IMPROVEMENTS AND MEASURES CONCERNING INTERLOCKING BLOCK PAVEMENT IN JAPAN FOR PEOPLE HAVING DIFFICULTY IN SEEING AND IN WALKING

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Summary
The interlocking block(hereafter called"IL block")which was developed in Germany is now acquiring a great popularity due to its excellent characteristics in design,appearance and function. It was introduced to Japan 23 years ago and its demand has been quickly expanding since and the total paved area reached nearly 8 million square meters in 1995(statistics by Interlocking Block Pavement Technology Association).
Some of the greatest advantages of IL block pavement are load-dispersing effects by interlocked blocks and beautiful appearance by colors and shades,because of which it has been applied in walkways,parks and plazas and is extending to traffic roads now. On the other hand,as it spreads wider and wider,some points are indicated to be improved,for example,the visually handicapped point out that it is difficult to discern guiding blocks from IL block and the handicapped in walking say that the shocks they sense from wheel-chairing on IL block pavement are rather big. This paper covers the test for improving the problems mentioned above using trial pavement constructed with improved and conventional IL blocks and the study on inquiry and opinions from the handicapped who actually walked or wheel-chaired on the trial pavement.

1.Outline of the Trial Pavement Surface

Trial pavement was constructed as shown in Fig.1 in IL block combination as shown in Table 1 in a yard located in the vicinity of Tokyo. The detail of dimension of conventional IL blocks and improved ones is shown in Fig.2 and Table 2.

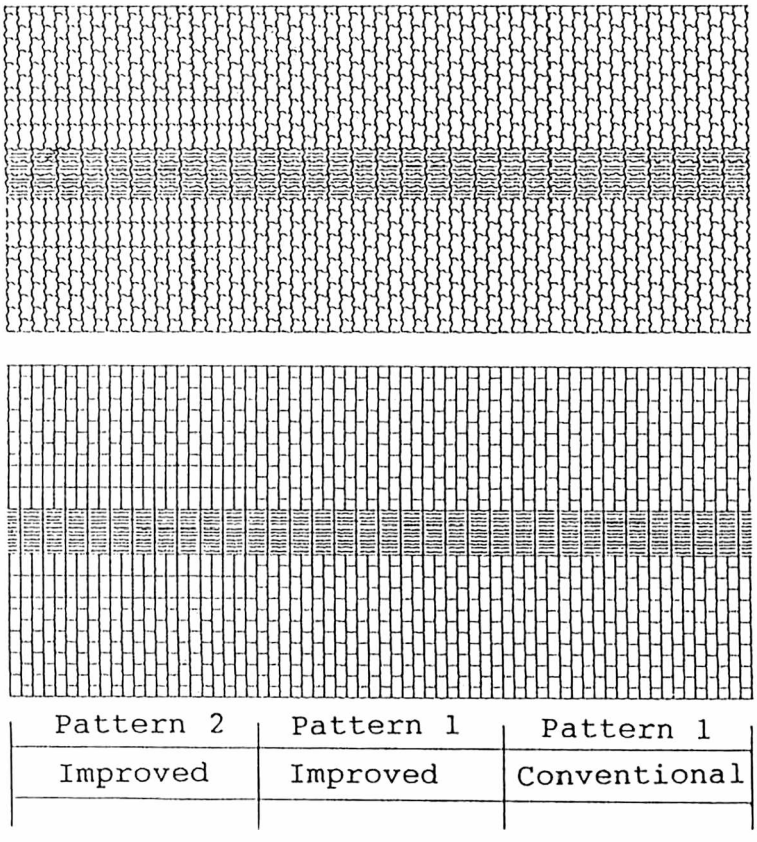

Fig.1 Plan of the IL Block Trial Pavement

Table 1 Combination of The Examination

IL Block Type / Examination Item / Laying Pattern	Uni type			Straight Type		
	Conventional	Improved	Improved	Conventional	Improved	Improved
	Pattern1		Pattern2	Pattern1		Pattern2
Walking Examination	○	○	○	○	○	○
Wheel-chairing Examination	○	○	○	○	○	○

