DESIGNING OF INTERLOKING BLOCK PAVEMENT WITH THE USE OF DATABASE SYSTEM

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ABSTRACT

The interlocking block was introduced into Japan about 20 years ago. Due to remarkable technological advances in the past, the interlocking block now has great varieties in colors, shapes and textures to meet customers' needs. On the other hand, one issue to be considered dealing directly with the users is how to propose designs speedily and accurately for their requests. It is not unusual to exchange ideas on various occasions until a concrete image has actually materialized. This means that a lot of time has to be spent to reach a decision. The design database system that has been developed, enables us to solve this problem and does the work more effectively. Data is classified into such database categories as construction site photographs, design sketches, so that the database entries best suited to the customer's requirements are chosen immediately. A sample design can be displayed on a computer screen at the meeting table, and as a result, it is possible to continue working for improvement with the user face to face. By using the design database system, the designing process is much shorter, and a careful consideration can also be given to environmental and welfare issues. But most importantly, it satisfies customer demands.

1. INTRODUCTION

It has been 20 years or so since the interlocking block (hereinafter referred to as IL block(s)) was introduced into Japan. Coloring black and gray monotone sidewalks with the IL blocks was indeed epoch-making. At that time, even a set of 6 primary colors was satisfactory enough for users. However, once the IL block pavement is used in many places, customer demands are diversified, and higher standard of quality has to be met. To comply with these requests, studies and research and development on the structure, quality and technologies of the IL block have been carried out by the Japan Interlocking Block Pavement Engineering Association and some other organizations. As a result, now the product itself has improved to satisfy various users' needs.

On the other hand, it is an urgent necessity to offer various designing patterns on the non-product level. Although the designing method changed from handwriting in the 70s to the computer in the 80s, the whole designing process requires a lot more time than before. This is caused by a number of factors such as the use of IL block in different colors, and environmental problems. But by far the biggest factor is how to concrete the users' requested designs out of their mental images. They describe their images in mind hoping for the designers to create what they want. If there is an image gap between the user and designer, they have to continuously work together until the right designing concept is obtained. There will not be any more of this problem, if we provide suitable design options to choose from at the very first meeting for the user. This is why we have developed

the block pavement designing database system (hereinafter referred to as DB).
This paper discusses the DB system and also writes about the IL block (colors, shapes) and designing in general from past to present.

2.CHANGES IN THE IL BLOCK IN JAPAN

With the spread of the IL block pavement, there has been a change in the types of the IL block the customers want. As an IL block supplier nationwide, we easily find this trend when we analyze the past sales volume per year. Figures 1 to 3 show the sales volume for the past 10 years.

