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Study of designing pavements for light aircraft

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Introduction : According to the Federal Aviation Administration, airport pavements are primarily constructed to provide adequate support for the loads imposed by aircraft using an airport. The Federal Aviation Administration states that an adequate pavement design produces a firm and stable, all-year, all-weather surface. In order to effectively fulfill these requirements, the pavement must be of such quality and thickness that it will not fail under the loads imposed by the various aircrafts using the airport. It is also vital for the pavement throughout the airport to be durable and long-lasting in order to control operating costs. The pavement chosen must possess sufficient inherent stability to withstand the constant traffic, adverse weather conditions, and other deteriorating influences to a degree that it does not constantly have to be attended to.

Key words : pavements, aircraft, runway etc

Although aircraft landing gears are involved in the design of airport pavement, the Federal Aviation Administration does not specifically prescribe any component of landing gear design. In 1958, the Federal Aviation Administration adopted a policy of limiting maximum Federal participation in airport pavements to a pavement section designed to serve a 350,000 pound aircraft with a DC-S-50 series landing gear configuration. The main intent of this policy was to insure that future aircraft were equipped with landing gears that would not stress the pavements more than the referenced 350,000 pound aircraft.

Since, aircraft manufacturers have accepted and followed the 1958 policy. Even though aircraft gross weights have substantially exceeded 350,000 pounds they still have designed all aircraft landing gear to conform to the policy. This feat has been accomplished by increasing the number and spacing of landing gear wheels. Therefore, even though the policy of 1958 is not exactly the same as it was the year it was adopted, the landing gear stills falls to the responsibility of the aircraft designers and manufactures.

Steps in the pavement design process :

1. **Existing Soil Investigation and Evaluation**

The first step in the pavement design process is to inspect the existing soil present throughout the site. According to the Federal Aviation Administration, the Unified Soil Classification system should be used in all matters concerning civil airport pavements. Soil conditions include factors such as the elevation of

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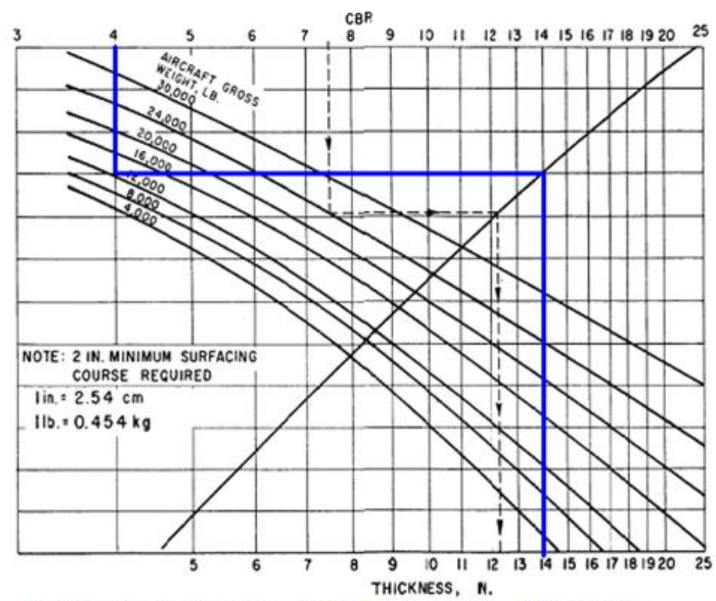
the water table, the presence of water bearing strata, and the field properties of the soil. Some examples of field properties of the soil include the soil's density, moisture content, and frost penetration.

The standard method for classifying soils for engineering purposes is ASTM D 2487, or more commonly known as the Unified System. One of the primary purposes in determining the soil classifications is to have some idea of how the soil will behave under different scenarios. The Unified System classifies soil first by grain size and then further subgroups that particular soil based upon its plasticity index.

2. Overall Pavement Thickness

Now that the engineering properties of the soil are known, the overall thickness of the pavement needed throughout the airport can be determined.

The strength of the sub grade is the main factor in determining the thickness of the pavement needed for a particular application. The value of the stiffness of the sub grade is required if the stresses and strains in the pavement and the sub grade are to be calculated. Sub grade strength is expressed in terms of its California bearing ratio (CBR) value. The CBR value is measured by an empirical test devised by the California State Highway Association and is simply the resistance to a penetration of 2.45nn of a standard cylindrical plunger to various penetrations in crushed aggregate, notably 13.24kN at 2.5mm penetration and 19.96kN at 5.0mm penetration.