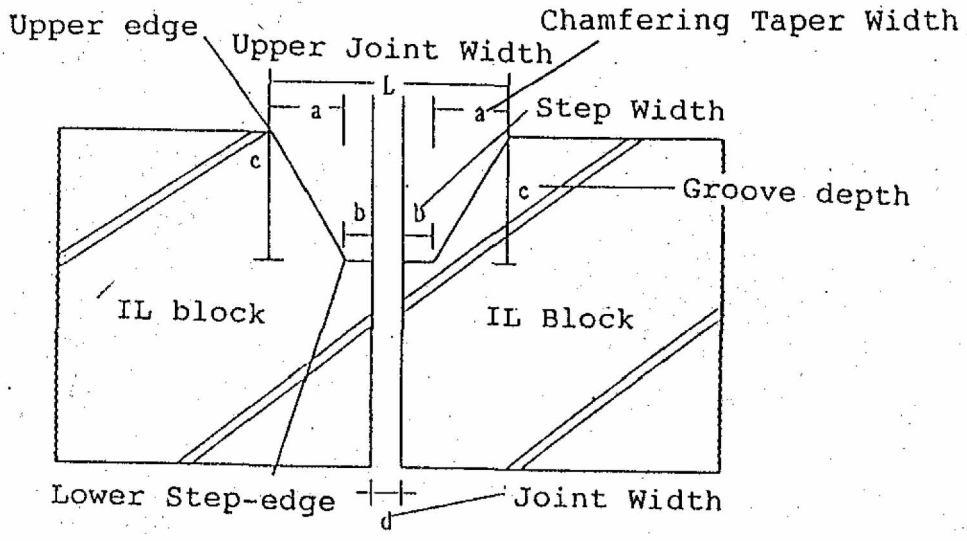

Fig.2 Chamfering of IL Block

Table 2 Chamfering Dimension of IL Block

Item / Test Sample	Chamfering Dimension (mm)			Joint Dimension (mm)	
	Chamfering Taper Width	Step Width	Groove Depth	Joint Width	Upper Joint Width
Conventional	4	1	4	3	13
Improved	2	1	2	3	9

2. Property Examination of the Pavement Surface

(1) Items of the Property Examination

The items of the property examination of the constructed trial pavement surface are as shown in Table 3.

Table 3 Items of the Trial Pavement Surface

Test Sample		Item	Joint	Evennes	Shock
Uni Type	Conventional	Laying Pattern 1	○	○	○
	Improved	Laying Pattern 1	○	○	○
	Improved	Laying Pattern 2	○	○	○
Straight Type	Conventional	Laying Pattern 1	○	○	○
	Improved	Laying Pattern 1	○	○	○
	Improved	Laying Pattern 2	○	○	○

(2) Test Method

1) Joint Width

The joint width measuring was done for the cross and longitudinal section upper joint width and the joint width using digital slide calipers.

2) Evenness

As to the cross section, evenness was measured by 3m profile-meter and as to the longitudinal section, the longitudinal configuration was measured by longitudinal profile meter.

3) Shock

The shocks were measured by vibrators attached to a front and rear wheels and to an armrest of a manual driving wheelchair. The actual value (vibration speed and vibration acceleration) was measured on the IL block pavement as well as on asphalt and tile pavements for comparison.

3.Walking Examination on the Pavement by the Handicapped

(1)Actual walking and walking examination

Actual walking and wheel-chairing examination were carried out in cooperation with official corporations and associations like Japan Association of the Blind, Tokyo Welfare Association for the Blind and so on.

1)Fig.3 shows roughly how the walking was done by the handicapped.

2)An examination group in principle consisted of one each of cooperator, assistant and examiner.

3)The examination pavement consisted of two types of interlocking blocks, three kinds of chamfering patterns totalling six cases and the examination was done on usual days and rainy days making twelve cases in all.

