INVESTIGATIONS INTO AND EVALUATION OF THE SERVICEABILITY AND CAUSES OF BREAKAGE OF INTERLOCKING BLOCK PAVEMENT IN JAPAN

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SUMMARY

Since interlocking pavers were introduced to Japan they have been widely applied, mainly to pedestrian roads such as walkways in parks, as well as to roadways and container yards. A recent estimate of the area so paved in the last year is approximately 7 million m^2 and the accumulated total areas of such pavement in Japan amount to 150 to 160 million m^2. The growing popularity of pavers has thus been remarkable. As pavers are increasingly applied, some breakages, particularly in roadways, have occurred. These are attributed to 1) rutting, 2) breakage of blocks, 3) reduction in evenness, 4) inadequate bearing capacity, 5) joint sliding, 6) disappearance of bedding sand and expansion of joint width, 7) crushing and 8) cracking around road facilities. Under these circumstances, there is a need to improve the durability of pavers and to determine means for appropriate maintenance and repair in order for the use of interlocking pavers to spread further.

The Japan Interlocking Block Pavement Engineering Association (JIPEA) has compiled an efficiency evaluation manual for interlocking block pavement, covering appropriate maintenance and repair methods. This manual includes 1) methods of investigation for accurately determining the serviceability of the pavement, 2) types of breakage and the possible causes thereof, 3) methods of investigation for selecting the appropriate means of repair and 4) methods for evaluating the serviceability and the causes of the breakage based on these investigations. This paper reports on the current investigations and the evaluation methods used for interlocking block pavement in Japan, based on the current manual.

1. INTRODUCTION

Since interlocking pavers were introduced to Japan they have been widely applied, mainly to pedestrian roads such as walkways in parks, as well as to roadways and container yards. A recent estimate of the area so paved in the last year is approximately 7 million m^2 and the accumulated total

areas of such pavement in Japan amount to 150 to 160 million m^2. The growing popularity of such pavers has thus been remarkable. As pavers are increasingly applied, some breakages, particularly in roadways, have occurred. These are attributed to 1) rutting, 2) breakage of blocks, 3) reduction in evenness, 4) inadequate bearing capacity, 5) joint sliding, 6) disappearance of bedding sand and expansion of joint width, 7) crushing and 8) cracking around road facilities. Under these circumstances, there is a need to improve the durability of pavers and to determine appropriate maintenance and repair in order for the use of interlocking pavers to spread further. The Japan Interlocking Block Pavement Engineering Association (JIPEA) has compiled an efficiency evaluation manual (JIPEA 2000) for interlocking block pavement covering appropriate maintenance and repair methods.

The aim of this paper is to discuss the current investigations and the evaluation methods used for interlocking block pavement in Japan, based on the current manual.

2. METHOD OF INVESTIGATION FOR SERVICEABILITY AND EVALUATION

2.1 Item of investigation

Both simple and quantitative investigations into the road surface have been carried out to assess the serviceability of interlocking block pavements in Japan. Simple investigations are conducted by assessing the serviceability roughly from information supplied by users and residents who live along the road. This gives a quick idea as to whether the problem concerns traffic safety; if this is the case, then repairs are carried out immediately. Also, if it is judged that preventative maintenance is needed due to the loss of joint sand, such maintenance is done.

Table 1. Example of simple and quantitative investigations

Items		Simple investigation	Quantitative investigation for the surface
Traffic Volume		Visual inspection	Traffic Volume
Rut depth		Visual inspection	Rut depth
Rate of block breakage		Visual inspection	Rate of block breakage
Smoothness	Roughness	Visual inspection	Roughness
	Faulting	Visual inspection	Faulting
Joint width		Visual inspection	Joint width
Skid resistance		Inspection by touch	Skid resistance
Permeability		Visual inspection	Permeability

On the other hand, when the simple investigation shows that there is damage to the road surface, an investigation into the surface condition is done to ascertain the reason for the change in the performance. Aspects such as volume of traffic flow, rut depth, block breakage, road roughness, joint width, skid resistance and permeability are assessed as part of the simple investigation. These items are shown in Table 1.

