MULTICOLORED DESIGN ARRANGING DEVICE (LAYING DEVICE) FOR MECHANICAL LAYING

An automatic arranging system in the manufacturing plant whereby mechanical laying is made possible for blocks with three different colors and shapes

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Summary
The trend of demand for interlocking blocks in Japan is assumed to shift from landscape-stressed demand prevailing now to heavy-load application demand.
The problems under these circumstances are;
1.A block for heavy-load application is so heavy that it limits manual laying.
2.In Japan,multicolored pavement is required even for heavy-load pavement from a landscape point of view. Therefore, blocks are prearranged manually in the plant or in the construction site for mechanical laying.
3.From a landscape point of view, there are diversified laying patterns. When multicolored pavement is further assumed, it is very difficult economically to achieve those patterns at the time of molding.
The newly developed arranging device to cope with these problems has the following functions;
1.Possible to combine blocks with three different colors with three different shapes
2.Four laying patterns possible
3.Accommodation to a change of block shapes possible
4.One time arranging area(unit area for mechanical laying) of up to 1.14sq.m.possible
The device consists of pallet supplying device,block transferring device,block line-up device,pattern forming device,color rearranging device,finished block palletization device and finished block conveying device.

The trend of demand for interlocking blocks(hereafter called "blocks")in Japan seems to shift henceforth from a landscape-stressed demand to a heavy load application demand like in Europe.
The problems under these circumstances are;

1. The thickness of available blocks for heavy load application is as thick as 80mm-100mm-120mm and blocks get dense and heavy limiting the possibility of manual laying.
2. Since we have developed demand for blocks from the landscape-stressed point of view, there are few mono-colored blocks even for heavy load demand(driveways, container yards) and random tri-colored blocks cannot be mechanically laid as they are. When they lay blocks mechanically in order to bring up laying efficiency at the construction site, blocks are manually preset for 1.0sq.m.arrangement at the manufacturing plant or at the construction site.
3. It is easy to expect that the mono-colored and simple design in Europe will henceforth shift to landscape-stressed demand, too,and the similar problem will take place when mechanical laying is assumed.
4. Prevailing domestic made block molding machines in Japan are mainly 0.6sq.m.arrangement types and even if mono-colored fish bone pattern can be arranged at the time of production, the mechanical laying efficiency is 0.5sq.m. at a time and it is not very good.

The device(called laying system) which has been developed in order to solve these problems has the following properties;

1. It can combine three kinds of color with three kinds of shape.
2. Four different laying patterns are possible.
3. It can cope with a change of block shapes.
4. Mechanical laying at one time can be 1.14sq.m.
5. As the product's dimensional fluctuation(especially side way swelling)is dispersed by combining and rearranging of blocks,joint modification is not needed.
6. There is no need for short distance transfer of heavy blocks.

The developed laying device consists of seven different devices whose designation, performance and structure are as follows;

1. Pallet supply conveyor device
   A conveyor to send in and out pallets with blocks on which are arranged as specified by the driving roller conveyor above the up-and-down double step lifter and by position fixing stopper cramp
2. First-row block suck-and-transfer device(three stations)
   A device to transfer palletized blocks; each row-unit of the palletized blocks is vacuum sucked and transferred by an up-and-down and back-and-forth device controlled by gear motor and inverter
3. Row of blocks line-up device(three stations)
   A device to fix the position by air cylinder to the base side for a row of blocks which are sucked and removed
4. Pattern forming suck-and-transfer device(three stations)
   A device to form specified patterns by the vacuum suck-and-transfer system controlling five axes, which are servomotor controlled three axes of back-and-forth, right-and-left and pitch and two axes of rotation and up-and-down by air cylinder
5. Pallet conveyor for pattern formation
   A motor driven chain delivering device of a pallet for

6.Finished pattern suck-and-transfer device for palletization
A device to vacuum-suck and transfer finished blocks placed at each station onto a pallet by an up-and-down and back-and-forth device controlled by geared motor and inverter

7.Pallet conveyor for finished blocks
A conveyor to send in and out pallets mounted with rows of blocks palletized by the up-and-down 2 step system driving roller conveyor and by position fixing stopper cramp.

Note:This device is under patent application.

1.Rearranging capacity of the laying system
rearrangements(sq.m./day),number of workmen required, hours required per day, rearrangement efficiency

2.Rearranging capacity by manpower
rearrangements(sq.m./day), number of workmen required, hours required per day, rearrangement efficiency

Note:1.It is difficult to work for a long time for rearranging manually due to its simplicity and working posture.

