Guidebook for the Proper Installation of Tactile Ground Surface Indicators (Braille Blocks): Common Installation Errors

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TOKUDA Katsumi ・MIZUNO Tomomi・NISHIDATE Arisa・

ARAI Kunijiro・AOYAGI Mayumi

International Association of Traffic and Safety Sciences

6-20, 2-chome, Yaesu, Chuo-ku, Tokyo,104-0028,Japan

Tel : +81-3-3273-7884 ; Fax : +81-3-3272-7054

E-mail : mail@iatss.or.jp ; URL. http://www.iatss.or.jp

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Introduction

This guidebook is based on the findings of a long-term International Association of Traffic and Safety Sciences (IATSS) research project including field studies, experiments, interviews with the visually impaired and written surveys of wheelchair users, stroller users, the elderly and parents of small children. We fervently hope that in the hands of those involved with Tactile ground surface indicators around the world this guidebook will enable the installation, under consistent rules, of Tactile ground surface indicators that are effective in helping people with impaired vision without creating obstacles for other pedestrians. Please direct questions about the content of this guidebook or requests for additional materials to the IATSS address below.

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TOKUDA Katsumi, University of Tsukuba
MIZUNO Tomomi, Kinki University
NISHIDATE Arisa, University of Toyama
ARAI Kunijiro, University of Tsukuba
AOYAGI Mayumi, Seitoku University

International Association of Traffic and Safety Sciences
Address : 6-20, 2-chome, Yaesu, Chuo-ku, Tokyo, 104-0028,JAPAN
Tel : +81-3-3273-7884
Fax : +81-3-3272-7054
E-mail : mail@iatss.or.jp

Notice from secretariat :
This Guidebook was made as a report of IATSS Research Project and not an official guideline based on related laws and regulations.
We would advise you to confirm the latest information from web site of Ministry of Land, Infrastructure, Transport and Tourism, Government of Japan and local governments when you operate activities.

Contents

1. Guidebook Objectives

This guidebook seeks to achieve the following objectives:

1）To introduce characteristics of and issues with Tactile ground surface indicators in Europe, America, Oceania and Asia.

2）To indicate specific criteria for promoting consistent installation around the world, which is essential to ensuring that Tactile ground surface indicators function effectively for people with impaired vision.

3）To provide materials that identify specific examples of installations that confuse people with impaired vision and that can be used to improve existing improper installations.

2. Characteristics of and Issues with Tactile Ground Surface Indicators in Europe, America, Oceania and Asia

(1) Installations in Each Country and Their Characteristics

Tactile ground surface indicators facilitate the safe movement of people with impaired vision. Since being devised in Japan in 1965 they have spread to other nations around the world. Because the visually impaired can use them with almost no modification to their normal way of walking, and because the cost of installation is low, tactile ground surface indicators are believed to be the most effective system for guiding people with impaired vision. In Japan, tactile ground surface indicators are installed in accordance with local ordinances based on the Ministry of Land, Infrastructure, Transport and Tourism's Guidelines for Installation of Tactile ground surface indicators for the Visually Impaired and Commentary.

There are two types of tactile ground surface indicators: warning blocks that indicate the location of hazards or destination facilities (Fig. 1) and directional blocks that indicate direction of travel (Fig 2). Standards are inconsistent overseas, with some countries using rules and blocks similar to those in Japan and others using their own rules and country-specific blocks.

Tactile ground surface indicators are designed to enable people with impaired vision to identify their own position, hazardous locations and the direction in which to walk. They must, therefore, be installed in safe locations in a consistent manner that facilitates identification by the visually impaired through contact with the feet. Nevertheless, numerous installations in Japan are dangerous, superfluous or create an obstacle for wheelchair users and others. Such situations are increasing overseas, as well. Although Japan exports tactile ground surface indicators, it has not adequately communicated to foreign countries the appropriate methods of installation and

operation. As a consequence, people with impaired vision in many countries find it difficult to walk using tactile ground surface indicators as a guide, resulting in both accidents and confusion.

