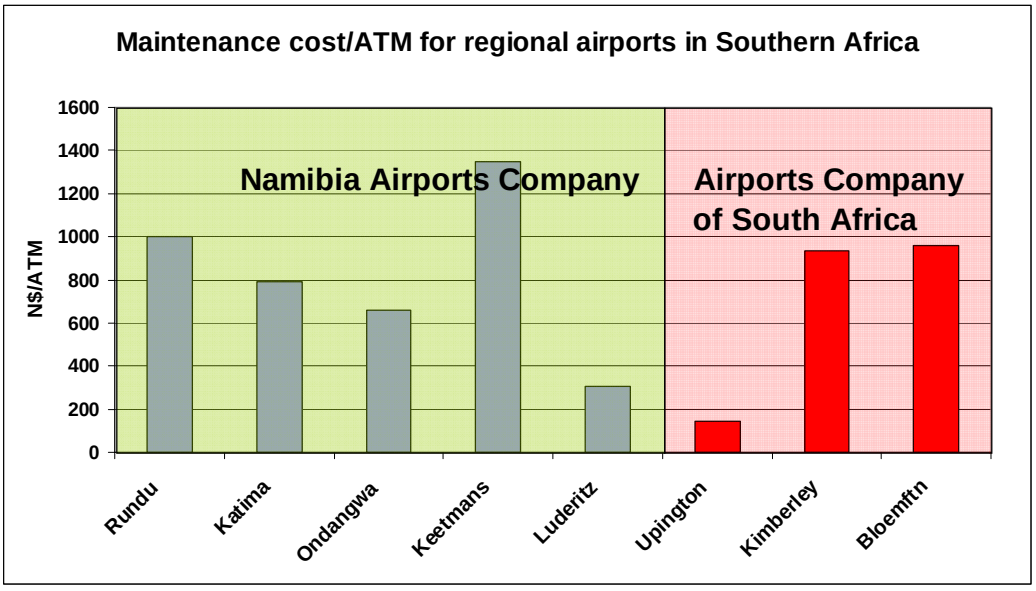


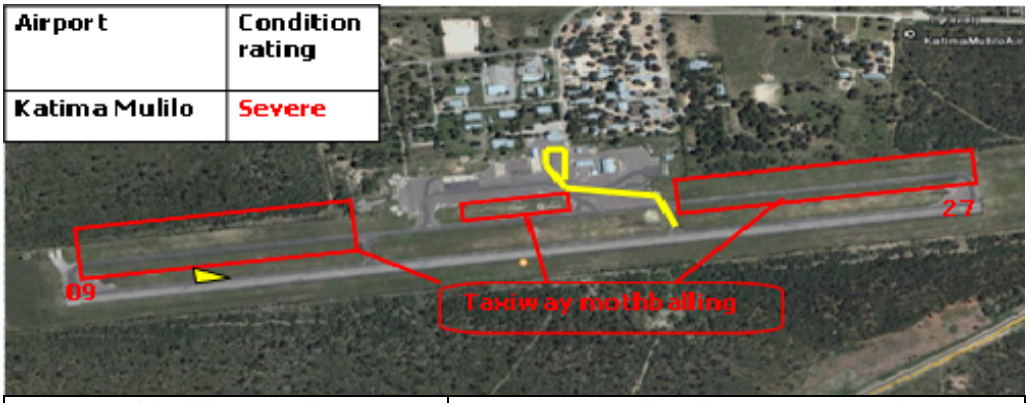
Figure 5: Comparative maintenance provision for NAC and ACSA smaller regional airports (ACSA, 2008 and Booysens, 2008).

It clearly shows that on a direct comparative basis, the ACSA aerodromes get a little more maintenance budget per ATM than the NAC budget provision per airport. However, it is significant that Upington received a relatively low maintenance budget. This may be explained in part due to the recent special maintenance which was provided and mothballing actions taken at this airport. The ratio of budget allocation levels of Kimberley and Bloemfontein should be taken as the ACSA norm for airport maintenance provision.

