

三、 柔性鋪面之回算與結構評估

B 柔性鋪面之回算與結構評估

Table 1.1 - Limiting deflection criteria for pavement evaluation

Figure 1.1 - Component versus system analysis of pavement structures

Destructive Testing vs. NDT

B.1 柔性鋪面之回算

(含BISDEF程式之使用介紹)

Determination of the Load-Carrying Capacity

Basic Approach :

1. Measure pavement deflection basins
2. Backcalculate the layer modulus for different seasons
3. Compute critical stresses and strains for different seasons
4. Use fatigue cracking and permanent deformation (rutting) prediction models to estimate the allowable load repetitions (Figure 1 - Pass Damage)
5. Miner's cumulative damage method for the combined effect of various loads

Basic Concepts for Flexible Pavements

One-Layer Pavement : Boussinesq Theory

$$\Delta = 1.5 \frac{pa}{E} \quad (\text{can be directly backcalculated})$$

Two-Layer Pavement :

Uniformly spaced intervals of 0, 12, 24, and 36 in.
(Falling Weight Deflectometer)

$$AREA = 6 \left(1 + 2 \frac{D_1}{D_0} + 2 \frac{D_2}{D_0} + \frac{D_3}{D_0} \right)$$

AREA=11.1(stiff as subgrade) ~ 36(perfectly stiff)
 D_0, D_1, D_2, D_3 = Measured deflection at 0, 12, 24,
36 in. from the center of the load

Steps: (in Figure 2)

1. Known AREA and layer thickness (t) $\rightarrow E_1/E_2$
2. Known AREA, t, and load (P) $\rightarrow D_0 E_2/P$
 E_1 and E_2

Three- and Four-Layer Pavement :

Elastic layer computer program, inputs required for
backcalculation:

1. Layer thicknesses
2. Estimated E values and allowable upper and
lower limits
3. Poisson's ratios for each layer (minor effect)
4. Deflection basin measurements

BISDEF Program Output

Typical Elastic Modulus Values

Homework #1: BISDEF Trials

B.2 柔性鋪面之結構評估

1. Measure deflection basins along the project (100 ft. or 300 - 500 ft. intervals)
 - (a) Hihways: 9,000 lbs FWD loading
 - (a) Airports: 24,000 lbs FWD loading
2. Measure AC surface temperature hourly
3. Plot a maximum deflection profile along the project and examine its uniformity
4. Backcalculate the layer moduli
5. Estimate each layer modulus for each season
6. Compute critical strains for different seasons
7. Compute the expected or “allowable” number of load applications to “failure” using an AC fatigue model and a subgrade permanent deformation model

Corps of Engineers:

$$\log_{10} N_{ac} = -\left[5.01 * \log_{10} TSTRAIN + 2.6651 * \log_{10} \left(\frac{E_{ac}}{14.22}\right) + 0.392\right]$$

$$N_{sg} = \left(\frac{0.005511}{VSTRAIN}\right)^{6.527}$$

Where:

TSTRAIN = tensile strain at the bottom of the AC layer;

E_{ac} = elastic modulus of the AC layer, psi;

VSTRAIN = vertical strain on the top of the subgrade;

N_{ac} and N_{sg} = allowable load applications.

8. Compute pass damage
Damage = $\Sigma (n_i / N_i)$
9. Develop a table of results (total pass damage)
10. Computed past damage vs. expected pavement condition
11. Assess remaining life of the existing pavement

B.3由面層撓度值回算鋪面彈性模數的初步研究

資料來源：

陳建桓、李英豪，“由面層撓度值回算鋪面彈性模數的初步研究”，中華民國第八屆鋪面工程學術研討會論文輯(已接受)，台北國際會議中心，中原大學，中華民國八十四年十二月六日至八日。

B.4 BISAR程式之使用介紹

Needed Correction:

Vertical load should be input in pound per square inch (psi) instead of pound (lb)!!!