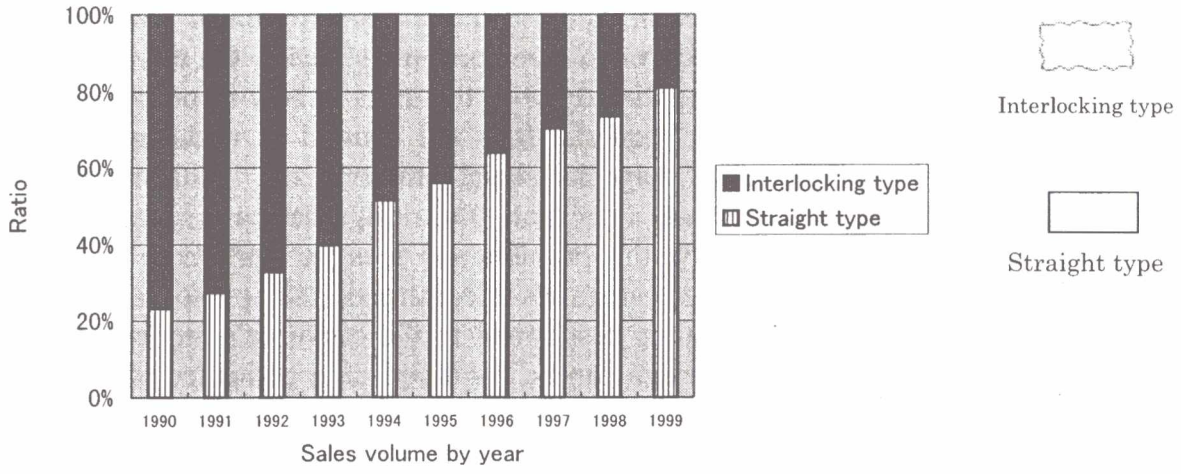

Figure 1 Changes in sales volume of interlocking type and straight type

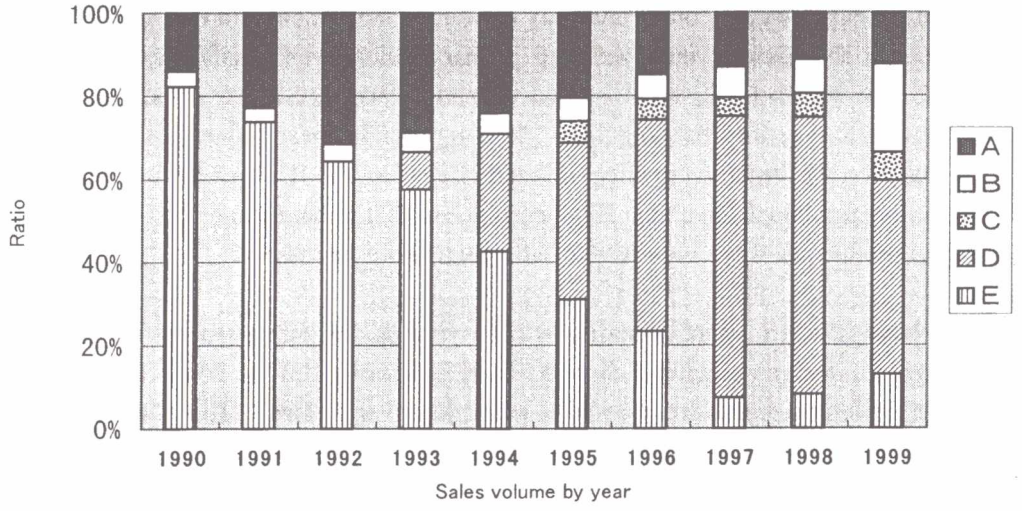

Figure 2 Changes in sales volume by type

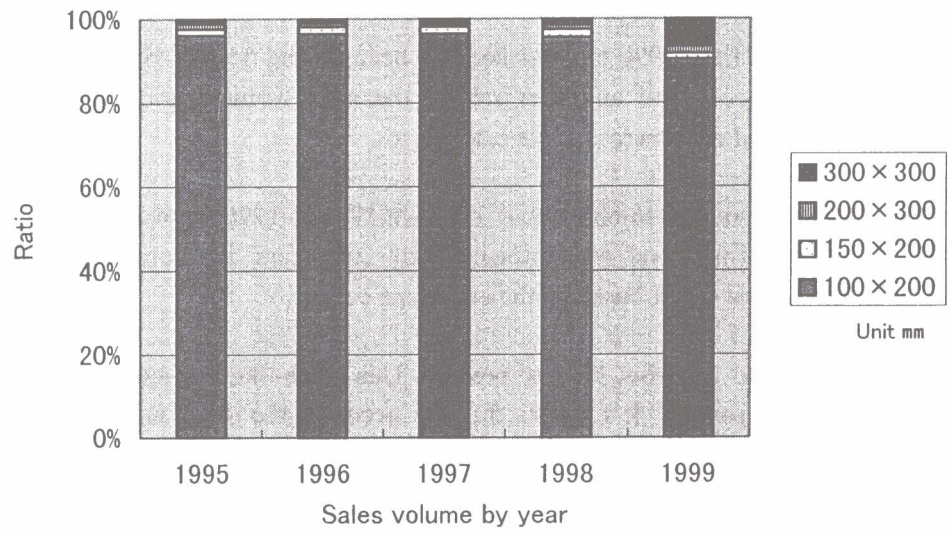

Figure 3 Changes in sales volume by size

(1) Shapes

The interlocking type accounting for about 80% in 1990, decreased to only 20% in 1999, and the straight-type accounted for 80% instead (refer to Figure 1). It is evident that the interlocking type has been rapidly replaced by the straight type. In 1976, when the IL block was on the market for the first time, there was only the interlocking type and the straight type came out in 1983. It may be assumed that the straight type gradually penetrated into the market. But in 1990, 7 years later after it's first appearance, the straight type was no longer a novelty product and both 2 types were equally accepted by users. The straight type has become more popular because it suits the tastes of the Japanese. The Japanese live in a house which is made up of simple square shaped fixtures like TATAMI", "FUSUMA", and "SHOJI" and for the Japanese, the straight shape gives a sense of security. We believe this tendency will continue in the future, and therefore, the DB database mainly contains the straight type designs.

(2) Products

Five products are compared in Table 1. Our analyses of each product, including its sales trend (refer to Figure 2) is given below.

Table 1 Il block products comparison

PRODUCT / ITEM	A	B	C	D	E
SURFACE	SURFACE FINISHING (GRIND・SHOT)	PERMEABLE	SURFACE FINISHING (SHOT)	STANDARD (NONSHOT)	STANDARD (NONSHOT)
TONE	VARIOUS COLORS	THREE COLORS (RED,BLACK, GRAY) AFTER1996, NATUAL COLORS BASED ON EARTH TONE	NATURAL COLOR OF STONE	NATURAL COLORS BASED ON EARTHTONE	ORTHODOX SIX COLORS (RED,YELLOW, BLACK,WHITE, GREEN)
PRICE	HIGH GRADE	REGULAR~ MEDIUM	MEDIUM	REGULAR	REGULAR

1) A

It doubled within 2 years from 1990 to 1992 and has been on the decline since then. This means that Japan's economic boom had an influence on the sales volume and our wide range of high-quality products suited customers' sophisticated tastes.

2) B

