PIARC

AIRFIELD PAVEMENTS

Thursday 23 October 2003 (1.30 - 5.00 p.m.)
and
Friday 24 October 2003 (8.30 - 12.00 a.m.)

SESSION AGENDA & INTRODUCTORY REPORT

22.57.E

Session Agenda

Opening

Mr. Jean-François CORTÉ (PIARC Secretary General/FRANCE)

Overview: The differences between Airfields and Roads

Mr. John COOK (Seminar Coordinator, Ministry of Defense/UK)

SESSION 1: FUNCTIONAL REQUIREMENTS

Mr. Bjarne SCHMIDT (Session 1 Chairperson, C1 Committee Chairperson/DENMARK)

1. Surface Integrity - Airfield Pavement Condition Assessment

Mr. James L. GREENE (U.S. Air Force Civil Engineering Support Agency/USA)

2. Runway Friction – IRFI/IFI and JWRFMP

Mr. Thomas J. YAGER (C1 Committee member/USA)
Mr. James C. WAMBOLD (C1 Committee member/USA)

3. Texture Measurement

Mr. Armann NORHEIM (Avinor/NORWAY)

4. Summary of Session 1

SESSION 2: AIRFIELD DESIGN, CONSTRUCTION AND EVALUATION

Mr. Sam AMOD
(Session 2 Chairperson, Development Engineering Consultants Ltd./SOUTH AFRICA)

1. Evolution of Airfield Design Philosophies

Mr. Raymond S. ROLLINGS
(US Army Engineer Research and Development Center/USA)

2. A Manufacturer's Point of View CAN/PCN

Mr. Edward L. GERVAIS (Boeing Commercial Airplanes/USA)

3. Airbus A380 Pavement Experimental Program – Rigid Phase

Mr. Cyril FABRE (Airbus/FRANCE)

4. Airport Pavement Evaluation

Mr. Don R. ALEXANDER (US Army Engineer Research and Development Center/USA)
Mr. Graham WOODMAN (WSP Group/USA)

5. Concrete Pavement Construction

Mr. Peter TINDALL (Britpave/Weeks consultant/UK)

6. Issues in Asphalt Mix Design and Construction for Airfields

M. James L. GREENE (U.S. Air Force Civil Engineering Support Agency/USA)

7. Design, Construction and Management of Airport Pavements on Reclaimed Ground

Dr. Yoshitaka HACHIYA
(National Institute for Land and Infrastructure Management/JAPAN)

8. Summary of Session 2

SESSION 3: MAINTENANCE, RESTORATION AND MANAGEMENT

Mr. Nelson RIOUX
(Session 3 Chairperson, C7/8 Committee Chairperson/CANADA-QUEBEC)

1. Airport Pavement Management Systems

Mr. Mohamed Y. SHAHIN
(US Army Construction Engineering Research Laboratories/USA)

2. Rehabilitation of Concrete Airfield Surfaces

Mr. Raymond S. ROLLINGS
(US Army Engineer Research and Development Center/USA)

3. Bituminous Surfacings

Dr. Hans C. KORSGAAD (Carl Bro A/S /DENMARK)

4. Design Guide for Assessment, Treatment, Selection and Future Minimization of Cracks on Composite Airfield Pavement in the UK

Mr. S. ELLIS (TRL Limited/UK)

5. Summary of Session 3

Closing

Mr. John COOK (Seminar Coordinator, Ministry of Defense/UK)

CONTENTS

INTRODUCTION

This session is primarily aimed at promoting good practice in airfield pavement engineering including the sharing of expertise with experts from the road pavement sector. The two half-days session will be divided into 3 parts as follows:

1. Functional Requirements / Surface Characteristics of airfield pavements;

2. Design and Construction of airfield pavements;

3. Maintenance, Restoration and Pavement Management Systems for airfield pavements.

This Seminar will involve presentations by leading experts from the airfield and road sectors and discussion with the audience.