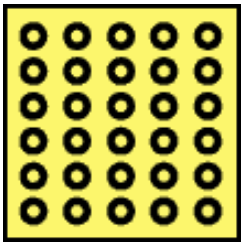


Fig. 1: Warning Block

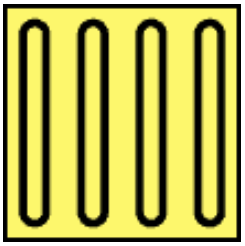


Fig. 2: Directional Block

1) Europe

①London, UK

Tactile ground surface indicators are installed at many locations throughout the city, near historical buildings like Big Ben, Buckingham Palace and the British Museum as well as in downtown and residential areas. Tactile ground surface indicators are installed in accordance with unique standards established by the United Kingdom's Department for Transport. Blocks with dots and blocks with bars are used, but both types are intended as warning blocks; neither serves a directional function.

Blocks are mainly installed before crosswalks, at medians, at station platforms and at the top and bottom of stairways. Blocks with dots are for installations at crosswalks, medians and station platforms while blocks with bars are for installations at stairways. The color of blocks installed before crosswalks is also supposed to vary with crosswalk type: red blocks are to be used before zebra crossings (where pedestrians always have the right of way), pelican crossings (equipped with push-button traffic lights) and puffin crossings (with sensor-equipped push button traffic lights) while other colors (yellow, grey, etc.) are to be used at other crosswalks where automobiles have the right of way. The difference in color is intended to assist people with low vision navigate the crosswalk safely, but many locations do not conform to the established colors. Different color blocks are also sometimes installed when repairs are made. Blocks are installed in an L-shaped configuration at crosswalks with push-button traffic signals, with the corner of the L marking the location of the push button (Fig. 3).

Blocks with bars are installed at the top and bottom of stairways such that the direction of the bars is parallel to the long dimension of the treads (Fig. 4).

Fig. 3: L-Shaped Tactile ground surface indicator Installation (London, UK)

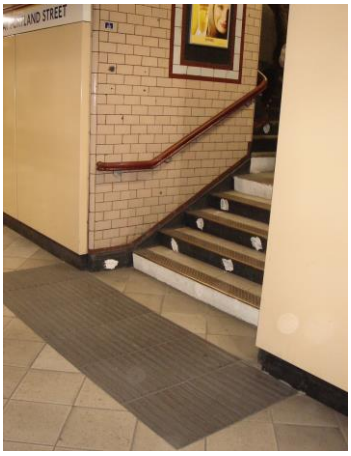


Fig. 4: Blocks with Bars Marking the Bottom of a Stairway (London, UK)

②Paris, France

In Paris, warning blocks are installed before crosswalks, at the top and bottom of stairs leading in and out of subway stations and on subway and train platforms. In some areas, blocks serving a directional function are installed within crosswalks (Fig. 5). Most blocks are white but black, grey and pale yellow are also used. To protect the scenery, subway station signs and other prominent manmade objects are not installed near historical sites such as the Arc de Triomphe, the Paris National Opera, the Louvre or the Place de la Concorde but tactile ground surface indicators, in colors that stand out (white and yellow), are an exception (Fig. 6)

Paris has recently been emphasizing barrier-free accessibility, including such experimental efforts as the uniquely configured blocks installed at the Montparnasse rail station (Fig. 7).