2.Manual rearranging cannot fix the exact position and blocks drop frequently when cramped up by the laying machine.Adding to it, modification of the joint line is required after laying.

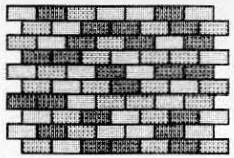
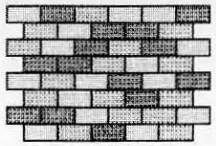
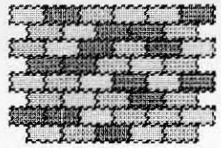
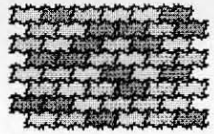
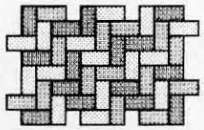
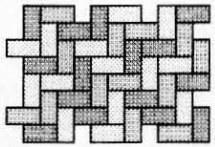
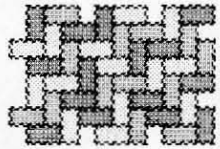
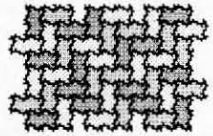
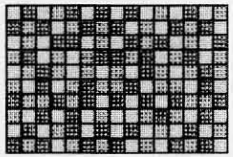
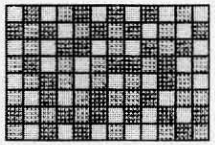
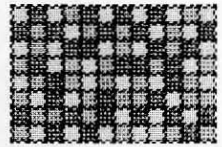
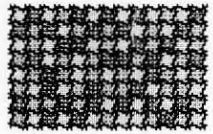
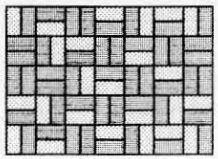
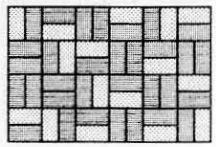
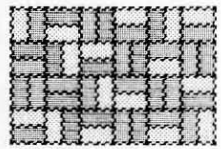
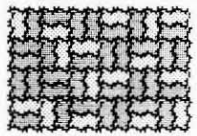
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BN-1				
	70 UNIT 1.40 m²	44 UNIT 1.27 m²	44 UNIT 1.27 m²	48 UNIT 1.22 m²
	a=1,000 b=1,500	a=960 b=1,440	a=960 b=1,440	a=900 b=1,462.5
BN-2				
	44 UNIT 0.88 m²	42 UNIT 1.21 m²	42 UNIT 1.21 m²	44 UNIT 1.11 m²
	a=800 b=1,300	a=960 b=1,440	a=960 b=1,440	a=900 b=1,462.5
BN-4				
	150 UNIT 1.50 m²	96 UNIT 1.38 m²	96 UNIT 1.38 m²	104 UNIT 1.32 m²
	a=1,000 b=1,500	a=960 b=1,440	a=960 b=1,440	a=900 b=1,462.5
BN-12				
	70 UNIT 1.40 m²	48 UNIT 1.38 m²	48 UNIT 1.38 m²	48 UNIT 1.22 m²
	a=1,000 b=1,400	a=960 b=1,440	a=960 b=1,440	a=900 b=1,350