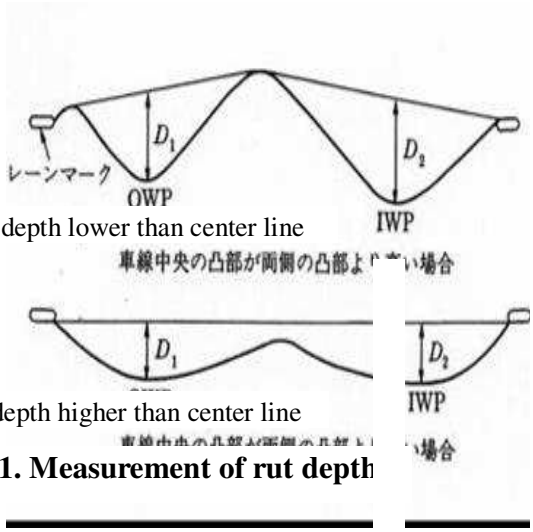


Figure 1. Measurement of rut depth

2.2 Method of investigation

Methods of investigation for the aspects listed in Table 1 (rut de block breakage rate, road roughness, displacement, joint width and skid resistance) are described below.

a) Rut depth

In general, rut depth is measured by using a leveling cord a transverse profilometer. The measurement interval is generally 20 m in the longitudinal direction (see Figure 1).

b) Rate of block breakage

Block breakages are categorized into edge defect, crack, compressive failure and stripping. These are examined close to the shoulder where rut depth is measured. The ratio of the number of blocks broken to the total number of blocks is determined; this is referred to as the ratio of block breakage.



Photograph 1. Measurement of road roughness using a 3 m profilometer

c) Road roughness

Generally, road roughness is measured in an area that is 1 m from the center line of the carriageway (see Photograph 1). Road roughness is determined from the standard deviation (σ) of vertical displacement.

d) Displacement between blocks

The displacement between blocks is assessed by visual inspection of obvious upheavals. The extent of displacement is determined by measuring the gap between two blocks (see Figure 2) using a gauge and a vernier caliper.

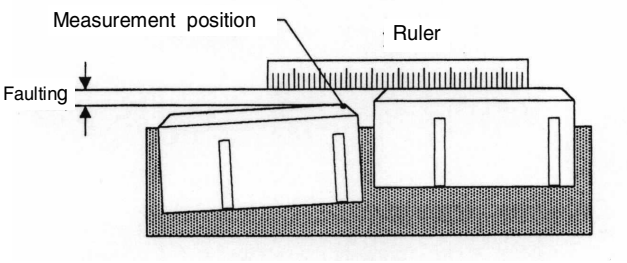


Figure 2. Method of measuring displacement

e) Joint width

Joint width is generally measured along the line of rutting. It is measured vertically to the joint line using a vernier caliper.

f) Skid resistance

Skid resistance is measured by means of a specially fitted vehicle or with a portable skid resistance tester. The former is used on carriageways to measure the coefficient of skid friction; the latter is applied to sidewalks and parking areas to determine skid resistance. If there is any difficulty in obtaining a measurement using the skid resistance measurement car, then the portable skid resistance tester is used instead.

2.3 Method of evaluation

In Japan, two methods are applied for the evaluation of serviceability. One is the method based on individual assessment against the standard value of maintenance, and the other is the method based on the MCI (Maintenance Control Index) value. Brief explanations of those indexes are given below.