Fig. 5: Directional Blocks within a Crosswalk (Paris, France)

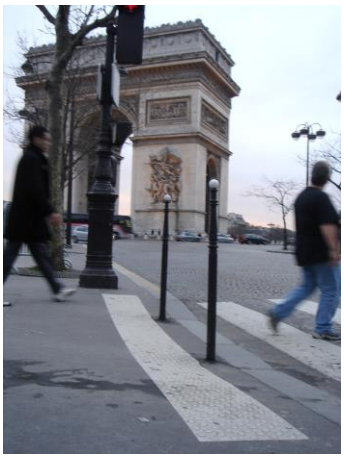


Fig. 6: Tactile Ground Surface Indicators near the Arc de Triomphe (Paris, France)

Fig. 7: Tactile Ground Surface Indicators at Montparnasse Station (Paris, France)

③Frankfurt, Germany

In Frankfurt, blocks are installed inside rail and subway stations and on the platforms at rail, subway and tram stations. Many blocks are white, although some are grey. The warning blocks inside rail stations are of similar configuration to those used in Japan. The directional blocks used at train stations and the blocks used at subway and tram stations are uniquely German in configuration. Directional blocks at train stations are made up of thin linear protrusions (Fig. 8). Directional blocks are installed at rail station platforms but no warning blocks—only non-slip strips with small dot-shaped protrusions located at the edge of the platform. Tram stations use the same directional blocks as at rail stations but warning blocks are never used at platform edges or where blocks intersect (Fig. 9).

Fig. 8: Directional Blocks Used at Rail Stations (Frankfurt, Germany)

Fig. 9: Tactile Ground Surface Indicators at Tram Station (Frankfurt, Germany)

④Brussels, Belgium

In Brussels, blocks are installed before crosswalks, at bus stops and at subway and rail stations and platforms. Most blocks are grey, with yellow, silver and black blocks also used. Brussels has a mix of locations where the blocks (warning and directional) and installation methods are similar to those in Japan and locations where block configuration and installation methods are unique to Belgium.

One of the Belgium-specific blocks uses metal disks of roughly 85mm in diameter and 8mm in height (Fig. 10). In Japan, the prescribed size of warning block protrusions is 22mm in diameter (±1.5mm) and 5mm in height, a size designed to promote mobility by the visually impaired without impeding the movement of wheelchair users or elderly pedestrians. Given the large size, height and slipperiness of the metal disks used in the Belgian blocks, one suspects that they present a significant obstacle for wheelchair users, children and the elderly.

In one part of the city, metal bars are embedded in the road surface where one would expect to find warning blocks (at the top of stairs and escalators, for example) (Fig. 11). Being only 3mm in height, these protrusions create no obstacle for wheelchair users or elderly pedestrians but also seem likely to go unnoticed by the visually impaired. In some places, similar metal bars are embedded in the road surface and serve a directional function (Fig. 12). Rubber warning blocks are also sometimes installed at bus stops where directional blocks intersect (Fig. 13).

Brussels, therefore, presents a mix of block types and installation styles that may create confusion for people with impaired vision.

Fig. 10: Metal Disks Used in Belgium (Brussels, Belgium)

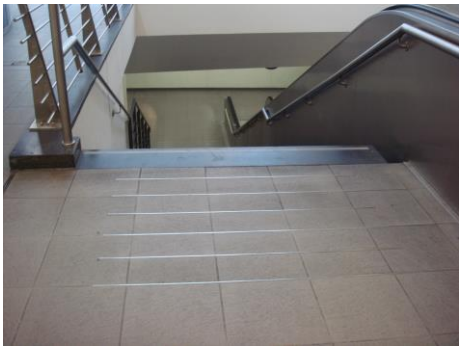


Fig. 11: Embedded Metal Bars Marking the Top of a Stairway (Brussels, Belgium)

Fig. 12: Embedded Directional Metal Bars (Brussels, Belgium)

Fig. 13: Rubber Warning Blocks Where Directional Blocks Intersect (Brussels, Belgium)

⑤Amsterdam, Netherlands

In Amsterdam, blocks are installed before crosswalks, at medians and on tram and subway platforms. Both warning blocks and directional blocks are installed according to the same rules as in Japan. Netherlands-specific blocks are used in addition to blocks configured like those in Japan. Most directional blocks are white or grey while warning blocks are yellow or grey. Where directional and warning blocks are used together the color of the blocks is often not uniform.

