ENSURING THE LONGER LIFE OF

AIRPORT RUNWAYS

By John I. Duval, P.E.

The future is bright for the U.S. aviation industry as more people choose to travel each year by air. The high watermark in the industry so far is the year 2015, when more than 894 million passengers traveled by air in the United States.

At the current growth rate, one billion U.S. passengers will travel by air in 2025. Time-pressed consumers are becoming increasingly reliant on air travel, attracted by lower costs and a steadily improving safety record.

Believe it or not, airline travel has never been cheaper. The average price of a round-trip domestic airline ticket in the U.S. is about one-half what it was 30 years ago.[1] Meanwhile, the airline industry safety record continues to steadily improve. A recent Northwestern University study concluded "commercial aviation is the safest form of travel at 0.07 fatalities per billion passenger miles." This compared to 7.28 fatalities per billion passenger miles for drivers and passengers of cars and light trucks.[2]

As the U.S. aviation industry grapples with the prospect of moving a billion passengers per year, pavement research and development has turned an eye toward the development of long-life asphalt pavements for airport applications. Those efforts are focused on two areas:

1. Structural design methods to allow engineers to confidently design longer life asphalt pavements.
2. Improved construction and maintenance methods to allow us to build long-life pavements with confidence.

DESIGN METHODS

Of all the recent advances in developing long-life pavements, none are more important than advanced structural design methods. The Federal Aviation Administration (FAA) currently requires airport pavements structures to be designed to support 20 years of aircraft traffic. Due to increasing passenger loads, airports face increasing pressure from the airline industry to minimize the downtime of airport pavement facilities. By increasing the design life of new airport pavements well beyond 20 years, we could dramatically reduce the number of runway and taxiway closures required for major rehabilitation and reconstruction.

The FAA continues to advance the FAARFIELD structural design software, which characterizes asphalt pavements in terms of mechanistic principles and designs for fatigue failure in terms of a cumulative damage factor concept. The FAARFIELD software will be central to understanding how asphalt pavement structures perform over longer design periods.

As David Brill, Ph.D., Research and Development Engineer at the FAA Tech Center, explains, "in the near future, FAARFIELD will incorporate advanced energy-based fatigue models for asphalt materials, which will give the FAA additional confidence that asphalt layers will perform their full design lives without excessive cracking."

CONSTRUCTION METHODS AND MATERIALS

Just as important as developing the tools for structural design of long-life asphalt pavements for airports is the development of the construction methods and materials that will allow us to confidently build these long-life pavement facilities. Intelligent Compaction is one of those tools.

"We know that compacting asphalt mixtures to optimum density is vital to achieving long life," says Bob Horan, P.E., Asphalt Institute Senior Regional

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Engineer, "Intelligent Compaction allows us to see compaction progress in real-time during rolling operations."

Improvements to asphalt material specifications and mix design methods are also helping to improve the quality and durability of asphalt mixtures for airport pavements. The FAA has been allowing the use of Performance Graded Asphalt Binders for more than ten years, which allows engineers to precisely specify the correct asphalt binder for use in a wide range of climatic conditions and loading scenarios.

The most recent update to FAA Advisory Circular 150/5370-10G "Standards for Specifying Construction of Airports," allows regular use of gyratory mix designs on all FAA-funded airport pavement projects including runways and taxiways, allowing airports to benefit from the state-of-the-art mix design technology.

"The pavement extended life initiative is a top priority," according to Jeff Gagnon, P.E., Manager of Airport Pavement Research at the FAA William J. Hughes Technical Center. The tech center team is developing new material specifications for green asphalt technologies under accelerated tests using a state-of-the-art heavy vehicle simulator.

FUEL RESISTANCE

Fuel-resistant HMA mixtures provide an innovative method for placing long-life asphalt pavements in even the most difficult environment, such as a refueling apron. The FAA recently issued a new standard specification designated Item P-601 "Fuel Resistant Hot Mix Asphalt (HMA) Pavement."

Fuel-resistant mixtures are designed to perform in critical areas such as parking aprons where heavy aircraft are refueled. These pavements are subjected to spilled fuel and hydraulic fluids that can soften traditional HMA mixtures and render them susceptible to rutting.

Fuel-resistant mixtures were specifically developed to add fuel resistance characteristics to an asphalt mixture without sacrificing rut resistance and fatigue performance. Importantly, no coal tar is allowed in P-601 mixtures. The use of P-601 mixtures is being considered for other uses beyond refueling areas and into other critical airfield pavement features. According to Ron Corun, Director of Asphalt Technical Services for Axeon Specialty Products LLC, "because they maintain their rut-resistance and crack-resistance under the most damaging conditions, we are seeing increased demand for fuel-resistant mixtures on critical taxiways and other pavements where aircraft queue to access the runway."

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INVESTING WISELY

In summary, long-life asphalt pavements at airports are becoming a reality as new technologies in structural design and construction methods and materials become the norm. State-of-the-art computer software such as FAARFIELD and construction methods and materials that include Intelligent Compaction, gyratory mix designs, PG binders and fuel-resistant mixtures, are examples of the kinds of innovations that are currently available to design and build long-life asphalt pavements for airports.

The magnitude of the investment in our airport pavement systems is enormous. In 2015, the FAA spent approximately 3.2 billion dollars in airport infrastructure through their airport improvement program, of which approximately 1.7 billion, or 53 percent, was specifically for pavements.

Developing long-life asphalt pavements is a sustainable and cost-effective objective that will help to maximize the nation's return on investment in our airport infrastructure. As our airports support ever-growing passenger demand that will exceed 1 billion air passengers per year within the next decade, long-life design and construction technology will help to reduce the impact and cost of airport pavement construction and maintenance on air travel. **A**

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2. Savage, I. (2013), "Comparing the Fatality Risks in United States Transportation Across Modes and Over Time," Research in Transportation Economics, Volume 43, Issue 1, July 2013

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