Fig.1

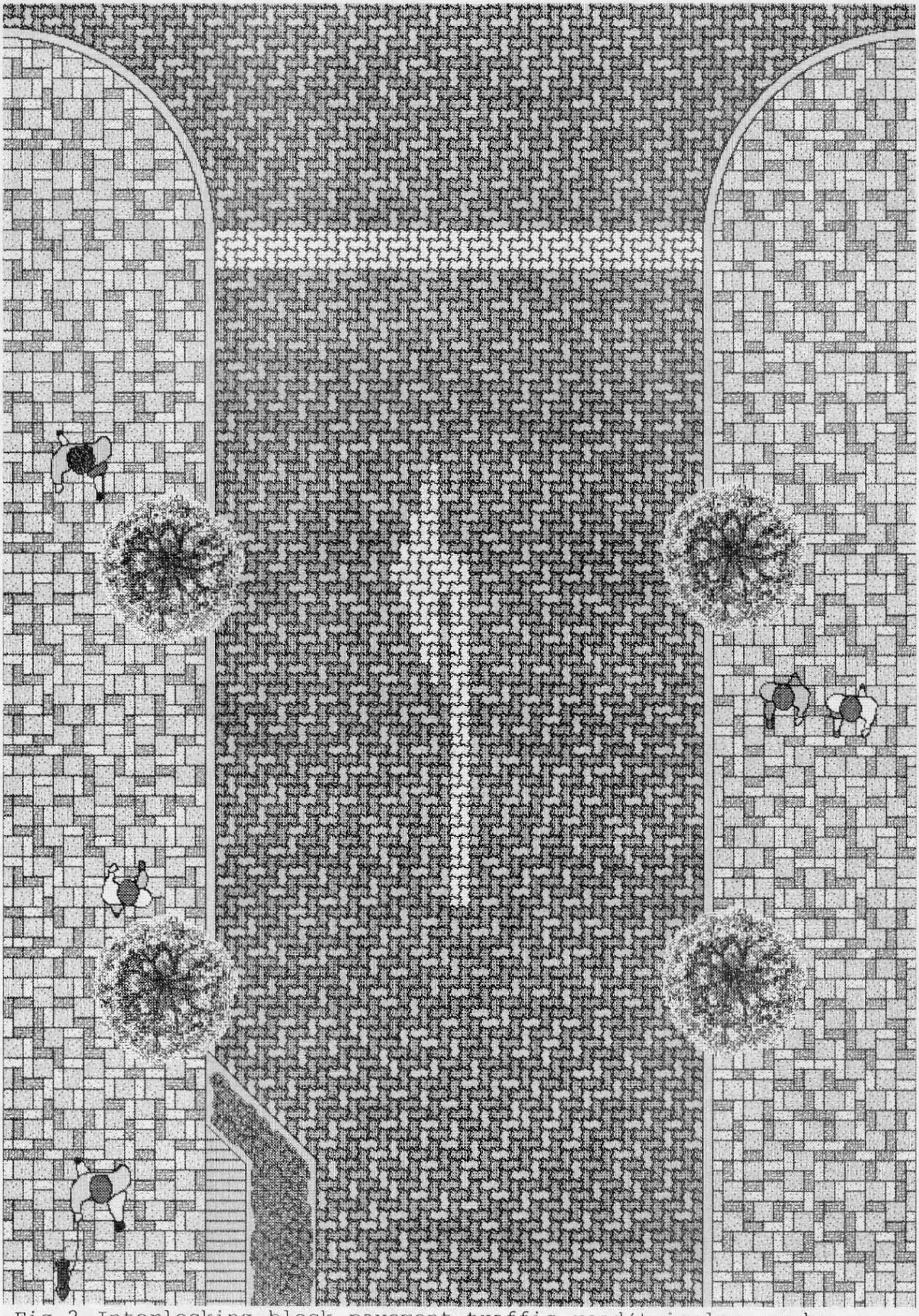


Fig.2 Interlocking block pavement-traffic road(tricolor random patching)