Design curves to find the overall thickness required for flexible pavement per AC 150/5320-6D.

The CBR value can be determined by conducting various tests on collected soil samples, or it can be obtained from a standard table provided by the Federal Aviation Administration. In the case of the Lake Mathews Airport, the CBR value and the soil characteristics for the site was found through a provided table. Table illustrates how the Field CBR value was found for the soil around the Lake Mathews Airport site.

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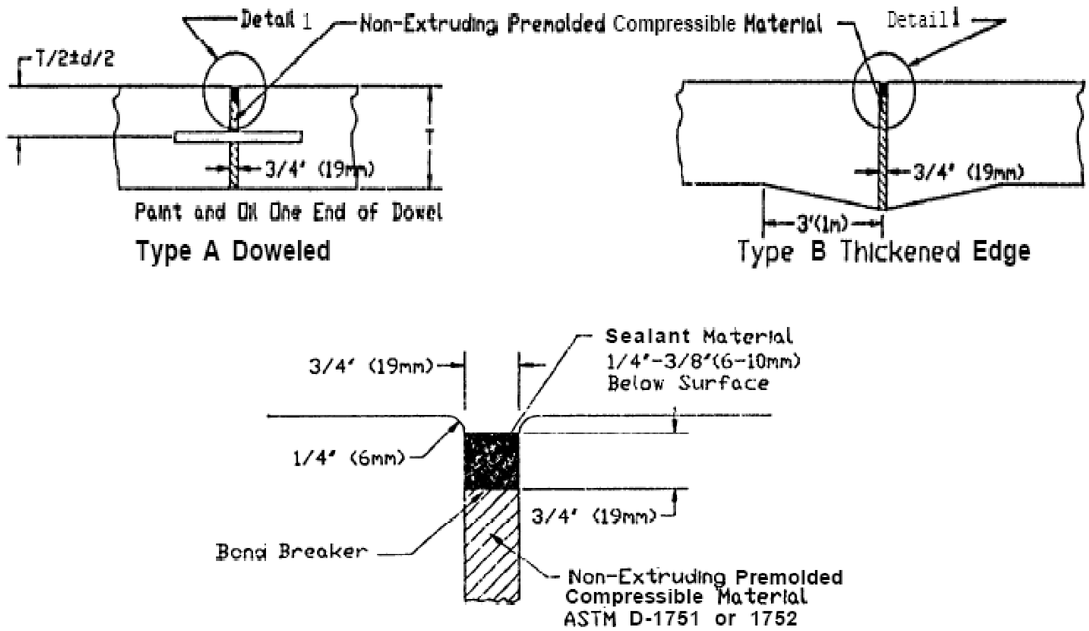

Fig 4.7 Expansion joint details for light load rigid pavement per AC 150/5320-6D.

