V -28 EFFECTS OF CONSOLIDATION OF FOUNDATIONS ON ASPHALT CONCRETE PAVEMENTS

J.N. Shen ○ SMJSCE Saga University
K. Onitsuka MJSCE Saga University

INTRODUCTION

Behaviors of pavement structures constructed on soft foundations will be influenced by consolidation of soft foundations. The compressive strains on the top of subgrade will be affected greatly by the consolidation of the soft foundations (Onitsuka et al, 1998). It is thought that the compressive strain is related directly with rutting of flexible pavement. Therefore, measures to minimize the influence of soft foundation on compressive strain are important to the pavements. In the study, in order to simulate design of pavement structures, the influences of the module of elasticity (E) of the pavement structures on the vertical compressive strain were performed based on CRISP program.

ANALYSIS MODEL

The pavement discussed here is a typical asphalt concrete pavement, which is used in Saga. The pavements consist of a 5 cm asphalt concrete (AC) as surface layer, a 15 cm aggregate base layer (BC), a 30 cm cement treated subbase (SBC) and treated subgrade (TS). A soft foundation (SF) supports the pavement structure. An axisymmteric (2D) model was adopted for the analysis. It is 11 m deep including 1m pavement thickness and a 10m deep soft ground, 6m wide for pavement structure, 25 m wide for the soft foundation.

All pavement materials were modeled elastically with modules of elasticity (E) and Poison's ratio (μ), see table1. The soft foundation was modeled by Cam-Clay model. Parameters of the soft foundation to describe the model were listed in also table 1. Traffic load used for the study is a standard load with a single axle of 100KN. It is 10 cm long with 0.795MPa in the 2D model.

Keywords: consolidation, asphalt concrete pavement
Department of Civil Engineering, Saga University
Honjo-1, Saga 840-802, Tel., 0952-288690

Tab.1 Parameters of pavement materials

	AC	BC	SBC	TS	SF
Module	E1	E2	E3	E4	E5
μ	0.35	0.35	0.35	0.35	0.25
κ					0.06
λ					0.61
M					2.5
Γ					1.3
γ (kN/m^3)	23	19	19	19	15
Kx (m/d)	1E-5	1E-2	1E-2	1E-2	1E-3
Ky (m/d)	0.5E-5	0.5E-5	0.5E-5	0.5E-5	0.5E-5

NUMERICAL RESULTS

Fig.1 shows the calculating results of the compressive strains with consolidation of the soft foundation for changing modules of elasticity of asphalt concrete layer (E1), base layer (E2), subbase layer (E3), subgrade (E4), with fixed modules of elasticity of other layers respectively.

It was observed that the increasing of E1 and E2 has small influence on the decreasing of compressive strain on the top of subgrade. The increasing ratios between stable compressive strains to the initial strain are almost identical, about 18% in the case, although the compressive strains vary a little, for different modules, during the consolidation.

Results, however, indicated that the E3 and E4 have much greater influences on the compressive strain than E1, E2. Not only can it decrease the initial compressive strains but also the increasing ratios.

Fig.2 shows an example of the distribution of settlement of soft foundation with consolidation. It is clear that the shape of settlement change with consolidation. The curvature of the curves of settlement near the load became less and less with the consolidation, but the settlement difference between the loading center and the point at 3m away from the loading center increase 3 times.