Photo 1. Shizuoka-nanaken-cho Street, Shizuoka-ken

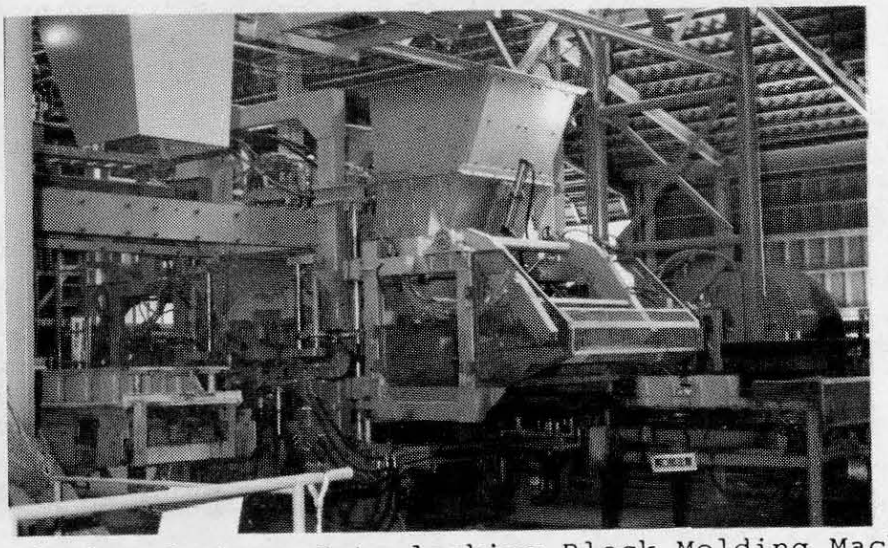


Photo 2. Laying System, Interlocking Block Molding Machine

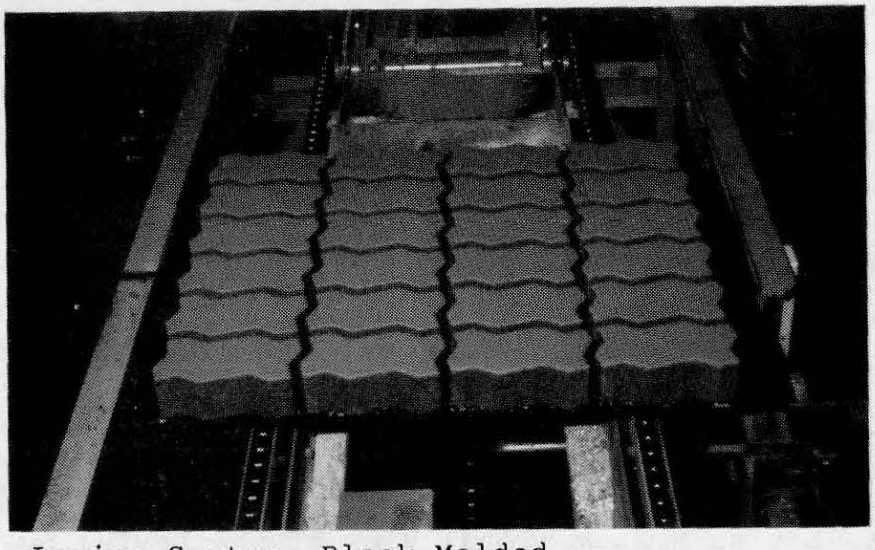


Photo 3. Laying System, Block Molded

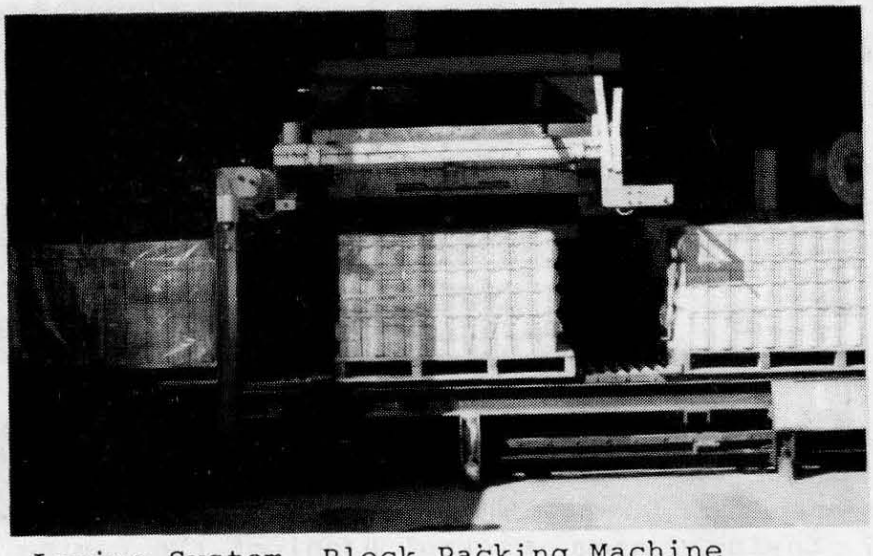


Photo 4. Laying System, Block Packing Machine

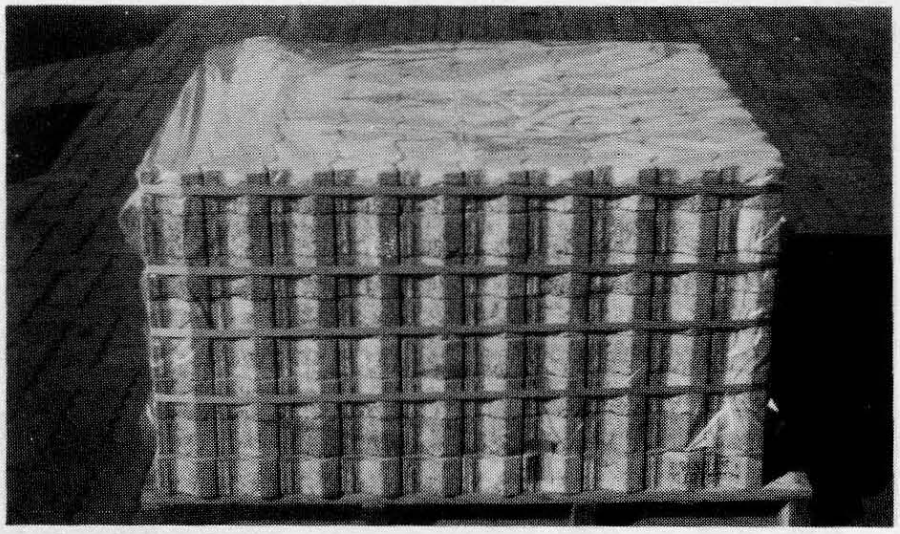