The permeable product amounted to only about 5% from 1990 to 1996 but was on the rise in 1997, reaching 20% in 1999. This trend was influenced by customers' environmental concerns and willingness to accept natural colors based on the earth tone color.

3) C

It accounts for around 5 to 7% from 1995 to present. This stone-like surfaced product has a very natural look when being paved. It suggests that the needs of the times are shifting toward the back-to-nature life-style.

4) D, E

E showed a decrease tendency from 1990 to 1997 but has been increasing slightly since 1998. This, to a large extent, originated in the appearance of Product D in 1993. D is one of our main products at present, which was caused by the fact that Product E has only 6 colors (red, yellow, black, green, gray, white) available. Our products offering natural colors matched customers' needs for a simple but graceful style.

(3) Size of products

According to Figure 3, 100×200 (㎜) size has been the most popular size. But comparing 1998 and 1999, 300×300 (㎜) size was on the increase. Unlike 100×200 (㎜), 300×300 (mm), a larger size than the former, has a small number of jointed spaces and is far better for people with disadvantages. For wheelchair users, the noise caused by jointed spaces is minimized, for the blind, the positions of surface indicators are easily recognizable, and for senior citizens, there is less risk of stumbling. Designed for disabled persons, 300×300 (mm) seems to have increased rapidly. Judging from the last year's increase, the number of 300×300 (㎜) size will rise more in the future.

To sum up this section of the paper. Until 1990, the products of 6 colors dominated the market. Though later in 1992, the products of various colors showed some increase, the natural color products are most common now. The notion that blocks should match their surroundings in color seems to be the norm. As for shapes, the interlocking type was gradually replaced by the straight type, amounting to 80 percent and this trend will continue in the future. Also, the increase of the permeable products and the larger size blocks reflect users' serious consideration for environment and welfare issues.