Table 2. Classification for design traffic volume on carriageway

Classification for design traffic volume	Number of commercial heavy vehicle T (cv / day · direction)
I	$T < 10$
II	$10 \leqq T < 100$
III	$100 \leqq T < 250$
IV	$250 \leqq T < 1000$
V	$1000 \leqq T < 2000$

a) Method based on individual assessment

Items that are evaluated for the standard

maintenance index are: 1) extent of rut depth/local settlement, 2) rate of block breakage, 3) road roughness, 4) displacement between blocks, 5) joint width and 6) skid resistance. These values are determined for carriageways and sidewalks/parking areas which have the design traffic volume shown in Table 2; the desired values are given in Table 3. The quantified results from the surveys are compared against the maintenance index values to evaluate the condition of the surface, and then decisions about repairs are made. Although in the case of sidewalks/ parking areas, not all the maintenance index values are clearly prescribed, when safety and comfort, and aesthetic qualities are deemed to have been compromised, repair work is considered.

Investigation item / Classification of road	Rut depth Local settlement Wearing depth (mm)	Rate of block breakage (%)	Roughness σ (mm)	Faulting between blocks (mm)	Joint width (mm)	Skid resistance	
						Coefficient of skid resistance	BPN
Design traffic volume classification III、IV、V	30	20	5	5	5	0.25	(60) *1
Design traffic volume classification I 、II	40	20	6	5	5	0.25	(60) *1
Walkside/Parking	30	—	—	5	7	—	40

* 1 :In case of having difficulties for measuring coefficient of skid resistance using SCRIM

b) Method based on the MCI (Maintenance Control Index)

In this method, investigation items are combined to determine the maintenance control index from an assessment equation. The MCI is derived from an equation which takes into account some of the investigation items, and then the serviceability of the pavement is categorized as indicated in Table 4. In case of interlocking block pavement, the MCI is usually determined from equation 1, based on the rate of block breakage, rut depth and road roughness. However, if there are no results available about road roughness, it is recommended that the MCI value be determined from equation 2 (JIPEA 2005).

Table 4. Evaluation classification of MCI

Rank	Comment	Point
A	No defect (Good)	10
B	Some defects,but it seems good	8
C	Many defects, but do not need to repair	6
D	Need maintenance a little	4
E	Need large scale repair	2

$$MCI = 10 - 1.48C^{0.3} - 0.29D^{0.7} - 0.47\sigma^{0.2} \quad (1)$$

$$MCI = 10 - 1.51C^{0.3} - 0.30D^{0.7} \quad (2)$$

Where C = rate of block breakage (%), D = rut depth (mm) and σ = road roughness (mm).

3. TYPES AND CAUSES OF BREAKAGE AND ITEMS INVESTIGATED

3.1 Types and causes of breakage

The types of breakage of interlocking block pavement in Japan are shown in Table 5. According to the investigation conducted by JIPEA in 2002, and which determined the causes of

Table 5. Types of breakage in Japan

Type of breakage	Contents of breakage
Rutting	①Settlement of subgrade and base course ②Settlement due to mislaying of bedding sand ③Wearing of block
Breakage of block	①Edge defect ②Crack ③Stripping of surface
Reduction of roughness	①Faulting between blocks ②Local settlement and cave in ③Inequality
Lack of bearing capacity	①Whole pavement ②Base course ③Subgrade
Block sliding	Movement and expansion of joint
Other	①Spread of joint ②Loss of joint sand ③Clattering phenominon
	④Reduction of skid resistance ⑤Reduction of permeable performance (For permeable block)
	⑥Around road facility、Faulting of joint to other pavement surface

breakage at 48 points (see Table 6), the main problems were rutting, breakage of blocks, displacement between blocks and sliding of blocks (see Table 7). In the absence of other investigation results, it is assumed that this is the current average state of breakage of interlocking block pavement in Japan. If immediate repair is required, investigations must be conducted to identify the cause of the breakage so that the appropriate repair method can be selected.

