Airfield and Highway Pavements 2017

Airfield Pavement Technology and Safety

Selected Papers from the Proceedings of the International Conference on Highway Pavements and Airfield Technology 2017

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AIRFIELD PAVEMENT TECHNOLOGY AND SAFETY

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON HIGHWAY PAVEMENTS AND AIRFIELD TECHNOLOGY 2017

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Preface

An ever-growing number of highway and airport agencies, companies, organizations, institutes, and governing bodies are embracing principles of sustainability in managing their activities and conducting business. Overarching goals emphasize key environmental, social, economic, and safety factors in the decision-making process for every pavement project. Therefore, the theme of the conference was chosen as "Sustainable Pavements and Safe Airports." It is dedicated to the state-of-the-art and state-of-practice areas durability, cost-effective, and sustainable airfield and highway pavements. In addition, recent advancements and technologies to ensure safe and efficient airport operations are included.

This international conference provides a chance to interact and exchange information with worldwide leaders in the fields of highway and airport pavements, as well as airport safety technologies. This conference brought together researchers in transportation and airport safety technologies, designers, project/construction managers, academics, and contractors from around the world to discuss design, implementation, construction, rehabilitation alternatives, and instrumentation and sensing.

The proceedings of 2017 International Conference on Highway Pavements and Airfield Technology have been organized in four (4) publications as follows:

Airfield and Highway Pavements 2017: Design, Construction, Evaluation, and Management of Pavements
This volume includes papers in the areas of mechanistic-empirical design methods and advanced modeling techniques for design of conventional and permeable pavements, construction specifications and quality, accelerated pavement testing, pavement condition evaluation, and network level management of pavements.

Airfield and Highway Pavements 2017: Testing and Characterization of Bound and Unbound Pavement Materials
This volume includes papers in the areas of laboratory and field characterization of asphalt binders, asphalt mixtures, base/subgrade materials, and recent advances in concrete pavement technology. This volume also features papers for the use of recycled materials, in-place recycling techniques and unbound layer stabilization methods.

Airfield and Highway Pavements 2017: Pavement Innovation and Sustainability
This volume is dedicated to the papers featuring most recent technologies used for structural health monitoring of highway pavements, intelligent compaction, and innovative technologies used in the design and construction of highway pavements. The volume also includes papers in the area of sustainability assessment using life-cycle assessment of highway and airfield pavements and climate change impacts and preparation for pavement infrastructure.

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Airfield and Highway Pavements 2017: Airfield Pavement Technology and Safety
This volume is dedicated to recent advances in the area of airfield pavement design technology and specifications, modeling of airfield pavements, use of accelerated loading systems for airfield pavements, and airfield pavement condition evaluation and asset management.

The papers in these proceedings are the result of peer reviews by a scientific committee of more than 90 international pavement and airport technology experts, with three to five reviewers per paper. Recent research was presented in the technical podium and poster sessions including the results from current Federal Aviation Administration (FAA) airport design, specifications, and safety technologies; design and construction of highway pavements; pavement materials characterization and modeling; pavement management systems; and innovative technologies and sustainability. The plenary sessions featured the Francis Turner Lecture by Dr. Robert Lytton and the Carl Monismith Lecture by Dr. David Anderson. In addition, two technical tours were offered: Philadelphia International Airport and the Center for Research and Education in Advanced Transportation Engineering Systems (CREATEs) Lab of the Henry M. Rowan College of Engineering at Rowan University.

Three workshops were presented prior to the conference: hands-on FAA's FAARFIELD software, design and construction of permeable pavements, and environmental product declarations.

The editors would like to thank the members of the scientific committee who volunteered their time to review the submitted papers and offered constructive critiques to the authors. We are also grateful for the work of the steering committee members in planning and organizing the conference: Katie Chou, Jeffrey Gagnon, John Harvey, Brian McKeehan, Shiraz Tayabji, and Geoffrey Rowe; as well as the local organizing committee chaired by Geoffrey Rowe and members including James A. McKelvey, Timothy Ward, Ahmed Faheem, and Yusuf Mehta for their help with the technical tours. Finally, we would like to especially thank the ASCE T&DI staff who helped put the conference together: Muhammad Amer, Mark Gable, Drew Caracciolo, and Deborah Denney.

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Towards a Performance-Based Airport Asphalt Specification

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Abstract

Prescriptive or recipe-based specification of asphalt surface mixture design, production and construction is normal within the airport industry. However, reports of distress in generally compliant airport asphalt has eroded confidence in this traditional approach. As a result, there is increased interest in performance-based airport asphalt specification. This aims to allow innovation for risk reduction and to make asphalt producers more contractually responsible for the performance of their airport asphalt surfaces. Where performance-indicative test methods are available for the evaluation of airport asphalt performance requirements, performance-based testing is appropriate. However, where no such performance test exists, the traditional prescriptive requirements must be retained. A combination of prescriptive and performance-based specification requirements is appropriate. Future work is expected to focus on developing additional performance-indicative test methods where they do not currently exist.

