CHAPTER 2: AERODROME PAVEMENTS - COMPOSITION AND FUNCTION

2.1 INTRODUCTION TO AERODROME PAVEMENTS

Aerodrome pavements are designed, constructed, and maintained to support the critical loads imposed on them and to produce a smooth, skid-resistant, and safe-riding surface. The pavement must be of such quality and thickness to ensure it will not fail under the loads imposed and be durable enough to withstand the abrasive action of traffic, adverse weather conditions, and other deteriorating influences. To ensure the necessary strength of the pavement and to prevent unmanageable distresses from developing, the aerodrome operator should consider various design, construction, and material-related parameters. This chapter helps aerodrome operators to assess these parameters by providing information on the composition of pavement sections and the functional aspects of flexible and rigid pavement components.

2.2 CLASSIFICATION OF AERODROME PAVEMENTS

Generally, pavements fall into two classes: rigid and flexible pavements. Combinations of different pavement types and stabilized layers form complex pavements that can be classified as variations of the normal rigid and flexible types. Overlay pavements—existing pavement structures that are overlaid by either of the pavement types—are also common.

2.3 RIGID PAVEMENT COMPOSITION AND STRUCTURE

2.3.1 Rigid pavements normally use Portland cement concrete (PCC) as the prime structural element. Depending on conditions, the PCC pavement slab may be designed with plain, lightly and continuously reinforced, pre-stressed, or fibrous concrete and usually lies on a compacted granular or treated sub-base, which is supported by a compacted sub-grade. The sub-base provides uniform stable support and may provide subsurface drainage.

2.3.2 The PCC pavement slab has considerable flexural strength and spreads the applied loads over a large area. Figure 2-1 illustrates a typical rigid pavement structure. Rigid pavements have a high degree of rigidity.

![Figure 2 – 1: Typical Rigid Pavement Structure](image)

Figure 2-2 shows how this inflexibility and the resulting beam action enable rigid pavements to distribute loads over large areas of the sub-grade. Better rigid pavement performance requires that support for the PCC pavement slab be uniform. Rigid
pavement strength is most economically built into the PCC pavement slab itself with optimum use of low-cost materials under the slab.

![Diagram of Wheel Load Transfer](image)

**Figure 2 – 2: Transfer of Wheel Load to Foundation in Rigid Pavement Structure**

### 2.3.3 PCC Pavement Slab (Surface Layer).

The PCC pavement slab provides structural support to the aircraft, provides a skid-resistant surface, and prevents the infiltration of surface water into the sub-base.

### 2.3.4 Sub-base.

The sub-base provides uniform stable support for the pavement slab. The sub-base also provides subsurface drainage, control swelling of sub-grade soils, provide a stable construction platform for rigid pavement construction, and prevent mud pumping of fine-grained soils. Rigid pavements generally require a minimum sub-base thickness of 100 mm.

### 2.3.5 Stabilized Sub-base.

All new rigid pavements designed to accommodate aircraft weighing 45,000 kg or more must have a stabilized sub-base. The structural benefit imparted to a pavement section by a stabilized sub-base is reflected in the modulus of sub-grade reaction assigned to the foundation.

### 2.3.6 Sub-grade.

2.3.6.1 The sub-grade is the compacted soil layer that forms the foundation of the pavement system. Sub-grade soils are subjected to lower stresses than the surface and sub-base courses. These stresses decrease with depth, and the controlling sub-grade stress is usually at the top of the sub-grade unless unusual conditions exist such as a layered sub-grade or sharply varying water content or densities, may change the locations of the controlling stress. The soils investigation should check for these conditions. The pavement above the sub-grade must be capable of reducing stresses imposed on the sub-grade to values that are low enough to prevent excessive distortion or displacement of the sub-grade soil layer.

2.3.6.2 Since sub-grade soils vary considerably, the interrelationship of texture, density, moisture content, and strength of sub-grade material is complex. The ability of a particular soil to resist shear and deformation will vary with its density and moisture
content. In this regard, the soil profile of the sub-grade requires careful examination. The soil profile is the vertical arrangement of layers of soils, each of which may possess different properties and conditions. Soil conditions are related to the ground water level, presence of water-bearing strata, and the properties of the soil, including soil density, particle size and moisture content. Since the sub-grade soil supports the pavement and the loads imposed on the pavement surface, it is critical to examine soil conditions to determine their effect on grading and paving operations and the need for under-drains.

2.4 FLEXIBLE PAVEMENT COMPOSITION AND STRUCTURE

2.4.1 Flexible pavements support loads through bearing rather than flexural action. They comprise several layers of selected materials designed to gradually distribute loads from the pavement surface to the layers underneath. The design ensures the load transmitted to each successive layer does not exceed the layer's load-bearing capacity. A typical flexible pavement section is shown in Figure 2-3.

![Figure 2 - 3. Typical Flexible Pavement Structure](image)

Figure 2 - 3. Typical Flexible Pavement Structure

Figure 2-4 depicts the distribution of the imposed load to the sub-grade. The various layers composing a flexible pavement and the functions they perform are described below:

![Figure 2 - 4. Distribution of Wheel Load in Flexible Pavement](image)

Figure 2 - 4. Distribution of Wheel Load in Flexible Pavement

2.4.2 Bituminous Surface (Wearing Course).

The bituminous surface, or wearing course, is made up of a mixture of various selected aggregates bound together with asphalt cement or other bituminous binders. The
material used in the surface course is commonly referred to as Hot-Mix Asphalt (HMA). This surface prevents the penetration of surface water to the base course; provides a smooth, well-bonded surface free from loose particles, which might endanger aircraft or people; resists the stresses caused by aircraft loads; and provides a skid-resistant surface without causing undue wear on tires.

2.4.3 Base Course.

2.4.3.1 The base course serves as the principal structural component of the flexible pavement. It distributes the imposed wheel load to the pavement foundation, the sub-base, and/or the sub-grade. The base course must have sufficient quality and thickness to prevent failure in the sub-grade and/or sub-base, withstand the stresses produced in the base itself, resist vertical pressures that tend to produce consolidation and result in distortion of the surface course, and resist volume changes caused by fluctuations in its moisture content.

2.4.3.2 The materials composing the base course are selected hard and durable aggregates, which generally fall into two main classes: stabilized and granular. The stabilized bases normally consist of crushed or uncrushed aggregate bound with a stabilizer, such as Portland cement or bitumen.

2.4.4 Sub-base.

This layer is used in areas where sub-grade soil is extremely weak. The sub-base course functions like the base course. The material requirements for the sub-base are not as strict as those for the base course since the sub-base is subjected to lower stresses. The sub-base consists of stabilized or properly compacted granular material.

2.4.5 Sub-grade.

The sub-grade is the compacted soil layer that forms the foundation of the pavement system. Sub-grade soils are subjected to lower stresses than the surface, base, and sub-base courses. Since load stresses decrease with depth, the controlling sub-grade stress usually lies at the top of the sub-grade. The combined thickness of sub-base, base, and wearing surface must be great enough to reduce the stress in soil layer.

2.5 AERODROME PAVEMENT OVERLAYS

Aerodrome pavement overlays may correct deteriorating pavement surfaces, improve ride quality or surface drainage, maintain structural integrity, or increase pavement strength. Overlays are used when a pavement is damaged by overloading, requires strengthening to serve heavier aircraft, shows severe ponding because of uneven settling, or has simply served its design life and is worn out. Aerodrome pavement overlays generally consist of either PCC or HMA pavements or the resulting pavement system may be classified as either rigid or flexible for load-support purposes.