Table 6. Summary of breakage

Application	Traffic volume for heavy vehicle T (cv / day·direction)				Total
	10≦ T < 100	100≦ T < 250	250≦ T < 1000	1000≦ T < 2000	
Arcade	9	—	—	—	9
Carriageway	9	4	—	2	15
Bus lane	—	—	7	—	7
Bus stop	1	3	1	1	6
Bus terminal	—	1	4	1	6
Intersection	—	—	3	2	5
Total	19	8	15	6	48

Table 7. Results of breakage investigation

Application	Number of application	Form of breakage									
		Rutting	Breakage of block		Reduction of roughness		Block sliding	Settlement around manhole	Faulting with other surface	Loss of joint sand	Noise and vibration
			Edge defect and crack	Wearing	Local settlement	Faulting between blocks					
Arcade	15	6	5	0	3	9	9	2	2	1	1
Carriageway	9	2	5	0	3	7	2	1	0	0	1
Bus lane	7	3	4	1	5	4	6	4	1	1	0
Bus stop	6	2	3	0	2	1	2	2	0	1	0
Bus terminal	6	3	4	0	3	1	3	3	1	0	0
Intersection	5	3	4	1	1	1	3	2	3	0	1
Total	48	19	25	2	17	23	25	14	7	3	3
(Percentage %)		(39.6)	(52.1)	(35.4)	(29.2)	(47.9)	(52.1)	(29.2)	(14.6)	(6.3)	(6.3)

3.2 Causes of breakage and investigation items

Brief explanations of each cause of breakage and the investigation items for repair are described below.

a) Rutting

Where the traffic flow is uninterrupted, remarkably deep ruts have appeared in the outer wheel paths when significant numbers of heavy vehicles have passed. This tends to occur even in the slow traffic lane, the shoulder lane, the entrance to an intersection and the climbing lane. The reasons are: 1) settlement of the subgrade and base course due to a lack of bearing capacity, 2) low quality of bedding sand due to many fine particles and a low resistance to particle crushing, 3) the mistaken use of coarse bedding sand, and 4) friction due to the low strength of the surface block mortar. Also, there are two processes that result in low resistance to particle crushing



Photograph 2. Bonding of bedding sand

in bedding sand. Firstly, the bedding sand may be crushed by the traffic load. Secondly, it can become densely compacted by the seepage of rainwater so that the particles bond together (see Photograph 2). As a result, the blocks tend to slide around on the bedding sand. Investigation items for these causes are shown in Table 8. In this case, the mould used for the CBR test is filled to about one-third of its volume with a sample of the bedding sand and then the final resistance of the sand is assessed, measured in increments of 0.075 mm passing the sieve, after it has been compacted 67 times with a 4.5 kg rammer, whose falling height is 45 cm.

Table 8. Investigation item and causes of rutting

Cause	Factor	Investigation item
Settlement of subgrade and base course	Lack of bearing capacity for subgrade and base course	①Bearing capacity for subgrade and base course
		②Traverse form of each layer
Low quality of bedding sand	Excessive fine particle	0.075mm passing
	Low resistance for grain refining	Resistance for grain refining
Misexecution of bedding sand	Excessive thickness of bedding sand	Thickness of bedding sand

b) Block breakage

Block breakage causes noise as well as being unsightly. In particular, if there has been a high rate of breakages, pedestrians experience difficulty walking on the pavement and so more noise is caused, even in towns and shopping arcades. The reasons for this problem are: 1) lower block strength, 2) sliding of blocks, 3) the pavement's lack of bearing capacity, and 4) loss of joint sand. Investigation items for these causes are summarized in Table 9.

Table 9. Investigation items and causes of block breakage

Cause	Phenomenon	Investigation item
Less strength of block	Edge defect, crack and stripping of surface due to compaction and traffic load at execution	①Bending strength
		②Compressive strength using core
Block sliding	Edge default between blocks	Movement of crack
Lack of bearing capacity of pavement	Edge defect between blocks due to traffic load with large deflection	Deflection by loading test on the block surface
Loss of joint sand	No interlocking in each blocks and then edge defect between blocks	①Loss depth of joint sand、Loss rate
		②Grading of joint sand、Loss rate

c) Increases in road roughness

An increase in road roughness reduces vehicle travel comfort and causes missteps on the sidewalk. The reasons for this are: 1) displacement between blocks due to low quality and incorrect thickness of bedding sand, 2) differential settlement of subgrade and base course, 3) loss and lateral movement of bedding sand, and 4) local settlement caused by incorrect thickness and low quality of bedding sand. See Table 10 for investigation items for those causes.