Netherlands-specific blocks include some with thin recessed lines as in Fig. 14. With very little surface irregularity, such blocks are extremely difficult to detect with the feet or a white cane. Grooves carved into the pavement at subway station platforms (Fig. 15) are also difficult for people with impaired vision to recognize.

Fig. 14: Netherlands-Style Warning Blocks (Amsterdam, Netherlands)

Fig. 15: Grooves Carved into the Pavement(Amsterdam, Netherlands)

2) The Americas

①USA (San Francisco, Los Angeles and San Diego, California)

California uses distinctive landmarks to help the visually impaired cross the road safely (Fig. 16). Rather than lay down tactile ground surface indicators before crosswalks, shallow grooves are cut into the pavement. These are more difficult to detect than tactile ground surface indicators when using feet or a cane. This installation method is uniform in San Francisco, Los Angeles and San Diego.

Although the number of locations is not large, warning blocks like those in Japan are also used before crosswalks, at rail and subway stations and at tram platforms. Directional blocks are also installed at rail station platforms. Blocks are yellow, black or white. Installations of blocks before crosswalks (Fig. 17) appear arbitrary, lacking consistent rules.

At rail station platforms, directional blocks are installed near train doors (Fig. 18). However, only one or two blocks (30–60cm) are installed as landmarks at each location; they do not serve to direct people toward stairways or ticket gates.

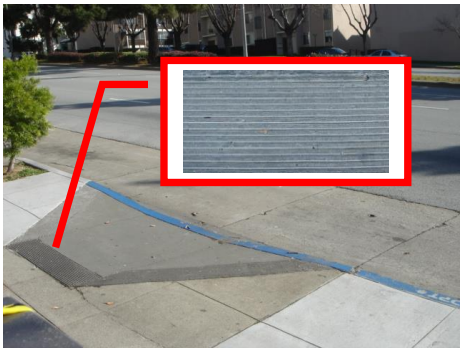


Fig.16: Shallow Grooves Cut into the Pavement before a Crosswalk (San Francisco, USA)

Fig. 17: Tactile Ground Surface Indicators before a Crosswalk (San Francisco, USA)

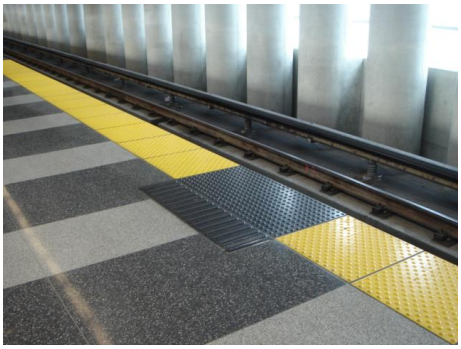


Fig. 18: Tactile Ground Surface Indicators at a Rail Station Platform (San Francisco, USA)

②Tijuana, Mexico

Tijuana uses landmark installations before crosswalks that are similar to those used in California. There are, however, no installations of tactile ground surface indicators.

3) Oceania

①Sydney, Australia

In Sydney, blocks are installed at rail, monorail and light rail station platforms, before exterior stairways, before exterior obstacles, at airports and at bus stops. Warning blocks and directional blocks are similar to those used in Japan, and installed in the same way, including at the Opera House and other well-known tourist spots. Unlike many other countries, however, blocks are not installed before crosswalks. As some rail, monorail and light rail stations, directional blocks lead from at or near the ticket gates to the platform. Blocks are yellow, silver, blue, green and grey. Blue blocks are frequently used at rail stations while yellow is often used at monorail and light rail stations.