Photo 5. Block Packed

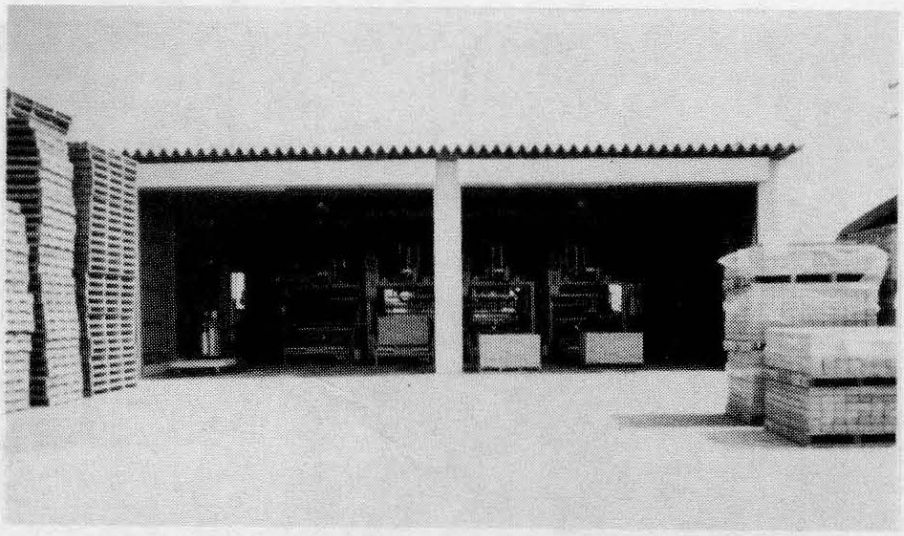


Photo 6. Laying System, Total View of the Laying System

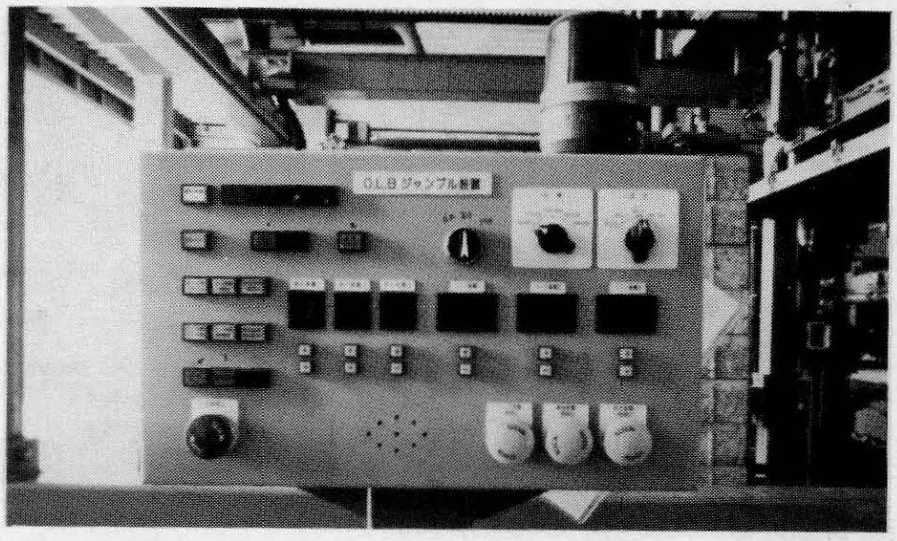


Photo 7. Laying System, Control Panel of the Laying System



Photo 8. Block sending set

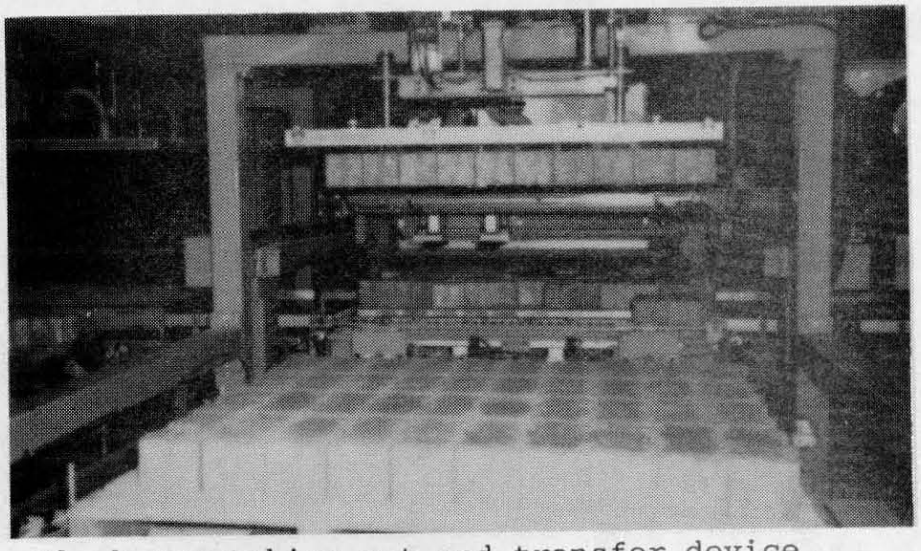


Photo 9. Block-row taking out and transfer device.