PART 1 - FUNCTIONAL REQUIREMENTS / SURFACE CHARACTERISTICS

Although the same materials and machines are used for construction of both road and airfield pavements, the functional requirements for airfield pavements are such that it is necessary to adopt a separate approach for the design and specification compared to those used for roads and other trafficked areas. The four key requirements, which need special attention on airports, are:

- surface cleanliness, integrity and durability in order to safeguard against FOD (Foreign Object Damage) to aircraft;
- sufficient friction to allow safe aircraft operations and in particular to allow aircraft to stop on the available runway-length after a rejected take-off;
- good Roughness / Evenness to avoid unnecessary repeated loads/damages on an aircraft airframe and to allow safe operations;
- structural design, and evaluation and load classification of pavements.

These requirements are mainly set due to the critical safety considerations for aircraft operations and especially the consequences if an incident or accident occurs during take-off.

This session will discuss the primary issues that need to be considered in setting requirements and criteria in respect of the above.

Surface Integrity and Durability

The first part in this session will discuss a system of functional rating of an airfield pavement.

The types of distress, severity and number of, will all have a different impact on serviceability. Pavements that ravel, spall or crack are a potential FOD risk to aircraft. This risk applies to all aircraft operations but is particularly critical for jet engine aircraft because of the potential for debris being blasted and sucked into engine intakes especially during take-offs. The cost of closing a runway in order to carry out maintenance/restoration work will invariably have a major impact on airport income hence the need for durable pavements.

Airfield Pavements must be resistant to jet blast, fuel, oil, hydraulic fluid and de-icing chemical/fluids and be strong enough to allow safe aircraft operations for the duration of their design lives.

Friction

Airport pavements shall provide a surface, which has sufficient friction characteristics when wet. Further the surface shall be constructed so that it minimises the potential risks of all forms of aquaplaning. As a recommendation in the ICAO Annex 14 Aerodromes there are a set of different wet friction levels based on different friction devices that are used around the world. Most countries use these or the higher requirements layed down by the relevant national aerodrome licensing authority or military standards authority. Other countries also publish macrotexture requirements for the pavement surface on their airports.

This session will discuss and focus on different devices available for both wet friction measurements and macrotexture measurements. The setting of criteria for new pavements and the design considerations in respect of remedial actions for existing pavements will also be addressed.

The Session will describe two major research initiatives which are the development of an International Friction Index and the ongoing Joint Winter Runway Friction Measurement Program (JWRFMP) which focuses on friction characteristics on contaminated runways (ice, slush, snow etc). This latter programme of work will calibrate friction device vs. aircraft breaking performance for which measurements have been made in Canada, Japan, Norway and Germany.

Roughness – Ride Quantity Indications

Requirements for runway surface evenness and roughness are strict compared with most roads and other trafficked areas. The short wavelength requirement (using a 3m straight edge) is easy to measure during construction or if subsequently a localised unevenness/bump develops. Medium and Long Wavelength Roughness, however, is much more difficult to analyse and assess, but on runways especially, it can have a significant affect on aircraft response and airframe fatigue. This Session will discuss these aspects of runway roughness.

Reference shall be made to the minimum surface evenness requirements set out in the ICAO Aerodrome Design Manual Part 3 and where appropriate to the higher requirements set by the relevant national aerodrome licensing authority or military standards authority.

Ongoing work regarding roughness criteria and existing standards will be discussed in addition to ways of dealing with this issue from an airport owner's perspective.

PART 2 - DESIGN AND CONSTRUCTION

Structural Design, Evaluation and Load Classification of Airfield Pavements

Structural design and evaluation of airfield pavements can typically involve consideration of single wheel loads varying from 5 – 25 tonnes and arranged in various combinations. There is also a wide range of tyre pressures typically up to 1.4 Mpa for civil aircraft and up to 2.5 Mpa for military aircraft. These design parameters contrast somewhat with the standard axle load typically used for road design. Hence a separate approach for the structural design and load classification of airfield pavements has been used for over 50 years. This Session will include presentations on the following:

- The evolution of design philosophies and aircraft load classification
- The ACN/PCN system with particular regard to recent developments
- State of the art on airfield pavement evaluation including consideration of construction types and variables, test methods and test conditions, use of design/evaluation models and assessment of key material characteristics and PCN classification.
- Evaluation of airport flexible pavements – an alternative approach to the ACN/PCN procedure.
- Major research initiatives on pavement designs for very heavy aircraft.