IMPACT OF MOTHBALLING ON NAC AIRPORTS

An ICAO Class 3C airport, such as the “fit for purpose” Lüderitz airport, was used as a minimum functional role model or standard for the rest of the five NAC airports to accurately identify redundant areas which can be mothballed. Maintenance needs to remedy the severely reduced areas for full functionality as an ICAO 3C Class airport was applied in the subsequent analysis. The approach followed was to concentrate on periodic or special maintenance and/or urgent intervention activities and not routine maintenance aspects. In general work identified did not include new construction work, but in a few cases this option had to be considered in order to make the mothballing options more logical and practical. The construction of turning circles are such possible examples to shorten runways to a more functional and manageable length.

Katima Mulilo airport can be used as an example where it was proposed to reduce the length of the main runway by the construction of a turning circle at an existing taxiway link, mothballing the vast majority of the taxiway and significantly reduce the apron area. This is illustrated in Figure 6 to follow.



Mothballing Options	Proposed Maintenance Actions
Close taxiways, reduce apron area.	Crack seal runway and limited resultant, shortened taxiway and apron followed with rejuvenator spray.
Close portion of 09 runway with a turning circle at approximately 2000m.	Back track on runway.
Displace threshold accordingly.	Follow up with new bitumen rubber seal within 5 years.
Change position of refuelling apron or repair.	

Figure 6: Illustration of mothballing and maintenance options on Katima Mulilo airport.

The current apron and taxiway area to be maintained was drastically reduced by identifying a new 15m wide strive line for taxiway by cutting diagonally across the vast apron and parking area. The refuelling station can also be moved closer to reduce the paved area to be maintained. The identified 15m wide strive line will be the only area which need the required special maintenance and the rest of the vast apron and taxiway areas are to be abandoned in any case due to the severe state of deterioration and maintenance neglect.

In Figure 7 to follow, the drastically reduced airside areas needing actual maintenance is shown in bar chart format next to the original total airside areas.

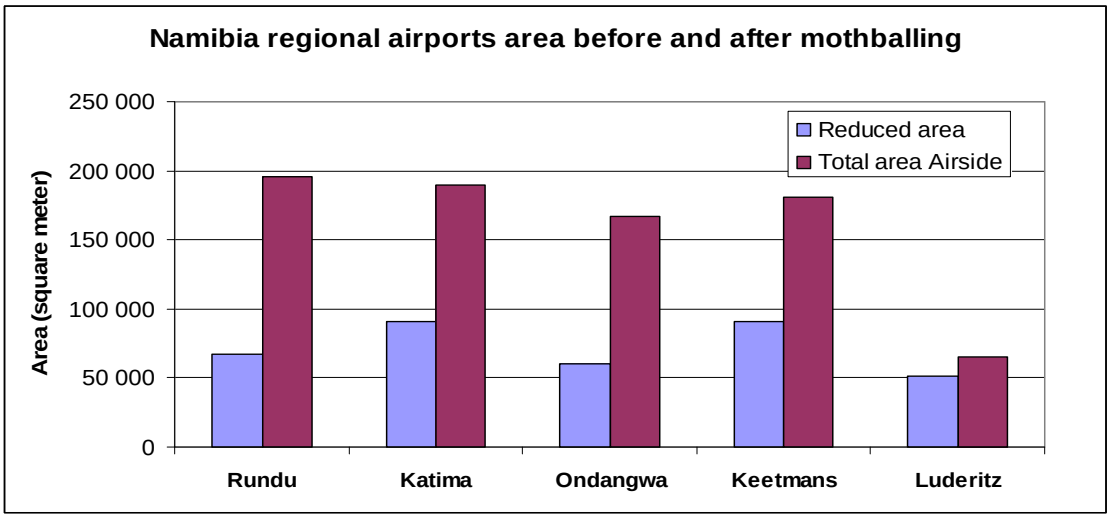


Figure 7: Reduced airside areas of NAC smaller regional airports due to mothballing action.

