

**ICAO SEMINAR ON
AIRFIELD PAVEMENT
MAINTENANCE AND
SHORT COURSE ON
AIRCRAFT /PAVEMENT
INTERACTION
SANTA CRUZ DE LA
SIERRA, BOLIVIA
22 TO 27 JULY 2002**

PAVEMENT MAINTENANCE IN AFRICA

V P. PERICLES

**Coordinator Airport Development
in Haiti**

Project HAI/98/901

**Office National de l'Aviation Civile
(OFNAC)**

OVERVIEW OF AERODROME MAINTENANCE IN AFRICA

- Organization of maintenance services.
- Management of maintenance.
- Priority given to maintenance services.
- Maintenance programming /planning.
- Maintenance methodology .
- Maintenance technology.
- Maintenance practices.
- Aerodrome maintenance and safety
- Relations with and assistance from international organizations
- Personnel training.

AERODROME MAINTENANCE IN AFRICA

- Historical Background
- First workshop on this subject – Dakar, Sénégal, 8-12/03/1982
- Second workshop on this subject – Dakar, Sénégal, 8-12/02/1988.
- Third workshop on this subject – Dakar, Sénégal, 6-12/02/1992
- Fourth workshop on this subject – Dakar, Sénégal, 5-8/12/1995.

■ Participation

All African States, including States, accredited to the Cairo, Nairobi and Paris Offices were invited. Also invited, were international organizations concerned such as: IATA, ASECNA, IFALPA, AACCC (ACI) and the FAA. Total participants: 51, 66, 70 and 81, respectively, in the first, second, third and the fourth workshop. Indication of increased interest in the subject.

JUSTIFICATION FOR ADEQUATE MAINTENANCE

- Continued expansion / construction of Airports in Africa.
- Need for higher level and quality of service.
- Increased investments made at these Airports.
- Availability of best procedures, methods and equipment to ensure serviceability, safety and achievement of substantial savings.
- Accomplishment of a high degree of operating reliability to assist in the safe and efficient movement during landing, take-off and taxiing maneuvers.
- Need to ensure the establishment of effective maintenance programme

ORGANIZATION AND PROGRAMMED MAINTENANCE IN AFRICA

- At the majority of the more than 170 Aerodromes in AFI, it exists some form of maintenance organization.
- The programs observed (up to 1998) varies in scope, size and effectiveness.
- In certain cases, these programs consist of sporadic unscheduled and unrecorded inspections and evaluation of the airport facilities.
- There were also cases of well conceived comprehensive programmes with adequate planning, scheduling and well distributed responsibilities.

- New and more sophisticated equipments and maintenance tools
- Engineers had been trained and assigned to airports in the AFI Region the number is below the need. In other States, services were totally lacking, thus creating a vacuum which constituted then, permanent, serious concern for safety.

MAINTENANCE PRACTICES

GENERAL

BASIC: Maintenance of all structures had been considered vital in order to prolong their economic service life, maintain their standard of appearance and ensure their capacity to operate properly throughout their expected life span.

- African states agreed that lack of proper maintenance leads, inexorably, to problems causing undesirable expenses, even disasters.

- This common concern of states in the AFI Region is not always translated into practice.
- Some positive measures are in force today at the majority of international airports in Africa, but not with the desirable consistency and periodicity.

MAINTENANCE PRACTICES

PRACTICES MOST OFTEN OBSERVED AT AFRICAN AERODROMES

- Pavement repairs, cleaning and scaling
- Removal of foreign objects (fob) from maneuvering areas.
- Routine checks of pavement joints for repairs.
- Cleaning of drainage system.
- Repair of lighting aids.
- Repainting of deteriorated pavement markings.

- Control of vegetation growth.
- Routine repairs of airport buildings.
- Inspection and correction of defective sewage system.
- Repairs of vehicles, with priority to emergency vehicles.
- Routine checks of equipments (COM, MET, ATS ...)