②Auckland, New Zealand

In Auckland, warning blocks are installed before crosswalks in the city center, at rails stations and platforms and before interior stairways at shopping centers and other large-scale facilities. In suburban areas, directional blocks and warning blocks are installed before crosswalks to create a T-shaped configuration of about 1–1.5m. In addition, directional and warning blocks are also installed in areas with facilities for people with disabilities. Such blocks are installed in the same manner as in Japan. Blocks are most often yellow, with silver and white also used.

4) Asia

①Seoul, Busan and Daegu, Korea

In Korea, warning blocks and directional blocks are installed in accordance with Japanese rules in many locations including sidewalks, subway and rail stations and platforms, public facilities and large shopping centers. The configuration of the blocks, with the exception of some subway stations in Seoul (Fig. 19), is the same. Blocks are yellow, silver, brown, white and grey. Because installation methods are adopted whole cloth from Japan, many of the same errors are found.

Fig. 19: Blocks Used in Some Seoul Subway Stations (Seoul, Korea)

②Beijing, Shanghai, Dalian and Guangzhou, China

Tactile ground surface indicators are installed broadly in major cities such as Beijing, Shanghai, Dalian and Guangzhou. They can also be found winding through suburban areas surrounding major cities; the volume of blocks installed is second only to Japan. Both warning and directional blocks are used, and installed in a manner roughly the same as in Japan. Some areas have their own rules, however, such as in parts of Guangzhou where no blocks are installed where directional blocks intersect, a location where warning blocks would normally be installed (Fig. 20). Block colors include yellow, grey, green, brown and beige. As in Korea, because installation methods are adopted whole cloth from Japan, many of the same errors are found. Maintenance is also inconsistent; here and there one sees broken blocks that have been left unrepaired.

③Taipei and Taichung, Taiwan

As in Korea and China, in Taiwan warning blocks and directional blocks are installed in accordance with rules nearly identical to those in Japan. Most blocks are yellow, with grey blocks also in use. Tactile ground surface indicators are frequently installed across the entire sloped area leading to a crosswalk (Fig. 21), creating an obstacle for wheelchair users and others. In addition, although there are many stepped areas on sidewalks in the city center, very few are marked with warning blocks. This is dangerous for people with impaired vision and fails to accommodate their needs.

④Hong Kong

In Hong Kong, warning and directional blocks are found at and around rail stations and warning blocks are installed before crosswalks and at medians in the city center. Blocks are yellow, silver, black, grey, green and brown. Installation methods are roughly the same as in Japan.

⑤Singapore

In Singapore, warning and directional blocks are installed primarily around subway stations. Installation rules are roughly the same as in Japan. Only a very few crosswalks in urban areas are equipped with warning blocks. Blocks are silver, yellow and grey.

⑥Kuala Lumpur, Malaysia

In Kuala Lumpur, blocks are installed mainly at rail, subway, LRT and monorail stations and the surrounding sidewalks. In some locations warning and directional blocks are installed as in Japan while in other locations directional indicators are carved into the pavement and warning blocks are installed where directional markers intersect and where pedestrians are to stop (Fig. 22). The latter practice is often followed at rail and LRT stations but the two types were found to coexist at one location. Blocks are yellow, silver and grey.

⑦Jakarta, Indonesia

Warning blocks indicating the entrance to parking lots are installed on the sidewalks in Jakarta's Jalan Thamrin business area as shown in Fig. 23, an installation method unique to Indonesia. Blocks of this type are installed at nearly every parking lot entrance, making for a great many installations. Warning blocks are also installed before some crosswalks in the Jalan Thamrin area. No blocks are installed outside this area, however. Blocks are yellow in color.

⑧Bangkok, Thailand

Warning and directional blocks are used on many sidewalks in central Bangkok. Warning blocks are also installed at the top and bottom of stairways at subway and monorail stations. Blocks are not, however, installed at rail stations or rail platforms. Installation rules are roughly the same as in Japan. Blocks are yellow or grey. Many damaged blocks seem to be left unrepaired. Bangkok is a city with many vendors who set up shop on sidewalks; these frequently end up covering the blocks (Fig. 24).