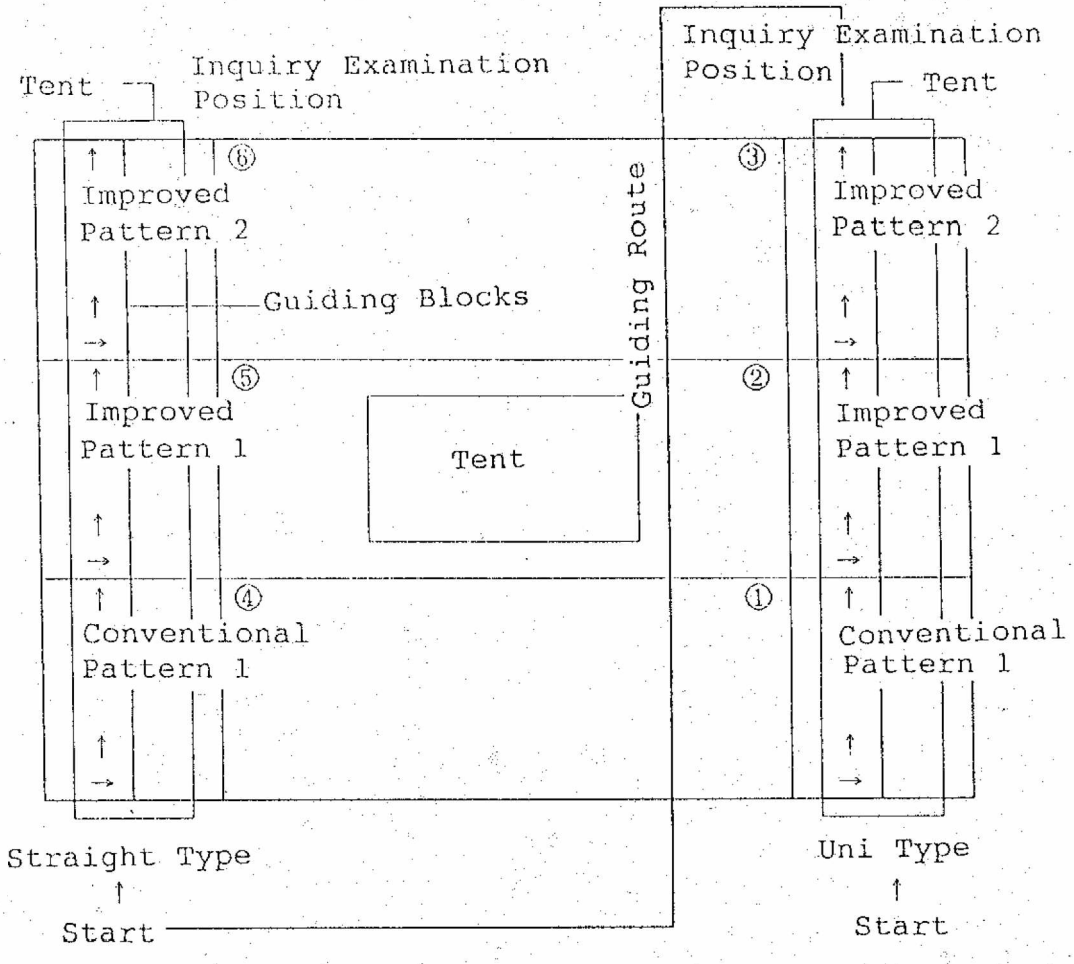

Fig.3 Route and Situation of the Examination Site

(2)Walking Examination by the Visually Handicapped

The walking examination by the visually handicapped featured "discernibility of IL blocks from guiding blocks" as well as "walking easiness" "slipperiness","hardness" and "evenness". Photo 1 shows how the examination was carried on.

