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Performance testing method of geotextile for interlocking block pavement

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ABSTRACT: Geotextile has been recently introducing a part of ILB pavement because of expecting to increase its durability. The use of geotextile for ILB pavement between upper base course and cushion sand under ILB prevents the cushion sand loss into the base course. The loss often causes the change of ILB position, damage of ILB, and pavement surface unevenness. This paper first described the effect of geotextile on ILB pavement through the field research and full-scale type of accelerated pavement testing, and concluded that "Roller Compacter Testing Method" was the most optimal laboratory testing method.

1 INTRODUCTION

The application of interlocking block (ILB) for pavement material has been increasing from 1950's in European countries. It covers not only sidewalk and street but also highway of heavy traffic volumes. The utilization of ILB in Japan has started approximately on 1970 mainly for sidewalk & street in commercial areas, parks, and resort areas, because of considering on its excellent design factors, for example, colors, shapes, and surface textures. The annual total constructing area in Japan lately exceeds more than ten million square meters. The recognition of its higher durability than concrete and asphalt pavement in Japan seems to promote the appliance of ILB pavement for highway of heavy traffic volume in future.

Geotextile has been recently introducing a part of ILB pavement because of expecting to increase its durability. The use of geotextile for ILB pavement is divided into two ways. The first is geotextile between upper base course and cushion sand under ILB, which prevent the cushion sand loss into the base course. The loss often causes the change of ILB position, damage of ILB, and pavement surface unevenness. The Second is geotextile between lower base course and subgrade. It primary helps the mixture of two layers to sustain the strength of the subgrade and secondary reinforce the subgrade. The clarification of highway traffic on ILB pavement and geotextile, and the establishment of the performance testing method for geotextile are also required for identifying the effect of geotextile application for ILB pavement. The performance testing method of geotextile proposed in "prENV ISO10722-1(1977)" is insufficient for the utilization of geotextile for ILB pavement, especially for the first application, because the testing method does not consider the transitional load of highway traffic.

This paper mainly focused on the first application of geotextile for ILB pavement. It first describes the effect of geotextile on ILB pavement through the field research and full-scale type of accelerated pavement testing. Second it refers the two of new laboratory testing methods. Finally it proposes the most optimal laboratory testing method selected from the two ones.

2 EFFECT OF GEOTEXTILE ON ILB PAVEMENT

2.1 *Field research*

Geotextile between ILB and upper base course shown in Figure 1 prevents cushion sand loss into aggregate layer of the base course. Mechanical reinforcement and water drainage are secondary functions of geotextile. Four filed researches have been realized for identifying these effects of geotextile on pavement performance. All the ILB pavement of these four sites "A-D", in which highway traffic volume is approximately equivalent, have been constructed three years before the field research. Geotextile was only used for the site "D". Research items are pavement flatness, longitudinal unevenness, elastic modulus of base course and subgrade, movement of ILB, joint space of ILB, damage of ILB, and residual rate of cushion sand. Figure 2 indicates the pavement evenness shows the most significant difference between the geotextile section "D" and the non-geotextile section "A-C".

The damage of geotextile by highway traffic could not be estimated because the strong adhesion of geotextile to base course aggregate caused great damage to geotextile when base course was taken off the geotextile.

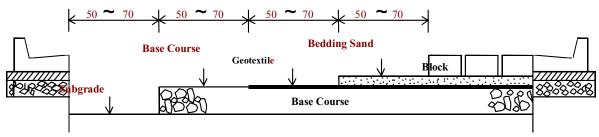


Figure 1 Geotextile for ILB pavement
(Unit: mm)

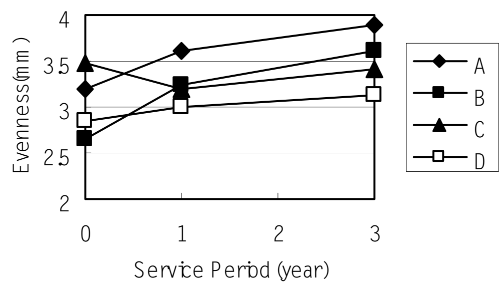


Figure 2 Effect of Geotextile on ILB Pavement
A-C: Conventional ILB pavement, D: ILB pavement with Geotextile

2.2 *Full-Scale Accelerated Pavement Testing*

A full-scale accelerated pavement testing (APT) has been conducted for more precise comparison than the field research for more precise comparison between geotextile-used ILB pavement section and non-geotextile-used ILB pavement section than the filed researches mentioned in the previous section. It is impossible to control the traffic and climate condition of different field site. The testing facility is composed of a circular testing truck of 200 meters diameter and 5 meters width, and automatically controlled three trucks shown in Figure 3.