Construction

The functional requirements particularly with regard to surface integrity and durability in conjunction with that of friction put a special focus on the specification for surface materials for airfields. This can be further complicated by the need to cater for either very heavy aircraft and /or aircraft with high tyre pressures. This part of the Session will consider some of the key specification and construction issues for asphalt and concrete pavements including some project experiences.

PART 3 - MAINTENANCE, RESTORATION AND PAVEMENT MANAGEMENT SYSTEMS

The maintenance and restoration of airfield pavements utilises construction processes based on road technology but requires special considerations in respect of the following:

- procedures and practices to enable pavements to be cost effectively maintained in a safe condition for aircraft operations and minimise disruption to aircraft operations;
- the management of aircraft operations/construction interfaces and the consequent constraints on construction methods;
- the focus on quality issues that the first two considerations necessitate.

With particular regard to the above issues, this Session will comprise presentations on the following:

Pavement Management Systems (PMS)

A pavement management system provides a means of determining maintenance needs having regard to operational requirements, construction practices and available resources. This in turn involves procedures and methods for carrying out periodic surveys and checks on pavements to assess their strength, skid resistance, surface integrity and general condition. This Session will consider these requirements for an airfield PMS with particular emphasis on surface condition and the timing of maintenance and repair regimes.

Resurfacing with Bituminous Materials

The speed and flexibility of construction of bituminous surfacings make them a common choice for the restoration of airfield pavements. This particularly applies to runways were possession times for construction work are often subject to severe restrictions at busy civil airports and military aerodromes. The special considerations that apply to runway resurfacing works highlight many of the specialities of airfield pavement engineering. Apart from the logistical challenges, key design objectives invariably include non-susceptibility to FOD; long service lives with minimum maintenance and good skid resistance in adverse weather conditions. These in turn necessitate a special focus on material specifications.

This session will present case studies, which highlight the key issues on runway resurfacing projects. It will also include discussion on the options and properties of bituminous materials for airfield pavement works.

The Maintenance and Rehabilitation of Concrete Pavements

Pavement Quality Concrete (PQC) pavements can provide long service lives, with relatively modest maintenance requirements even in demanding situations requiring high resistance to jet blast and fuel spillage, to indentation from parked aircraft having high tyre pressures and to a measure of impact from ground equipment. However the cost of replacement, the relatively long possession times required for the construction process and the onerous failure criteria in respect of surface integrity and FOD susceptibility necessitates special consideration in respect of rehabilitation strategies. This Session will address the following key issues:

- maintenance strategies,
- the lessons learned from maintenance problems,
- the selection of restoration treatments.

The Restoration of Composite Pavements

Composite pavements have often evolved as a result of bituminous overlays being applied to old concrete pavements as an expedient restoration measure. About 90% of taxiways and the main length of runways on UK MOD aerodromes comprise composite pavements incorporating concrete sub-structures which were constructed between 45 – 60 years ago. Whilst these pavements have generally given very good performance a major consideration in their maintenance and restoration is that of reflection cracking. The main issues affecting the design / maintenance strategy are that of serviceability requirements, access for maintenance, the rate of development of reflection cracking and relative cost of treatments. This session will discuss these issues based on studies carried out on reflection cracking at UK MOD aerodromes.

Durability Problems on Nordic Airfields

In the 1990s asphalt durability problems due to the use of new de-icing chemicals were observed at some Nordic Airports. Premature degradation and disintegration of asphalt pavements occurred and there were also softening and stripping affects on bitumen and asphalt concrete together with loose stones on the runways. A joint research project was started by the Norwegian and Swedish Civil Aviation Authorities and more recently the Finnish CAA, to solve the problem. The Session will discuss the background to this problem, also the research programme and its conclusions.