Fig. 20: No Blocks Used Where Directional Blocks Intersect (Guangzhou, China)

Fig. 21: Blocks Installed Across the Sloped Area before a Crosswalk (Taipei, Taiwan)

Fig. 22: Directional Indicators Carved Into the Pavement (Kuala Lumpur, Malaysia)

Fig. 23: Tactile Ground Surface Indicators Used to Indicate Parking Lot Entrances (Jakarta, Indonesia)

Fig. 24: Sidewalk Vendors Covering Blocks (Bangkok, Thailand)

(2) Installation Errors Similar to Those in Japan

As mentioned above, many countries install their blocks following installation methods used in Japan, and "import" the same sort of installation errors seen in Japan. Below we discuss examples of blocks installed overseas that exhibit such errors.

1） Failure to Install Warning Blocks Before Crosswalks and Stairways

Examples of warning blocks not being installed before crosswalks or stairways despite the directional blocks leading to such spots were observed in New Zealand, Korea, China and Taiwan.

2） Narrow Warning Blocks

Examples of narrow warning blocks were observed in the UK, Australia, Korea and Taiwan. Such installations at station platforms, as in Fig. 25, can lead a person with impaired vision to fall onto the track.

Fig. 25: Use of Narrow (15cm Wide) Warning Blocks (Sydney, Australia)

3）Incorrectly Located Blocks

Incorrectly located blocks include warning blocks positioned too far from obstacles, those positioned too close to obstacles, failing to indicate the start or end of a stairway and incorrect positioning of blocks at the entrance to crosswalks or doors.

Examples of warning blocks positioned too far from obstacles were observed in the USA, Australia, Korea, Taiwan and Hong Kong. Examples of blocks positioned too close to obstacles were found in Korea and China. Examples of incorrect positioning of blocks at the entrance to crosswalks or doors were found in France, the USA, Australia, Korea and Taiwan (Fig. 26). Such errors are the result of failing, when modifying the location of a crosswalk, to change the location of the blocks, instead leaving them where they were.

4）Failure to Install Warning Blocks Where Directional Blocks Intersect

Examples of failing to install warning blocks where directional blocks intersect, as in Fig. 27, were observed in Korea, China, Taiwan, Malaysia and Thailand. Such installations can lead a person with impaired vision to become lost by preventing detection of a turning point

5）Obstacles Above or Near (Within 30cm of) tactile ground surface indicators

Examples of obstacles above or near directional blocks (other than items such as bicycles or motorcycles that can be moved) were observed in Germany, Korea, China, Malaysia and Thailand. Because objects located above waist level cannot be detected with a white cane6, in a situation like the one illustrated in Fig. 28 a person with impaired vision could fail to notice the pedestrian bridge and crash into it, suffering serious injury.

Fig. 26: Incorrect Positioning at the Entrance to a Crosswalk (Paris, France)

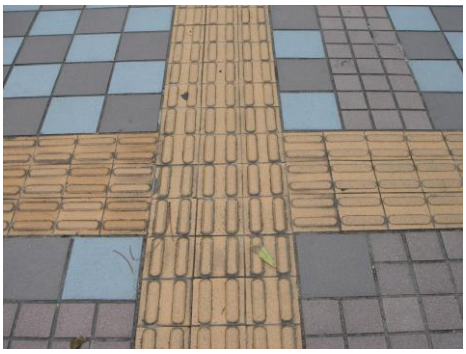


Fig. 27: Failure to Install Warning Blocks Where Directional Blocks Intersect (Taipei, Taiwan)

6）Excessive Number of Blocks

Examples of installations with an excessive number of blocks were observed in the UK, Korea, Taiwan, Singapore, Malaysia and Thailand. Installations before crosswalks like the one illustrated in Fig. 29 not only obscure the entrance to the crosswalk but also make it difficult to identify the direction of the crosswalk, leading to the danger that a person with impaired vision might step out in the wrong direction, perhaps toward the middle of the intersection. Such installations create obstacles not only for the visually impaired but also for the elderly and for those using wheelchairs or strollers.