Figure 3 Full-Scale Accelerated Pavement Testing

The number of test specimens is four listed in Table1. The ILB damaged rate is the ratio in the number of broken ILB and total ILB. Figure 4 and 5 indicate damaged ILB rate and rutting depth, respectively. Comparing the results of ILB damaged rate and rutting depth, all the geotextile-installed sections presented the better performance than none-geotextile installed sections. The difference between the geotextile-installed section and none geotextile-installed section of permeable asphalt treated base course is larger than that of mechanical stabilized base course. The relatively larger void size of permeable asphalt base course than that of mechanical stabilized base course might causes this difference.

Table 1 APT Specimens

G	eotextile	Base Course
A	No ne	Mechanically Stabilized
B	A pplied	Mechanically Stabilized
C	N one	Permeable Asphalt treated
D	A pplied	Permeable Asphalt treated

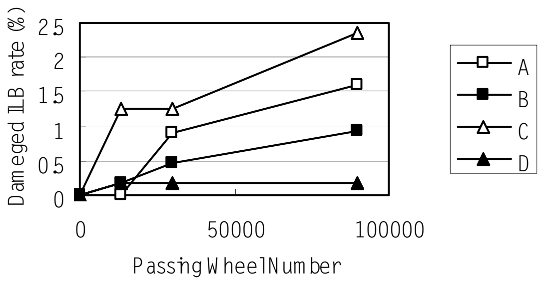


Figure 4 Damaged ILB Rate

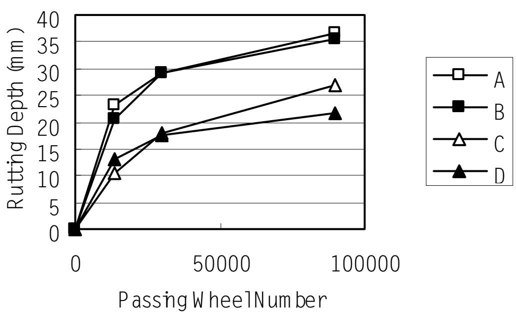


Figure 5 Rutting Depth

3 PERFORMANCE TESTING METHOD

3.1 *Specification*

The two different types of methods were tested to propose a new practical laboratory testing method for estimating the effect of geotextile on ILB pavement.

Figure 6 illustrates the general views of each test machine. Wheel tracking (WT) test is originally a testing method for asphalt pavement. Roller compacter (RC) is a machine to make specimens for asphalt mixture of highway pavement. Table 2 shows the specifications of each testing method and Figure 7 illustrates the cross-section of each specimen. Subgrade is replaced by rubber base.

ILB vertical displacement, which is corresponding to the pavement rutting depth in the previous section, ILB horizontal displacement, and geotextile damage estimated by the number of wholes and cracks, were measured after finishing these two testing methods.

(a) Roller Compacter

(b) Wheel Tracking Test Machine

Figure 6 Laboratory Testing Machines

Table 2 Test Condition

	RC Test	WT Test
Loading Weight	29.4 kN/m	686±10 N
Loading Speed	5 times/ min	5 times/min
Loading Number	100 times	100 times
Specimen Size (mm)	400×400×150	400× 400×150

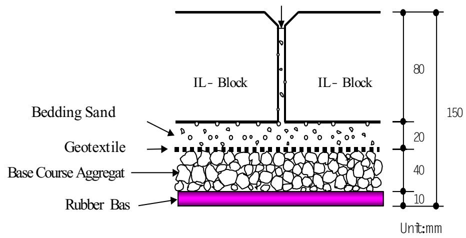
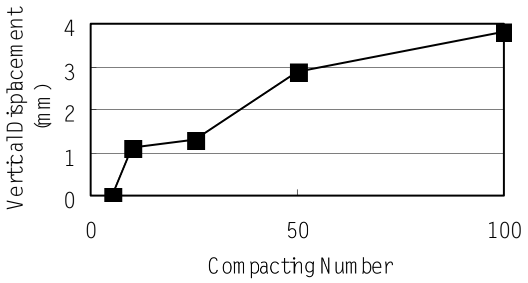