Table 10. Investigation items and causes of surface roughness

Cause	Factor	Investigation item
Faulting between blocks	Variation of block thickness	Thickness of block
	Excessive and inequal thickness of bedding sand at execution (Differential deformation of bedding sand)	Thickness of bedding sand
	Bonding due to low quality of bedding sand (Joint sand is transferred to beneath the block)	①0.075mm passing
		②Resistance for grain refining
Local settlement,cave in and inequality	Differential settlement for subgrade and base course	①Transverse form of each layer
		②Bearing capacity of subgrade and base course
	Transfer of bedding sand (For impermeable base course and slope)	①Transverse form of bedding sand
		②Grading of bedding sand (Especially 0.075mm passing)
		③Grading of base course material
	Loss of bedding sand (To base course or from joint to surface)	①Transverse form of bedding sand
		②Thickness of bedding sand
	Excessive thickness of bedding sand at execution	Thickness of bedding sand
	Bonding due to low quality of bedding sand	Grading of bedding sand (Especially 0.075mm passing)

d) Lack of bearing capacity

Lack of bearing capacity induces many distress problems such as rutting, local settlement and spurting of bedding and joint sand due to the pumping action of the traffic load. These problems are categorized as: 1) whole pavement issue, 2) base course issue, and 3) subgrade issue. These correspond to 1) lack of bearing capacity of the subgrade and base course and lack of surface thickness, 2) insufficiently thick base course and low quality of base course material, as well as poor construction techniques such as insufficient compaction of the base course, and 3) low quality of subgrade material. Investigation items for these causes are shown in Table 11.

e) Sliding of blocks

As shown in Table 7, sliding of blocks tends to occur at shopping arcades and in towns, where the right traffic lane to bus stops, bus terminals and intersections is affected.

Sliding also causes other problems such as breakage and displacement between blocks, as well as walking difficulty, so that traffic noise might be caused as well. The causes of sliding are: 1) low quality of joint sand, 2) laying patterns and block shapes that are not suitable for the traffic classification, 3) loading interactions (combinations) such as torsional and braking motions at specific places, 4) low quality of bedding sand, and 5) use of dry mixing mortar for the bedding sand.

Investigation items for these causes are shown in Table 12. In Japan the block shape and laying pattern are also specified for the traffic classification, as listed in Table 13.

Table 11. Causes and investigation items for lack of bearing capacity

Cause	Factor	Investigation items
Lack of bearing capacity on pavement	Lack of pavement thickness	Deflection by loading test on the block surface
	Lack of base course thickness	
	Misexecution of each layer	
Lack of bearing capacity on base course	Lack of base course thickness	①Deflection and settlement by loading test on the base course ②Base course thickness ③Grading of base course material,PI, Modified CBR ④Degree of compaction
	Low quality of base course material	
	Misexecution of base course	
	Influence of seepage on the granular base course	
Lack of bearing capacity on subgrade	Low quality of subgrade	①Deflection and settlement by loading test on the base course ②CBR for subgrade

Table 12. Causes and investigation items for block sliding

Cause	Phenomenon	Investigation item
Low quality of joint sand	Block sliding due to the reduction of interlocking on the bedding sand	①Loss depth and rate of joint sand
		②Grading and loss rate of joint sand
Shape and laying patter of block is inapproriate	Block sliding induced by reduction of interlocking and loading action	①Traffic classification
		②Shape and laying pattern of block
Loading action on the specific point	Caused by torsion and stopping action of vehicle at intersection and pedestrian crossing	Developmental state of lateral mov
Low quality of bedding sand	Block sliding by grain refining and bonding on the bedding sand	①0.075mm passing of bedding sand
		②Resistance for grain refining on bedding sand
Use of dry mixing mortar to the bedding sand layer	Block sliding due to the stiff bedding sand layer	Quality of bedding sand