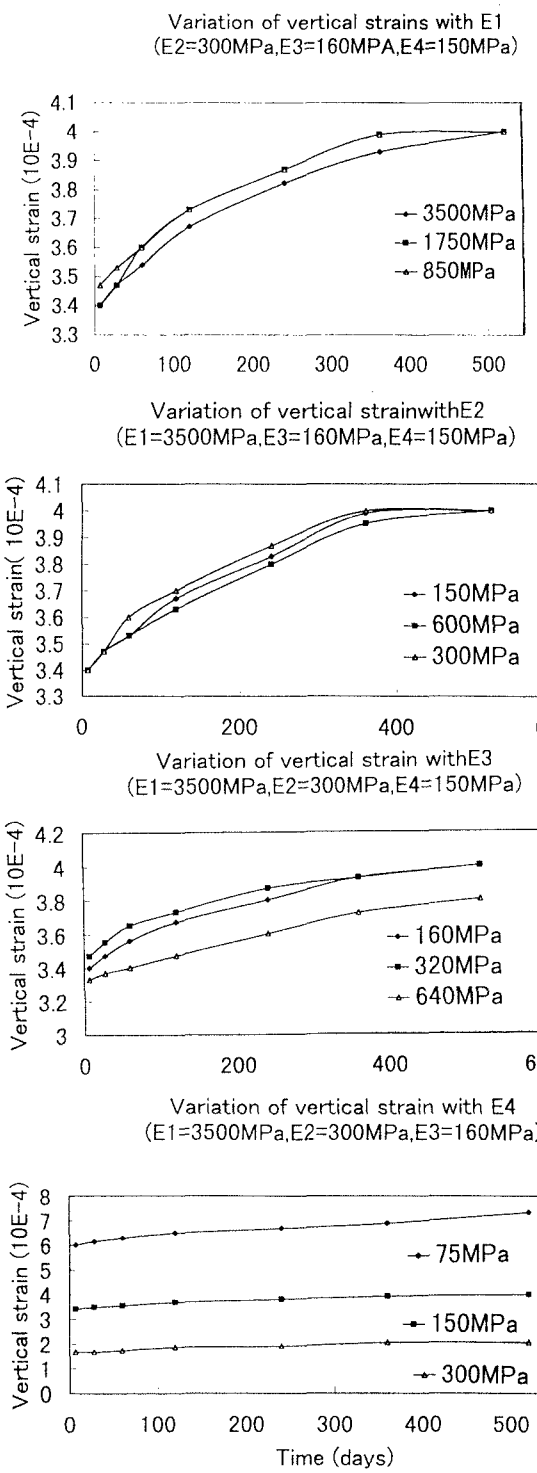

Fig.1 Variation of vertical compressive strain on the top of subgrade with consolidation for changing modules of elasticity E

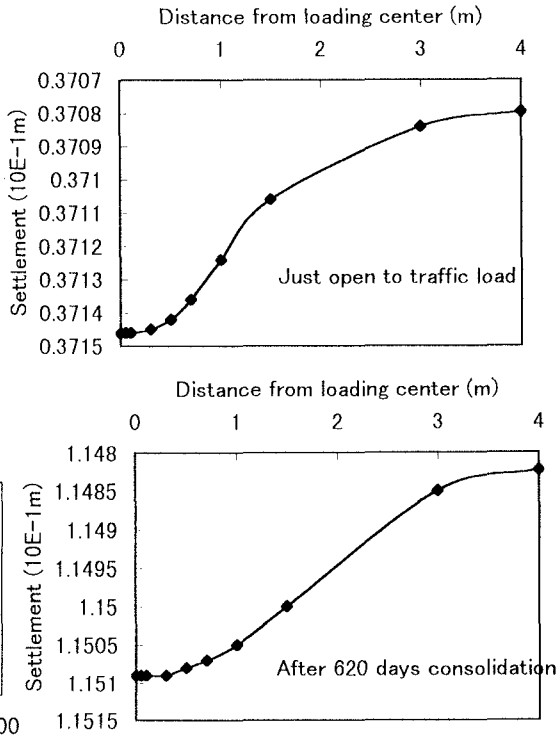

Fig.2. Distribution of settlement of soft foundation with consolidation

This is the reason that the compressive strain increase significantly with the consolidation of soft foundation.

CONCLUSIONS

Changing of modules of elasticity of pavement layers can reduce the influence of soft foundation on the compressive strains on the top of subgrade. Usually, modules of elasticity of subgrade and subbase are more sensitive than modules of asphalt concrete and base layers.

The distribution of settlement of soft foundation changes with consolidation. The different settlements of the soft foundation increase with consolidation. Thus, compressive strains in pavement structures increase with the consolidation.

REFERENCE

K. Onitsuka, J. Shen (1998) "Consolidation induced strains in asphalt concrete pavement " , Submitted to Fifth International Conference on The Bearing Capacity of Roads and Airfields, Trondheim, Norway.