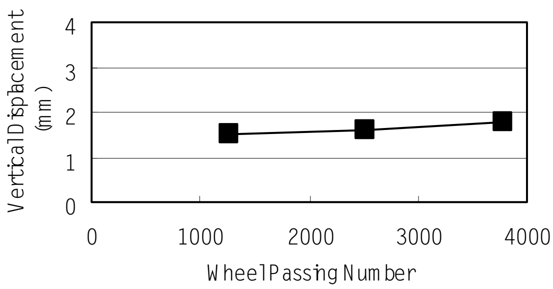
Figure 7 Specimen Cross-Section

3.2 *Result*

Figure 8 shows the vertical displacement. The amount of RC test has been increasing with the roller compacting number. No significant relationship between the amount and the wheel passing number could be found in WT test.

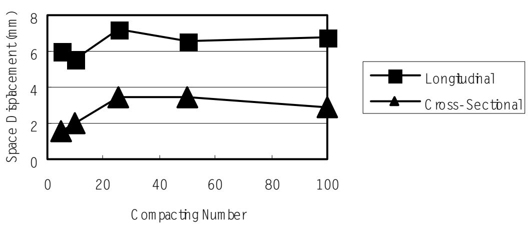


(a) RC Test

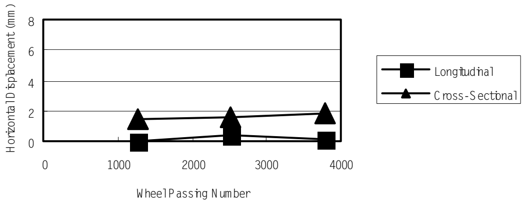


(b) WT Test
Figure 8 Vertical Displacement

Figure 9 indicates the ILB horizontal displacement both in longitudinal and lateral directions. The both displacements of RC test have been enlarging with according as the compacting number increment. The longitudinal displacements are relatively larger than the lateral ones. The displacements of WT test do not have so much close relationship with the wheel passing number as those of RC test. The longitudinal displacements are conversely smaller than the lateral ones.

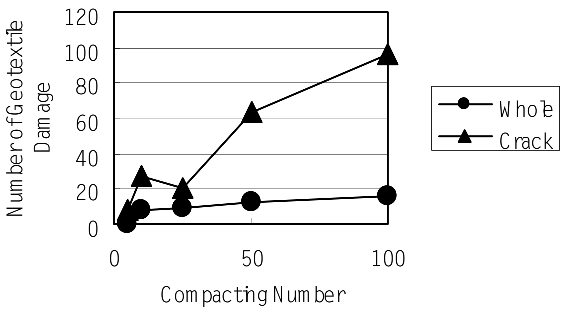


(a) RC Test

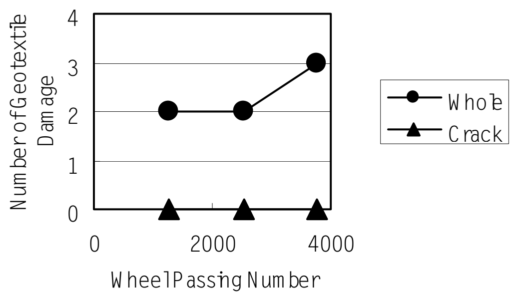


(b) WT Test
Figure 9 Horizontal Displacement

Figure 10 illustrates the geotextile damage. The geotextile damages of RC test have been enlarging with according as the roller compacting number increment. The damages of WT test do not have so much clear relationship with the wheel passing number as those of RC test.



(a) RC Test



(b) WT Test

Figure 10 Geotextile Damage

The qualitative and quantitative results of RC test agree to the results of the full-scale accelerated pavement testing. The results of WT test, on the other hand, disagree with those of the full-scale accelerated pavement testing. This fact indicates that RC test shows better performance than WT test.

This difference between the results of RC and WT test can be caused by each loading condition. RC loading plate, of which width is approximately as same as the specimen width, conflicts ILB lateral displacement. The width of WT test tire is smaller than the specimen width and the tire allows relatively larger ILB displacement in lateral direction than in longitudinal direction.

4 CONCLUSIONS

The effect of geotextile on ILB pavement performance was identified through a field research and a full-scale accelerated pavement testing method. The result comparison between the accelerated testing and two laboratory testing method proved that roller compacter test is better than wheel tracking test for performance and durability estimation of geotextile on ILB pavement.

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