Table 13. Shapes of blocks and laying pattern specified

Classification for design traffic	Commercial vehicles volume T (cv / day·direction)	Specification	
		Shape	Pattern of laying
I	T < 10	①Rectangle ②Square ③Hexagon ④Octagon ⑤Polygon ⑥Other	Selection is free
II	10≦ T < 100	①Waved rectangle (4 types) ②Straight rectangle (100×200mm)	①Herringbone bond 45°、90° ②Stretcher bond
III	100≦ T < 250	Waved rectangle (4 types)	Herringbone bond 45°、90°
IV	250≦ T < 1000		
V	1000≦ T < 2000		

4. INVESTIGATION INTO THE CAUSES OF BREAKAGE AND EVALUATION METHOD

4.1 Investigation method

Investigations into the causes of breakage are conducted after the current situation with regard to the extent and position of breakage assessed from a visual inspection or an excavation survey. Investigation on the surface is carried out at both breakage and non-breakage points.

Excavation surveys are conducted by excavating the area affected. This is continued until the layer causing the problem is found. They are also done at both breakage and non-breakage points, taking the current situation into account. Moreover, open-cut surveys are done, by excavating the base course and beneath the subgrade, when the deformation of the upper base course is large and the lack of bearing capacity has been confirmed. A brief explanation of these investigation methods is given below and summarized in Table14.

Table 14. Investigation items for causes in surface and excavation surveys

Cause	Investigation by excavation	
	Block and bedding sand	Subgrade and base course
① Movement of block	①Block (Thickness, Strength and permeability)	①Thickness of base course
②Faulting of block	②Quality of joint sand	② Quality of base course material
③Loss depth of bedding sand (Rate of loss)	③ Thickness, transverse form and quality of bedding sand	③Bearing capacity and transverse form on the subgrade (Deflection, surface index)
④Joint width	④ Bearing capacity and traverse form on the base course (Deflection, surface index)	④CBR for subgrade soil
⑤Bearing capacity		
⑥Method of edge treatment around road facility		

a) Sliding of blocks

Measurements of block sliding are carried out by examining a specific area. These are done in two or three lanes, corresponding to the state of movement in a transverse or longitudinal direction. A leveling cord is fixed tightly to the edge of a block which seems not to have undergone loading before. The distance from the center of the block, which is marked vertically, to the leveling cord is measured. If there is movement towards the forward-proceeding direction, the opposite block is taken as the incorrectly positioned block and then the movement is recorded along with the direction of movement of the block.

b) Depth reduction and of loss of joint sand

Investigations into depth reduction are done in two or three traffic lanes in the transverse direction, paying particular attention to points where significant amounts of lost sand are obvious. Measurement is done by inserting a vernier caliper into the joints. Also, the rate of loss is measured in the transverse direction in two to three areas of more than 5 m^2. The number of joints within the area that have lost more than 20 mm in depth is determined.

c) Bearing capacity on the surface

There are two main methods for the investigation of bearing capacity on the surface. One uses the Benkelman beam tester and the other applies a small loading tester. Recently, the Handy Falling Weight Deflectometer (HFWD) has been more widely used as a small loading tester. This employs a falling 8 kg weight loaded at 4.9 kN onto a 9 cm diameter plate. Measurements are made at both breakage and non-breakage points. As shown in Figure 3, the deflection at D_0, which is beneath the loading plate, and the deflection at D_1, which is the center of six adjoining blocks and 20 cm away from D_0, are measured using a second sensor. It is possible to evaluate the performance of load distribution utilizing the ratio of deflection between D_0 and D_1. Photograph 3 shows how such measurements are done.