3.CHANGES IN PROPOSING DESIGNS

For the first 10 years (until 1984), all the designing work was done by handwriting. Ordinarily, the designing process included manual labor like drawing and coloring with colored pencils. It took a considerable amount of time and the whole process was rather ineffective. However, at that time, there were still 6 colors available and it was still manageable to do the work in such a manner. In addition, the IL block pavement was at an early stage, and there was little information accessible on the customers' side. Therefore, in almost all cases, our proposals were adopted completely. As the IL block was available in various colors and textures, the manual proposal became difficult. To solve this problem, we developed the "sales support system". It is a system which produces and color-prints designing sketches through the computer. This system shortened the drawing process

while with the spreading of color pavement, uses had an easy access to numerous information As a result, the initial proposal had to be revised many times. The main purpose of the development of DB was to make up for the time lost for this process. Thanks to DB, the basic design is decided at the first meeting and can be improved by revising. Then, the final form is made by CAD and is color-printed for the user's approval. This is the system widely used now. Other options are: composite photographs of IL blocks and of construction sites, three-dimensional sketches.

4.OUTLINE OF DB

(1) Conditions that the development of DB depended upon

DB was developed under the following three conditions.

1) Data must be the design sketches and photographs of sites using our products.

2) A wide variety of designs should be available to comply with users' different needs.

3) The operation of DB should be simple and easy so that even a computer beginner can handle it with ease.

Needless to say, how to classify a large volume of data was the key to success in developing DB. Because each person's sense of designing, including colors, is different, there will be no definitive answer like a math quiz. Indeed, this may be always the case, but it is also true to say that there must be some common designs and colors that a large number of people can easily accept. For example, the distinction of warm colors and cold colors is well known. The red color is associated with warm, hot, exciting. On the contrary, the blue color is cool and cold. Data categories including colors, construction patterns, textures, have been classified and filed based on our business expertise, which have made searching for sources easy.

(2) Outline of DB

DB contains about 750 design sketches and 700 photographs of constructions sites. DB requires the users to locate an entry by restricting their search with key words, concepts, or categories. It is operated through the Microsoft database software Access. Figure 4 is the flowchart of DB research process. There are two ways to find information on DB: searching with design sketches and searching with construction site photographs. Each category has 4 subcategories listing specific details. "The design sketch search" provides design sketches, photos of sites based on these sketches, and some other similar locations. This has made a blueprint a thing of the past, and helps the customer comprehend the image of the site upon completion. "The design sketch search" also places sketches of random designs by reproducing three kinds of design patterns (The ratio of each design is the same.). It is because the pattern conveys a different impression even if the same colors and designs are used (There was a need among customers to see different design patterns.).

In fact, three kinds of design patterns - Stretcher Bond, Herringbone Bond, Basket Bond, which we selected for the database, are in great demand and are very popular. The search results can be printed out (a print sample is shown in Figure 5) and be transferred to other media. Also, new data is easily added to DB when necessary.