Photo 10. Block-row line-up table, laying transfer device

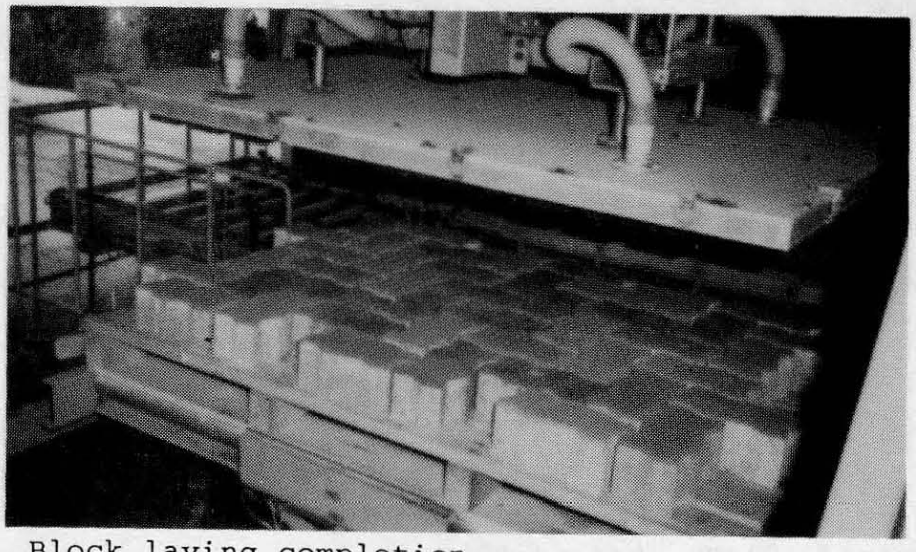


Photo 11. Block laying completion

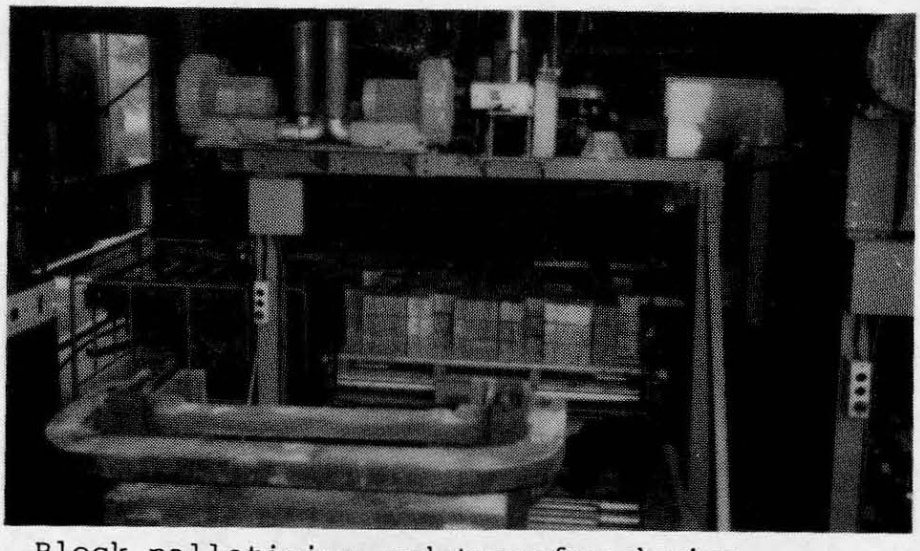


Photo 12. Block palletizing and transfer device



Photo 13. Higashi-ogishima container yard, Kawasaki-shi;the construction site and blocks



Photo 14. Higashi-ogishima container yard, Kawasaki-shi;cramped block transfer



Photo 15. Higashi-ogishima container yard, Kawasaki-shi;mechanical laying of blocks