MAINTENANCE PERSONNEL PROGRESS HAS BEEN ACHIEVED IN AFRICA (1998) IN THIS FIELD

- A Section or Department responsible for maintenance has been created at most aerodromes
- It comprises a senior engineer who heads a group of engineers and technicians
- The number of personnel is often related to the size and activities at the airport.
- There continues to have shortage of trained technicians, primarily in the pavement, electrical and mechanical engineering fields.

- Lately, the introduction of larger aircraft at many aerodromes in Africa and the advent of new technology (CNS, ATM), implies additional heavier burden on maintenance units. Thus, a need for more specialized equipments for maintenance and better organization.

SOLVING THE PERSONNEL PROBLEM

- Different approaches by States in training and retention of personnel.
- Trained personnel are lost to other employees due to lack of incentives and/ or competitiveness, also career prospects.
- Need to reverse current trend?
 - a) intensification of training
 - b) creation of incentives.
 - c) competitive salaries, career prospects to retain personnel.
 - d) funds derived from aviation and assistance (UNDP, bilateral arrangements) should be used to finance personnel training and recycling. Participation at this meeting is just but one example of wise investment in human resources.

PAVEMENT MAINTENANCE MANAGEMENT SYSTEM

- Importance of preventive Vs corrective maintenance.
- Periodical pavement evaluation for maintenance purpose.
- Evaluation and identification of the pavement surface distress.
- Evaluation of the hydroplaning risks of the pavement.
- Runway roughness evaluation.
- Collecting and reporting of pavement deterioration.
- Monitoring of evolution of identified deficiencies.
- Planning/programming of corrective intervention.
- Financing.

STATES USING SUCH SYSTEM (1998 DATA)

- South Africa– Integrated Airport Pavement Management Systems (IAPMS).
- ASECNA States (16) Similar to JFK, la Guardia and Newark Intl
- Ghana- Computer Assisted Management (CAM).
- Morroco/Tunisia- use a monitoring system/condition survey
- Results: Reduce frequency of large scale and costly intervention.

- Note: the IAPMS is a self contained software package designed to run on an 1986 class desktop computer.

It assists the engineer or planner to make the kinds of rational predictions of future pavement conditions and performance that are essential for accurate budget forecasting and sound management. The net effect is the preservation of infrastructure through improved pavement performance and reduced maintenance and rehabilitation cost.

MAINTENANCE PRACTICES

- Preventive maintenance
- Routine maintenance
- Major maintenance
- Landscaping
- Environment (protection)

Pavement maintenance

- General*
- Flexible pavement
- Rigid pavement
- Unpaved surfaces*

FLEXIBLE PAVEMENT

Preventive measures

- *Programming / scheduling
- .Routine evaluation
- .Technical evaluation
- .Planned intervention

Corrective measures

- .Short term
- .Long term, resurfacing (overlay)
- .Reconstruction

RIGID PAVEMENT

(Practices/observation)

- General surface texture condition
- Structural condition
- Pavement sealant and faults in joints
- Growth of plants and fungus on pavement and in joints

NON CONVENTIONAL /RECYCLED MATERIALS

- Fly Ash
- Lime cement fly ash
- Fibrous concrete
- Sulfur asphalt
- Shells
- Silica sand asphalt

UNPAVED SURFACES

Maintenance generally conducted

Under contract with nearby public or private companies including nearby farmers.

Monitoring by authorized personnel (CAA) to ensure compliance with air traffic safety.

Visual and / or mechanical inspection

Typical distress looked for:

FLEXIBLE PAVEMENT

- Cracking of the surfaces (Alligator cracks, random cracks, longitudinal cracking due to failure of underlying pavement layers.
- Surface wear.
- Loose materials (identification of their provenance)
- Subgrade failure.
- Deformation of surface
- Channelisation of traffic
- Localized failure due to overloading conditions.
- Pumping.
- Vegetation growth on the surfaces.