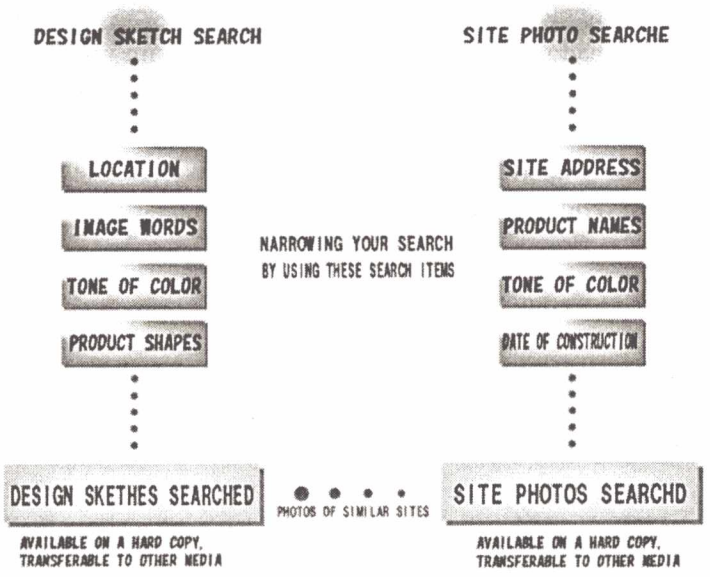

Figure 4 Flowchart of DB search process

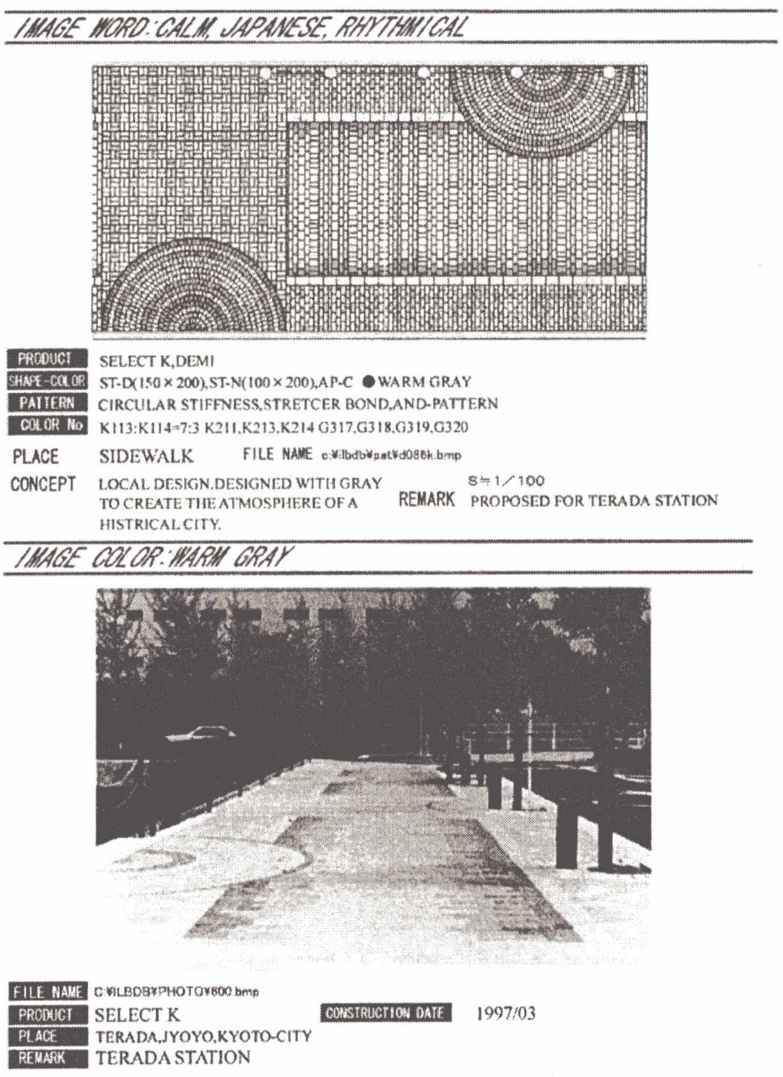

Figure 5 Hard copy sample

(3) Search items in design sketches

To search for design sketches, the four search items – locations, image words (associated with colors and designs), tone of colors and shapes of IL block, are used to locate a required data. These search items are explained below.

1) Locations

(a) Classification by purpose

Locations are classified into the five sub items: walkways, public squares, outside spaces around buildings, roads, and parking spaces. These five places were chosen because they amount to 95% of demand. If the search item walkways is chosen, DB provides design samples appropriate for walkways.

(b) Classification by motifs and paving patterns for the tactical-ground surface indicator for the blind

Other than classification by purpose, we have also another two sub items: "motifs", "paving patterns for the tactical-ground surface indicator for the blind." We included "the tactical ground surface indicator" because there are so many shapes available especially for the walkway use, and a variety of samples have to be prepared. The motifs was also added into the system, as a number of customers requested to see the designs which combine motifs like plants or animals. Seeing a combined image on a computer screen helps the customers understand what they really want.

2) Image words

At the meeting table, the client often makes a request using ambiguous words like bright or calm. This is why we gave a great attention to select image words for colors and designs. The image words consist of 18 words: 13 adjectives, 3 design words (frequently used by users) and 2 model words (as shown in Table 2).