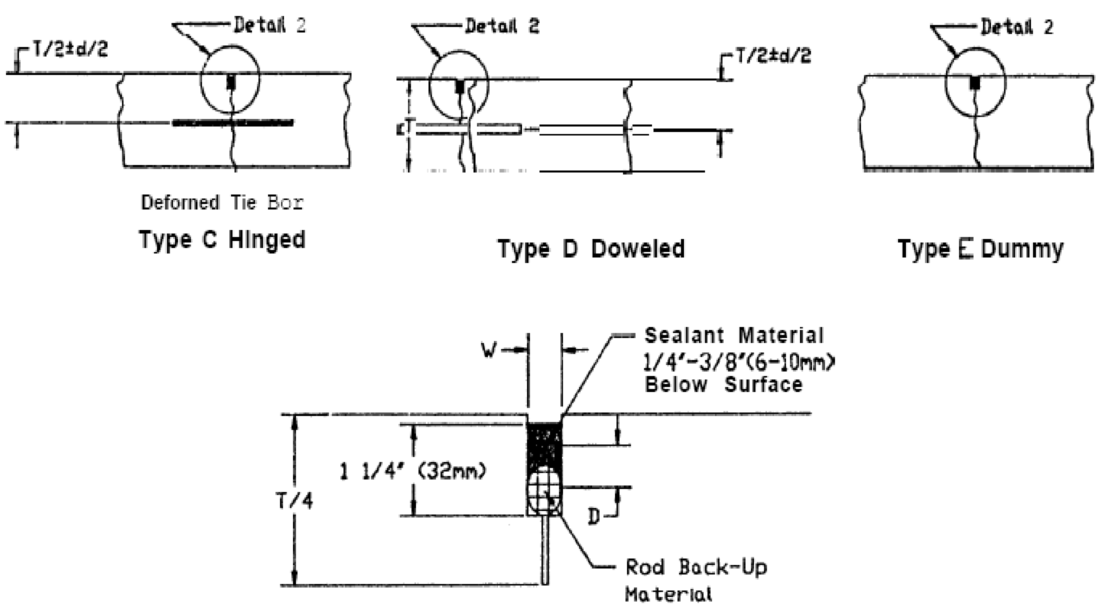

Fig 4.8. Contraction joint details for light load rigid pavement per AC 150/5320-6D.

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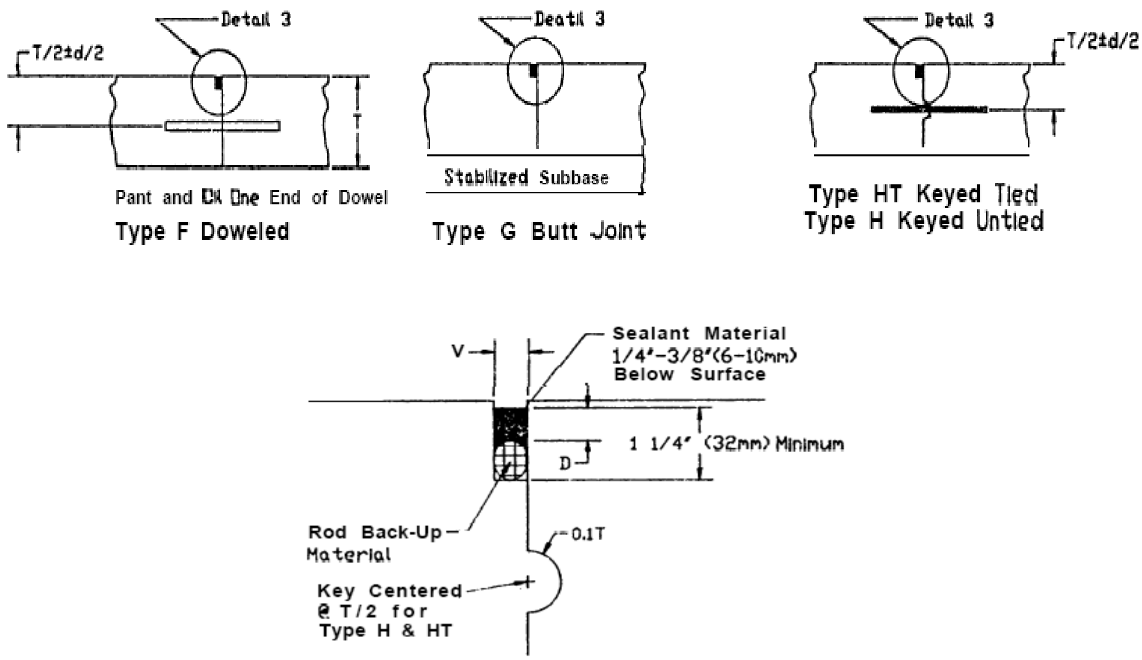

Fig 4.9. Construction joint details for light load rigid pavement per AC 150/5320-6D.

The Federal Aviation Administration notes that several differences exist between light load and heavy load rigid pavement joints. For example, butt-type construction and expansion joints are permitted when an asphalt or cement stabilized subbase is provided. Also, half round-keyed joints are permitted even though the slab thick nesses are less than nine inches. Odd-shaped slabs should be reinforced with 0.05% steel in both directions. The Federal Aviation Administration defines odd-shaped slabs as slabs that are not rectangular in shape, or rectangular slabs which length-to-width ratios exceed 1.25.

For the Lake Mathews Airport, longitudinal joints are going to be placed every 12.5 feet, for a total of six sections. In the transverse direction, joints will be placed every 15 feet. These transverse joints will extend for the entire length of the runway.

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