- Deterioration attributed to jet fuel spillage and other contaminants (oil, rubber deposits dirt or leakage from cargo containers).
- Erosion of pavement edges and shoulders
- Surface erosion caused by wind.
- Erosion due to poor drainage system.

IN SUMMARY

FINDINGS 1995

- Maintenance levels below required standards
- Expensive facilities, specially pavement, being run down fast due to lack of preventive maintenance.
- Civil aviation sector being wrongly construed to be a drain to the economy of the country.
- Civil aviation considered in some countries as a source of funds.
- Quality of services at the airports sometimes below minimum level.
- Civil aviation staff demotivated leading to loss of qualified staff (to private sector)

ALLOCATION OF FUNDS BY CAA IN AFRICA

- In general, allocation of funds for aerodrome maintenance in AFI region is reduced to a minimum.
- Survey conducted in 1995 indicates that from the fifty three (53) African States, thirty seven (37) are known to make provisions for maintenance.
- Among the States, nineteen (19) are from the Western and Central African Office.
- In most of the thirty seven (37) States, the allocation is apparently not sufficient.
- In five States, no funds are specifically reserved for maintenance works.
- The service is provided but sporadically performed at times not until the affected areas constitute a threat to safety.

PAVEMENT MAINTENANCE IN AFRICA THE FUTURE

- The problem is not how to design and build new pavement system for larger, heavier, greater frequency and magnitude of loading modern aircraft.
- The dilemma is how to upgrade and provide remedial measures for existing pavement systems to meet current and future traffic demands.
- Other dilemma, the required systematic team effort (Airport Authorities, the users and decision makers) is complex and not successfully implemented in Africa

THE FUTURE

■ WHAT IS REQUIRED?

- a) Establishment of a well organized and thought pavement maintenance plan fully supported by the CAA and government authorities (coordination)
- b) To ensure that the higher authorities do not consider civil aviation as a drain to the economy of the country.
- c) Achievement the above (b) and remembering that civil aviation development projects are not popular with the providers of the material resources.
- d) Provision of incentives to ensure that civil aviation staff are not demoralized, leading to brain drain
- Implementation of the use of appropriate new technology
- Planning ahead for the resources: financial, personnel, tools and equipments.

UNPAVED RUNWAYS IN AFRICA

- 1- Stabilized lateritic soils
- 2- Temperate soils
- 3- Grass Runways
- 4- Turf

UNPAVED SURFACES

Problems

- .Irregularities of the surface
- .Presence of foreign objects, rocks etc...
- . Pot holes
- .Mud and erosion after heavy rain
- .Vegetation growth on surfaces
- . Loss of bearing strength

Causing accidents due to

- .Loss of control of aircraft by pilots.
- .excessive tire wear.
- .Aquaplaning and loss of control over slippery surface.

- Note: The ICAO ADREP contains data giving number of accidents which occurred on unpaved surfaces.

LATERITIC SOILS

- Reddish brown silty clay and coarse to medium fine sand with trace of medium to fine gravels.
- It contains iron and aluminum oxides. These soils are subjected to heat. Characteristics which are most intriguing and may explain why lateritic soils can be found only in the tropics.
- Laterite available mainly in Central, Eastern and Southern Africa.
- Lateritic soils used as sub-base material for construction of roads and runway / taxiway pavements.

- Limited studies are available on these soils: Ghana Building and Road Research Institute, Study by Samuel A. Ola of Ahmadu Bello University, Zaria, Nigeria (A S C E Proc. Paper 10534, May 1974) and the study by G.A. Liantaud, Ingénieur en chef du Service Outre–Mer du C.E.B.T.P. France.
- It has been demonstrated that less than 50% of the cement requirement for a temperate zone soil is required for efficient stabilization of a lateritic soil. This result demonstrates the need for determining the appropriate cement requirements for lateritic soils like those presented by the PCA for temperate zone soils, (Refer to ASCE Proc.10534 by Samuel A.Ola)