It is as expected that the benchmark airport (Lüderitz) showed virtually no potential for reduction, where as all the other aerodromes showed significant reductions possible with ICAO Class 3C functionality. If it is assumed that maintenance budgets on the airside will be retained at the current levels, the budgets can stretch further if expressed in Namibian dollar per square meter to be maintained. The effect of the area reduction on the same budget provision is illustrated in Figure 8 to follow. In all cases there is a significant stretch of available budget possible by means of the mothballing operations proposed.

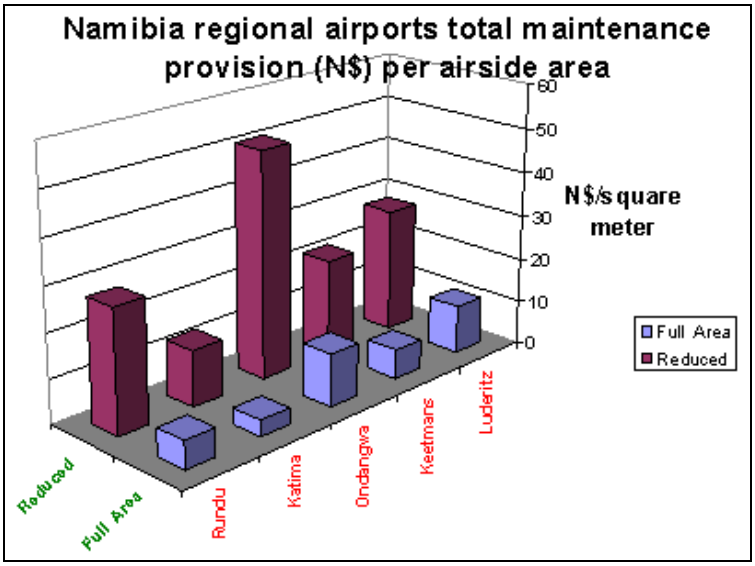


Figure 8. Illustration of maintenance budget stretch by mothballing operations.

CONCLUSIONS

There are clear similarities in the maintenance challenges that low air and passenger traffic airports face in Southern Africa. These similarities include: backlog of maintenance and rehabilitation needs; lack of funds; lack of knowledgeable persons or the relevant equipment; ex-military infrastructure; etc. These airports are often operated as “loss leaders” in the suite of airports managed by the client or operator agencies.

It was observed that ex-military aerodromes have significant superfluous capacity in terms of large aprons, extra taxiways, taxiway links and length of runways, which are not fully utilised when operated as commercialised civil aviation airports.

Most of these airports suffer from significant maintenance backlogs. The “cost of neglect” is therefore by default a significant cost imposed on these civilian airports which make it virtually impossible to maintain these commercialised airports at full operational functionality of the large infrastructure “inherited”.

In this paper it was shown that these loss leader airports can be managed more cost effectively. It can be done by reducing the needed infrastructure and to provide a focussed maintenance strategy. This is done by reducing the maintenance burden by bringing airside infrastructure in line with the operational (civilian and commercialised) needs of the airport. This action is often referred to as “mothballing” or preservation measures of airside infrastructure.

Airport class (ICAO classification) can be reduced in most cases when aircraft movement and passenger movements are analysed and projected for future growth as persisting at low levels. If such an airport is thus classified as a “loss leader” for the foreseeable future a cost cutting exercise to suit actual operational needs is needed. However, low traffic figures that justify lower airport classification or mothballing needs to be balanced with a collective understanding of the strategic, regional and national connectivity and socio economic value of such an airport.

Basic inventory information and visual inspections on the condition of facilities are keys to formulating realistic mothballing proposals to ensure a lower airport classification to be realistically operated and maintained. Such “loss leader” airports can thus be operated with a lower maintenance burden and thus ensuring lower cost in total to the whole suite of airports.

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