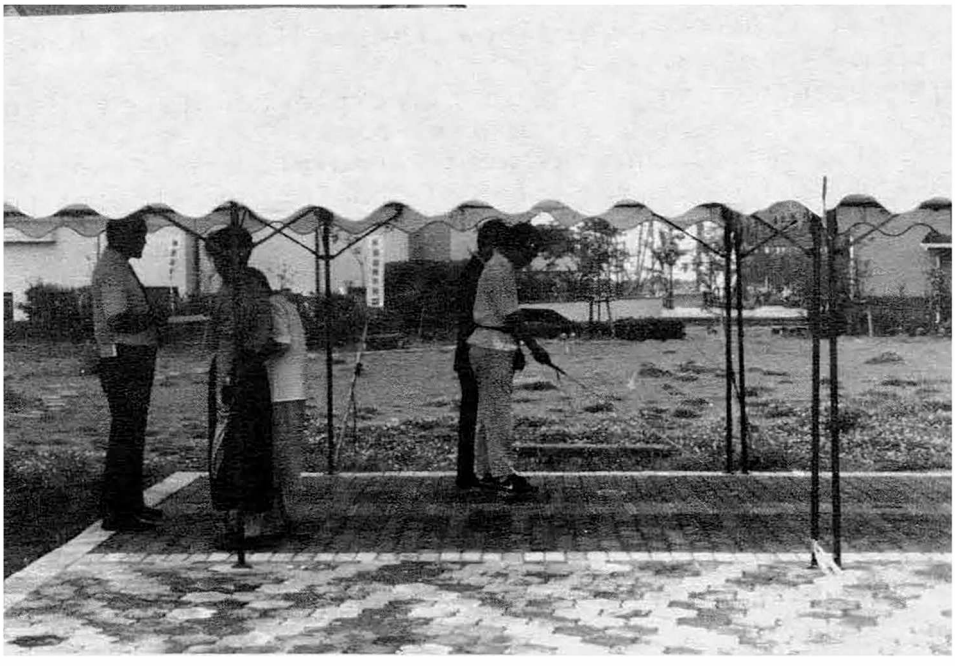

Photo 1 Walking Examination by the Visually Handicapped

(3)Wheel-chairing Examination

The wheel-chairing examination featured "shocks sensed from wheel-chairing" as well as "slipperiness" and "evenness". Photo 2 shows how the examination was carried on.

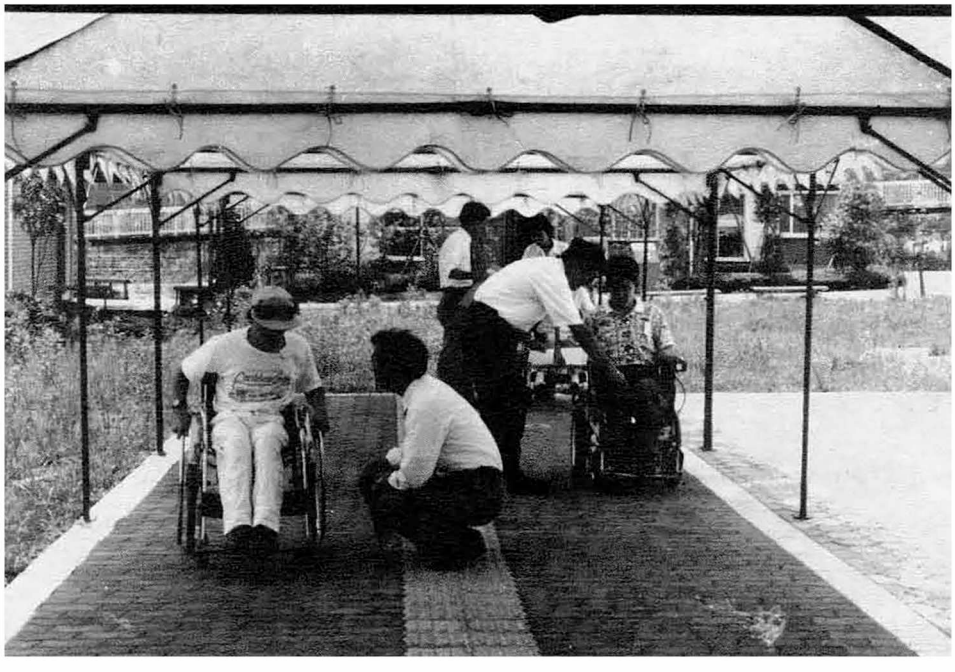

Photo 2 Wheel-chairing Examination

4.Property Examination Results of the Pavement

Summing-up with regard to joint width, evenness and shock measurement by wheelchair for the trial pavement is as follows;

(1)Joint Width

1)The total average of the joint width(d) is less than the presumed value of 3.0mm both for Uni and straight types meaning appropriate work has been done.