Table 2 Design sketch search item: Image words

	1 3 Adjectives	Popular design patterns	Functional models
Image words	・Bright ・Lively ・Enjoyable ・Soft ・Natural ・Simple ・Calm ・Japanese ・Western ・Urban ・Direction ・Sharp ・Rhythmical	・Wave ・Water ・Motifs ・Random	・Guidance ・Surface indicators

3) Tone of color

Tone of color of IL block is divided into the following five types: 1. Earth red (auburn, reddish color), 2. Warm gray, 3. Brown (brownish color), 4. Violet (pink and pinkish color), 5.Others

4) Shapes

Names are given to different shapes. When users want to see a design sample using a certain shape of product, they have only to refer to the name of shape.

(4) Search items in site photos

The site photo search is exactly the same as the design sketch search. Search items include the following 4 items: 1. Products utilized, 2. Image color (classified into 5 types as in design sketch search), 3. Site location, 4. Date of construction.

5. SEARCH PROCESS AND THE BENEFITS OF USING DB

(1) Search process

An example of design sketch search is explained below:
In case of paving IL blocks for the walkway on a busy street leading to a railroad station in a Japanese historical town;

1) The location is walkway. We narrow our search with the search item walkway to locate information. Six sources related to the walkway design appear on the screen.

2) Because the walkway is located in a Japanese historical town, surrounded by old historic buildings, with the image word Japanese, we continue narrowing our search.

3) We finally track down one specific source best suited. The figure 5 (top) is the sample design we obtained after the searching process. This rhythmic but somewhat calm design sample is the most suitable one for the walkway on a busy street in a Japanese historic town.

4) To help the client visualize the design in a more concrete manner, we provide the photos of sites utilizing this design. Figure 5 is a visual aide for the user made by DB, with the sample design, the photo of the construction site and a similar site utilizing the sample design (which are available on a hard copy).

5) If the client accepts the design we have proposed, a designing plan of the site produced by CAD, will be submitted to the user for approval.

(2) Search results
The search results list the following information:

1) Design sketch search

(a) Product names, Names of block shapes, Color numbers, Paving patterns and other product information
(b) Image words, tone of color, search items matching the design sketch
(c) Design concepts and others

2) Site photo search

(a) Product names
(b) Site addressee, date of construction
(c) Tone of color of sites
(d) Others (names of sites)

(3) Benefits of DB
By using DB, we have the following benefits:

1) Reduction in working time

The whole designing process from the first hearing to the user's final decision has shortened. It is because we do not have to spend a lot of time on customers' meetings and the design producing does not take much time than it used to. In addition, collecting data (design sketches and reference photographs), which was time wasting, does not take much of our time any longer.

2) Classification and filing of information

Human beings have a limited capacity to store information and use it fully. But DB selects necessary information instantly with a set of search items.

3) Space saving

A large volume of information (design sketches, reference photos, and other necessary data) is stored, filed and classified in a computer instead of in cabinets and shelves. DB can save a lot of space in the office.

6.CONCLUSION

Since the IL block was introduced into some 20 years ago, customers' requests have varied. At the same time, there is also a great demand among users for high-quality designs.

The word "design " originally means planning, drafting, and device but also means "plot" (equal to deceiving). In other words, design is a deliberate undercover scheme in which the designers use their techniques (making space larger, distance longer or shorter etc.) to have an impact on the users' mind. Ideally, pavement designing should improve the value of the place and its surroundings. Also, it should be natural and does not change with time. To make such designing possible, the designers always have to be careful about how people see things, how things are seen by people. This way, they can create a walkway making walking enjoyable, or a space more comfortable. In block pavement designing, this is not always the case. However, in the near future, The Il block pavement designing will be sophisticated by further studies on the environment and the users' behavior. Even after the design concept is fixed, we still take time to think about complicated factors (described above) for improvement, because simply DB does not cover them. We believe that once new areas of information are filed, classified and available on DB, we can provide effectively a comfortable space and satisfy more sophisticated tastes of customers.