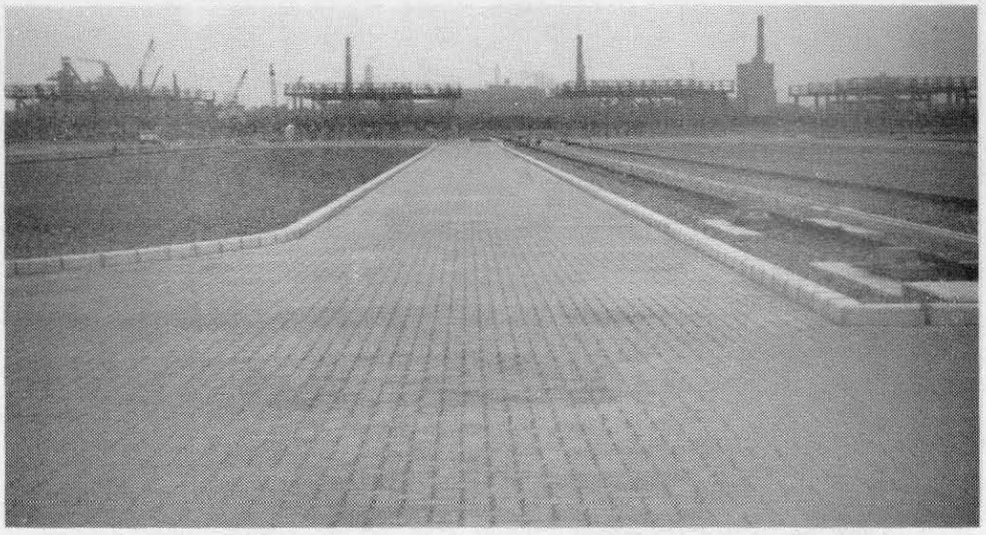


Photo 16. Higashi-ogishima container yard, Kawasaki-shi;completed site



Photo 17. Higashi-ogishima container yard, Kawasaki-shi;completed site



Photo 18. Higashi-ogishima container yard, Kawasaki-shi;completed site



Photo 19. Hukuroi Plant;packed blocks

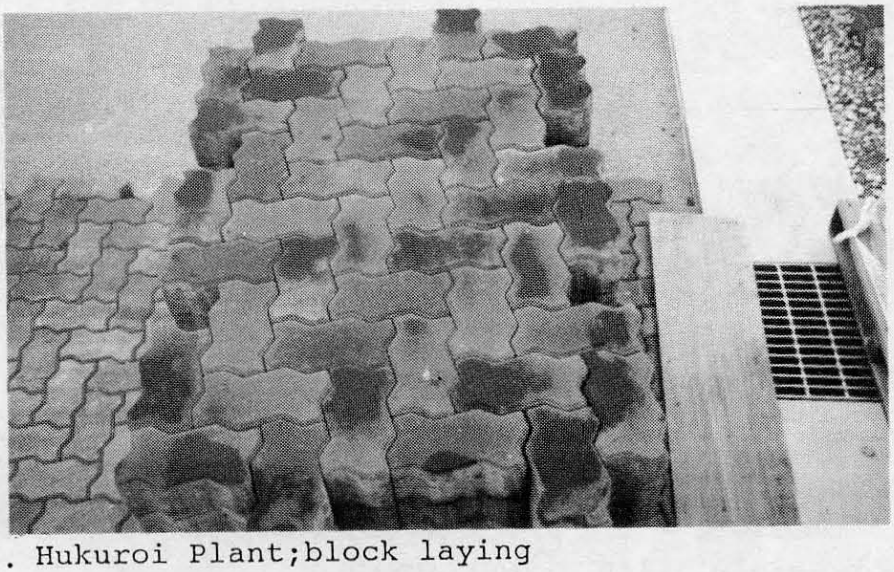