Introduction

Since the 1950s, a prescriptive or recipe-based approach has generally been adopted for the specification and design of airport asphalt surfaces (White 2016f). The prescriptive specification is usually based on the Marshall-design method adapted for airport surfaces by the US Army Corps of Engineers (the Corps) in the 1940s and 1950s (White 1985). Many airports and aviation authorities retain the basis of the Corps methods in current airport asphalt design, specification and construction practice (White 2016f). Importantly, grooves are generally sawn transversely in runway surfaces to promote aircraft skid resistance (Zuzelo 2014). As a consequence, the traditional airport surface asphalt is often described as 'grooved, dense graded, Marshall-asphalt'. Although grooved Marshall-asphalt is common for airport surfacing, some jurisdictions prefer alternate asphalt mixtures, which are discussed later.

Generally, airport pavements are resurfaced when the condition of the asphalt presents an unacceptable risk to safe aircraft operations. Many airports traditionally planned on resurfacing flexible airport pavements on a fifteen-year cycle. Some of these airports have now reduced that expectation to resurfacing every ten years. Concerningly, a number of airports have also experienced surface distress requiring partial or full resurfacing within six years of surface construction (White & Embleton 2015; White 2016f). This has resulted in reduced confidence in the traditional prescriptive airport asphalt specification to provide reliable surface performance under modern aircraft loadings.

The reduction of confidence in the traditional prescriptive specification has prompted interest in a performance-based approach to airport asphalt specification. The aim is to allow asphalt producers to innovate for risk reduction and to make asphalt producers contractually responsible for the performance of airport asphalt surfaces. This paper outlines the basis and approach for the implementation of a performance-based asphalt specification for airports. The focus is on Australian experience, but international issues are incorporated where appropriate. However, the issues and concepts apply to many airports around the world where a performance-based specification is of interest.

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Background

Airport surface requirements

As described below, the modes of distress requiring earlier than expected airport pavement resurfacing are generally linked to inadequate asphalt mixture resistance to either fracture and deformation (White 2016f). Durability is also important and includes both resistance to moisture damage (stripping) and resistance to the generation of loose stones (ravelling) that damage aircraft. Surface friction for aircraft skid resistance is also critical to aircraft safety, and asphalt surface texture is essential, particularly when grooving is not provided (Table 1).

Table 1. Summary of airport asphalt performance requirements (White 2016f)

Physical requirement	Protects against	Level of importance
Deformation resistance	Groove closure Rutting Shearing/shoving	High
Fracture resistance	Top down cracking Fatigue cracking	Moderate
Surface friction and texture	Skid resistance Compliance requirement	High
Durability	Pavement generated FOD Resistance to moisture damage	Moderate

Surface deformation

Asphalt surface deformation has been reported at airports. Some Australasian examples include rutting at Cairns (Australia), Perth (Australia), Kuala Lumpur (Malaysia), Doha (Qatar) and Dubai (UAE) airports (Rodway 2009). Taxiways at San Francisco (USA) airport also rutted during hot weather, under slow moving and sharp turning B747 aircraft (Monismith et al. 2000). At San Francisco it was concluded that a more viscous bitumen was required to improve the shear strength of the asphalt mixture.

Surface shearing has also been reported. Mooren et al. (2014) investigated surface tearing under aircraft turning at Amsterdam airport (Netherlands). A lack of mixture cohesion at elevated temperature, due to softening of the bitumen, was found to result in inadequate shear strength in the surface. Similarly, an Australian airport was reported to experience unusual softness during summer months (Emery 2005). It was concluded that the binder had a high temperature susceptibility although a reduction in softness was observed after three years. A similar case of surface tenderness was reported at another Australian airport, also linked to bitumen (White 2014). Moreover, Newark airport, in New Jersey (USA) experienced similar asphalt shearing in the heavy aircraft braking zone associated with aircraft landings (Bognacki et al. 2007).

Groove closure is one of the most commonly reported airport asphalt surface distresses, particularly in hot countries like Australia (Rodway 2016). Groove closure most commonly occurs where aircraft move slowly and in a direction parallel to the alignment of the grooves, such as entering a runway from a perpendicular taxiway (White & Rodway 2014). Groove closure has been reported at numerous airports in Australia, usually occurring within the first three years and most often during extended periods of unusually hot weather (Emery 2005).

The two ends (approximately 800 m long each) of the main runway at Brisbane airport (Australia) were resurfaced in 2013. Grooving was performed over the full length and width of the new asphalt six weeks following construction. During a week of unusually hot weather in the following summer, significant groove closure was observed, particularly at the intersection of the dominant departure taxiway and the main runway (White & Rodway 2014). Melbourne and Perth airports (Australia) also experienced significant groove closure in runways and taxiways (White 2016f).

Groove closure was reported at the new Hong Kong airport despite trafficking being delayed for 12 months after its construction (White & Rodway 2014). Similarly, the runway at the new airport at Delhi (India) was intended to be grooved following its construction in 2008. In order to confirm that the grooves would not close, a test section of grooving was constructed across the runway and

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