Federal Aviation Administration

Airport Technology Research & Development (ATR)

FIELD INSTRUMENTATION AND TESTING

Technicians install field instrumentation sensors for data acquisition on an airport runway

Field data enhances predictive modeling capabilities for longer lasting pavements

Airfield pavements undergo diverse climatic and loading conditions that trigger deterioration, and ultimately, pavement failure. To create specifications for long-lasting pavements that withstand this range of conditions, FAA complements full-scale Accelerated Pavement Testing (APT) with field testing and pavement performance monitoring at airports.

> THE OBJECTIVE OF THIS PROGRAM IS TO COLLECT PAVEMENT RESPONSE AND PERFORMANCE DATA UNDER DIVERSE CLIMATIC CONDITIONS TO IMPROVE THE UNDERSTANDING OF PAVEMENT BEHAVIOR.

The field instrumentation and testing program at FAA includes three focus areas: (1) Field tests on pavement layers during construction; (2) laboratory characterization of materials collected during construction; and (3) pavement response monitoring using sensors installed during construction.

Although the results of pavement material testing in the laboratory provide fundamental inputs for pavement design, physical material properties in the field have been found to differ due to inherent variability, construction methods, and other distinct conditions. The main objective of this program is to collect pavement responses and performance data under diverse climatic conditions. While full-scale APT at FAA's pavement testing facilities uses controlled conditions, field projects provide pavement responses such as deflections, strains, and stresses resulting under the combined effect of local climatic conditions and aircraft loads.

Understanding how these real world conditions affect pavement behavior and performance enhances FAA's design and evaluation capabilities and improves our ability to better predict pavement life. As a result, better design and evaluation tools will reduce downtime at our nation's airports for pavement construction and maintenance activities and optimize the use of Airport Improvement Program (AIP) funds.

Last Updated August 2020

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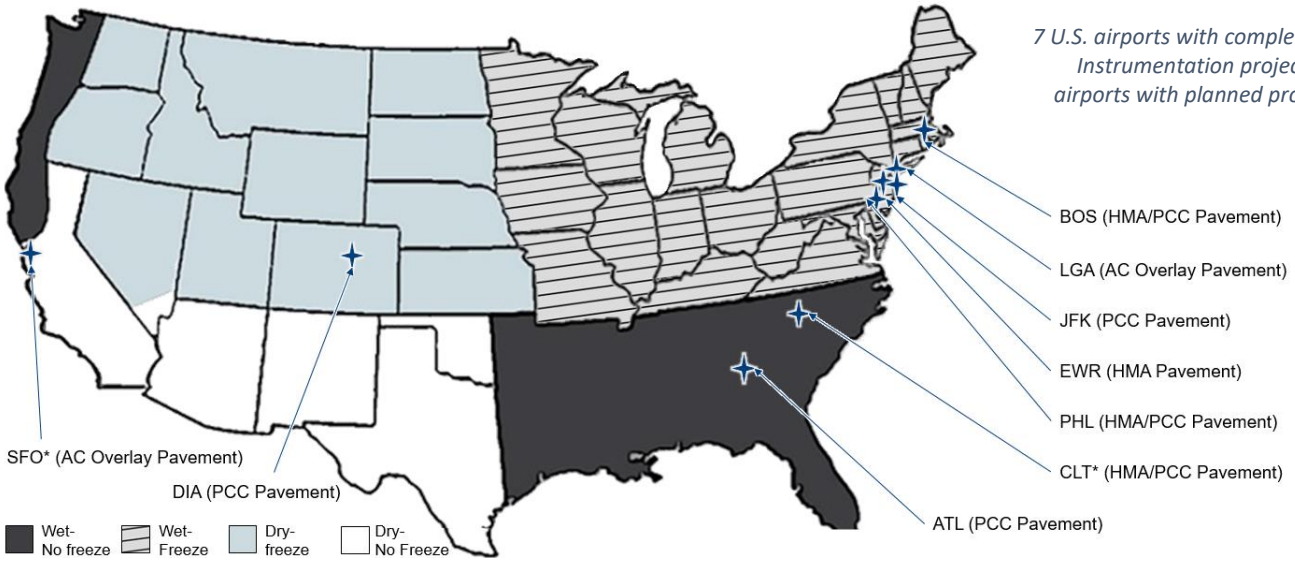

Airfield pavement instrumentation 101

The instrumentation used for airfield pavement data collection includes:

- Sensors such as pressure cells, strain gages, and thermocouples;
- A Data Aquisistion System (DAQ);
- A video camera;
- A communication link (land-line or cellular) to transmit data to FAA;
- And power supply, such as solar panels or airfield supplied power.

Once installed, the video camera is used to observe the type of aircraft approaching the sensors, and the DAQ is triggered to begin data collection. After the aircraft passes over the sensors, the DAQ is shut off, and the data is then transmitted to the FAA for analysis. ATR will continue collecting data from both rigid (concrete) and flexible (asphalt) pavements throughout all four climactic zones across the nation (see map above) in order to represent a broad range of climatic regions.

Alternative methods for characterizing soils in the field

The California Bearing Ratio (CBR), commonly used to characterize subgrade strength, may eventually be replaced by less destructive, more cost effective, and more efficient methods. Resilient modulus, in combination with a measure of strength such as shear, is under investigation as an alternative for this task. Below are a few of the methods currently being studied:

Vane Shear

The vane shear test is a rapid and economical in situ method for measuring the shear strength of low- or medium-stiffness cohesive soil. Shear strength is a function of the torque required to induce shear failure in the soil. Normally used for field tests, the technique can also be adapted for lab-compacted samples.

Dirt Seismic Pavement Analyzer (DSPA)

DSPA is a portable device that measures modulus of unbound materials in the field. The DPSPA is set on a surface, and its source initiates highly repeatable seismic waveforms that are recorded by two accelerometers. Soil modulus is determined based on compression or shear wave velocity. DSPA results can also be used to study subgrade uniformity. The test is non-destructive in nature, repeatable, rapid, and easy to perform.

Light Weight Deflectometer (LWD)

LWD is another portable, non-destructive testing method for characterization of unbound materials (subgrade, subbase, and aggregate base layers). A weight is dropped from a pre-determined height, and pavement surface deflections are recorded. The deflection basin obtained is used for backcalculating layer modulus.

Visit the ATR Website at **www.airporttech.tc.faa.gov**

Last Updated August 2020