D_0: Deflection below the loading plate

1 to 6: Deflection around the loading plate

Figure 3. Measurement points of deflection with HFWD



Photograph 3. Measurement of bearing capacity with Handy FWD (HFWD)

d) Bearing capacity of the base course and foundation

The HFWD and the dynamic plate loading tester are commonly used to investigate the bearing capacity, examined below the base course during an excavation survey. For the subgrade, the CBR test is often used to evaluate bearing capacity by sampling the subgrade soil. The HFWD is used to measure the deflection at a distance of 20 cm from the loading plate at both breakage and non-breakage points. For loads above traffic classification III (Table 2), the deflection at the upper base course must be less than 0.084 mm (JIPEA 2005, Kasahara et al. 1994). The dynamic plate loading tester is used by dropping a 10 kg weight from a height of 70 cm onto a loading plate 30 cm in diameter and then measuring the settlement so that the coefficient of deformation E_{v2}, which represents the deformation properties of the upper surface of the base course, is evaluated. In Japan, for roads categorized as above traffic classification Ⅲ, E_{v2} is specified as more than 180 MN/m^2.

Table 15. Evaluation method for cause investigation on surface

Investigation target	Investigation result of items aussumed the cause of breakage	Evaluation (Judgement standard for finding cause)		
		Comparison with standard	Comparison with non breakage point	Breakage
Block	Movement			○
	Wearing			○
	Skid resistance	○		
	Permeable function	○		
	Pattern of laying and shape	○		
Joint	Joint width	○		
	Loss of joint sand (depth, rate)		○	
Bearing capacity of pavement	Loading deflection on the surface		○	

4.2 Evaluation method

Evaluation methods based on the investigation results for both surface and excavation surveys are shown in Tables 15 and 16 respectively. If the investigation item is specified in a standard, it is compared against the specification, otherwise it is compared against a non-breakage point or it is judged by the extent of breakage. In Japan, the quality of blocks, and of joint and bedding sand are specified as shown in Tables 17, 18 and 19 respectively (JIPEA 2005).

Table 16. Evaluation method for cause investigation by excavation

Cause	Investigation by excavation	
	Block and bedding sand	Subgrade and base course
① Movement of block ②Faulting of block ③Loss depth of bedding sand (Rate of loss) ④Joint width ⑤Bearing capacity ⑥Method of edge treatment around road facility	① Block (Thickness, Strength and permeability) ② Quality of joint sand ③ Thickness, transverse form and quality of bedding sand ④ Bearing capacity and traverse form on the base course (Deflection, surface index)	①Thickness of base course ② Quality of base course material ③Bearing capacity and transverse form on the subgrade (Deflection, surface index) ④CBR for subgrade soil

Table 17. Quality standard for blocks

Types	Standard	Remarks
Maximum particle size	Less than 4.75mm	① Passible to lay equally ②Easy to conduct rolling ③Good for drainage ④No effect for frost heave and freezing and thawing ⑤No change of performance by seepage
0.075mm pass	Less than 5%	
Fineness modulus	1.5 to 5.5	
Resistance for grain refining	Increment of 0.75mm pass is less than 1% after compaction test	

Table 18. Quality standard of joint sand

Item	Standard	Remarks
Maximum particle size	2.36mm	①Easy to fill ②Difficult to grain refining ③Less clay and silt
0.075mm pass	Less than 10%	

Table 19. Quality standard of bedding sand

Type	Application	Item	Standard
Normal	Carriageway Car park Side walk	Size (Width, Length)	Within± 2.5mm
		Thickness	Within± 2.5mm
		Strenght(Bending strength)	More than 5.0MPa
Permeable	Side walk	Size (Width, Length)	Within± 2.5mm
		Thickness (Bending strength)	More than 3.0MPa
		Permeability	More than 1.0×10^{-2} cm / sec

5. CONCLUSIONS

This paper introduced the current investigation and evaluation methods for serviceability and the causes of breakage of interlocking block pavement in Japan. These methods are given in a manual covering the maintenance of interlocking block pavement, published by JIPEA. As there are several aspects to selecting an interlocking block pavement, such as shape of block, color, roughness and laying pattern, it is possible to construct various types of pavement surface using interlocking paving blocks. Therefore the application to other types of pavement like landscape pavement can be expected. For this reason it is very important for the future to implement appropriate maintenance and repair procedures.

6. REFERENCES

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