Photo 20. Hukuroi Plant;block laying

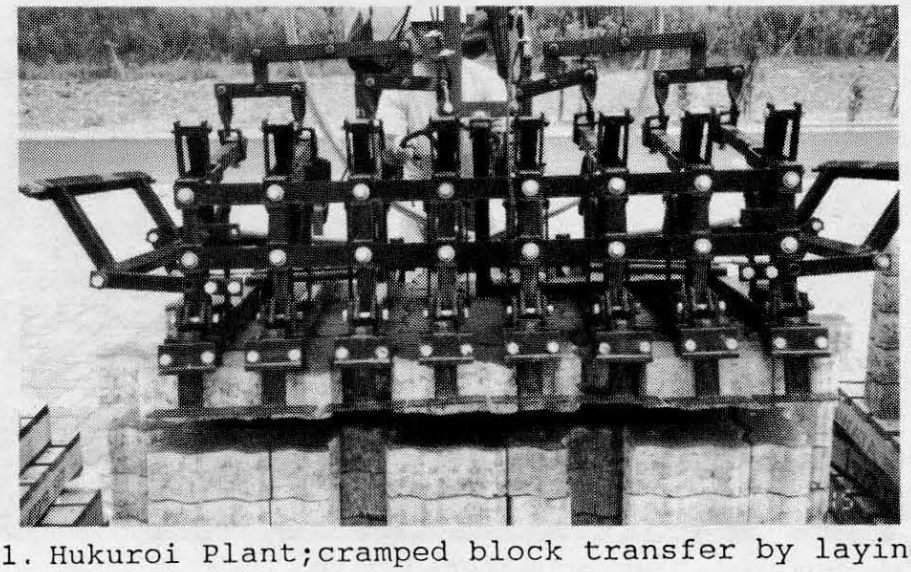


Photo 21. Hukuroi Plant;cramped block transfer by laying machine



Photo 22. Hukuroi Plant;block transfer by laying machine



Photo 23. Hukuroi Plant;block laying

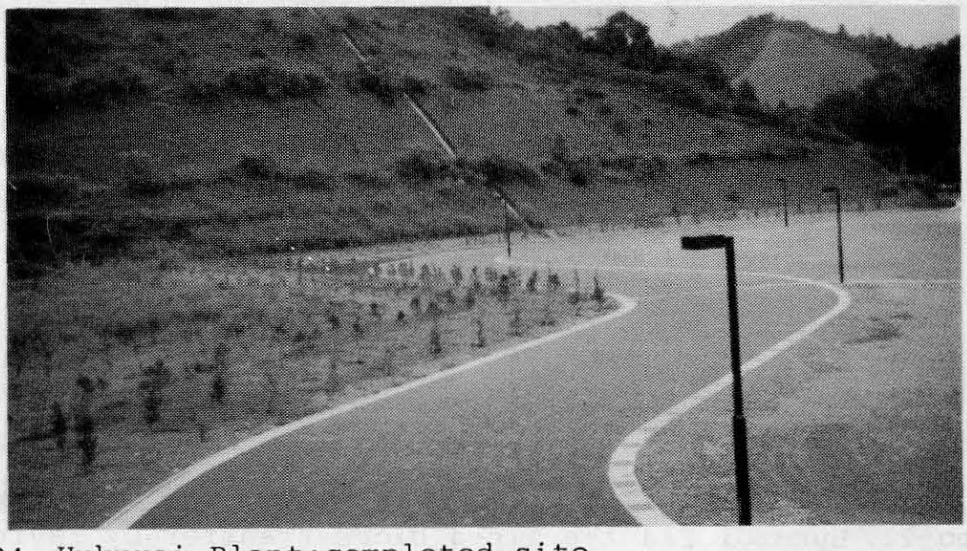


Photo 24. Hukuroi Plant;completed site