2)The total average of the upper joint width(L) is approximately 17mm for conventional Uni types and 14mm for conventional straight types whereas that of both improved Uni and straight types is approximately 11mm meaning the joint width became 3-6mm smaller by improved chamfering.

(2)Evenness

1)Evenness of the longitudinal section all clears the construction control limit of 5mm provided by Interlocking Block Pavement Technology Association.

2)Both improved Uni and straight types and pattern 2 are 1.0mm smaller than the conventional ones meaning the improved chamfering effect is recognized.

3)There were some places where the boundary between IL blocks and guiding blocks was ambiguous in the cross sectional profile curve.

(3)Shock

1)The actual value of vibration speed and vibration acceleration showed maximum on the front wheel as to IL block pavement and tile pavement.

2)The average actual value of vibration speed and vibration acceleration was the biggest with conventional blocks followed by improved ones and the laying pattern 2 was the smallest showing well the effect by changing chamfering and laying patterns.

3)IL block pavement shows smaller vibration acceleration and bigger vibration speed as compared with asphalt pavement and vibration speed and acceleration are both smaller as compared with tile pavement.

5.Assessment of Walking by the Handicapped

Here is a summing-up of the walking examination by the visually handicapped and by wheelchair for combined IL blocks;

(1)Walking assessment by the visually handicapped

1)Discernibility of IL blocks from guiding blocks
Conventional guiding blocks can be discerned and it will enhance by improved chamfering.

2)Walking easiness of IL blocks
No problem with the conventional ones but can be bettered by improved chamfering

3)Slipperiness of IL blocks
Some say IL blocks are slippery in the rain but mostly say it is not.

4)Hardness of IL blocks
No difference is seen in hardness for both conventional and improved IL blocks, mostly assessed soft.

5)Evenness
It is enhanced by improved ones and the laying pattern 2.

6)Opinions and requests

(a)Walking
14 to 20 visually handicapped rely upon guiding blocks and they say it is easier and safer to walk on walkways like IL blocks, flag stones or tiles which have joints

than walking on asphalt or concrete which have no joints in case there are no guiding blocks are available.

(b)Discerning guiding blocks

How the visually handicapped recognize guiding blocks is by foot and stick, but it is done mainly by foot. Some opined that sometimes it is hard to recognize. It seems because guiding blocks are lower than IL blocks and the following improvements are suggested;

-They should be laid so that the extruded surface of guiding blocks is higher than the adjacent pavement.

-The size of guiding blocks should increased to 50mm and the width between the extruded lines should be widened and the block thickness should be reduced.

-The lines on the surface should be increased by 5-6 and the joint width should be reduced.

(2)Wheel-chairing Assessment by the Handicapped

1)Wheelchairability

Improved IL blocks are easier to wheelchair than conventional ones.

2)Slipperiness of IL blocks

There is no difference in slipperiness between the conventional ones and improved IL blocks.

3)Shock

The improved ones showed better results compared to the conventional ones.

4)Evenness

The improved ones showed better results compared to the conventional ones.

5)Opinions and requests

(a)Uni and straight types have good wheelchairability and evenness and the laying pattern 2 is rhythmical and easy to move straight.

(b)The laying pattern 2 of Uni types showed much less shock compared to the conventional as well as the improved ones and straight types are less than Uni types.

6.Conclusion

The visually handicapped desire more easily discernable guiding block pavement and the handicapped on wheelchair desire pavement with less shock.

The following measures are considered to be appropriate to those requests;

(1)The conventional guiding blocks are good enough for the visually handicapped to discern but it will be further enhanced by improved chamfering tested this time. Construction should be done so that the extruded surface of guiding blocks should be higher than the adjacent pavement level.

(2)The chamfering width of the conventional block should be changed to that of the improved one for the handicapped in walking.

Last but not least, I wish to express my greatest gratitude to Japan Association of the Blind, Tokyo Welfare Association for the Blind and National Association for the Spinal Damaged for their cooperation.

References

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