7）Interruption by Objects such as Manhole Covers

Examples of blocks interrupted by objects such as manhole covers (Fig. 30) were observed in all countries that installed blocks except the USA and Singapore, where there are few block installations and no such examples could be found during the current survey. Interrupted blocks mean confusion for people with impaired vision, who lose their directional guide. There is a need to communicate to the world the importance of installing blocks even on manhole covers.

8）Warning Blocks in Places Where They are Unnecessary

Examples of warning blocks installed in places where they are unnecessary were found in Korea, China, Taiwan and Hong Kong. As in Fig. 31, warning blocks were frequently installed in situations where there was a slight change in the direction of directional blocks. Warning blocks cause people with impaired vision to stop and attempt to identify what danger their attention is being drawn toward. Unnecessary warning blocks greatly reduce walking efficiency.

Fig. 28: Pedestrian Bridge Located above Tactile Ground Surface Indicators (Beijing, China)

Fig. 29: Installation of an Excessive Number of Blocks (Kuala Lumpur, Malaysia)

Fig. 30: Directional Blocks Interrupted by Manhole Cover (Seoul, Korea)

Fig. 31: Installation of Warning Blocks Where They are Unnecessary (Hong Kong)

9）Warning Blocks Where Directional Blocks Should be Installed

Examples of warning blocks installed where directional blocks should be were observed in Korea and China. Providing directional guidance with warning blocks creates confusion for people with impaired vision, who are unable to determine whether the location is a route to be followed or a location where they are to exercise caution.

10）Installations at Medians

Examples of installation at medians were observed in the UK, the Netherlands and Hong Kong. Blocks at medians can lead people with impaired vision to mistakenly believe they have passed through the crosswalk and begin to walk along the median7.

11）Installations that Impede Wheelchair Users

Installations that impede wheelchair users include blocks installed on or at the beginning and end of sloped walkways, blocks installed on slopes that lead to crosswalks and blocks installed at disabled parking spaces. Examples of blocks installed at sloped walkways were observed in the USA, Australia, New Zealand, Korea, China, Taiwan, Hong Kong and Singapore (Fig. 32). Such installations can be found throughout Japan but should be avoided as they impede the movement of wheelchair users9.

Examples of installations on slopes that lead to crosswalks were observed in the UK, the USA, New Zealand, Korea and Taiwan.

Examples of installations at disabled parking spaces were observed in the USA and Hong Kong (Fig. 33). People with impaired vision do not use such parking spaces by themselves so blocks that impede the movement of wheelchair users should not be installed.

Tactile ground surface indicators are indispensable in assisting people with impaired vision to be mobile, and their profusion around the world is most welcome. However, if blocks are not installed properly the visually impaired may be put in dangerous situations. As described in this paper, most countries that use blocks generally install them according to Japanese methods in combination with unique rules of their own. As movement between countries grows, particularly within Europe, these inconsistent installations cause great confusion for people with impaired vision. Increased globalization is expected to bring further opportunities for the visually impaired to visit countries other than their own and common global rules are urgently needed.

Fig. 32: Tactile Ground Surface Indicators Installed on a Slope (Taipei, Taiwan)

Fig. 33: Tactile Ground Surface Indicators Installed at Disabled Parking Spaces (Hong Kong)

3. Braille Block Installation Methods

(1) Braille Block Installation Methods

1) Directional Blocks

The following conditions must be met when installing directional blocks:

- No obstructions above or within 30cm surrounding the blocks;
- Direction of movement is easily recognizable;
- Blocks provide guidance to the correct location;
- Continuity is maintained;
- No warning blocks installed at bends with interior angles of 135º or greater; and
- Surface area is sufficient to enable tactile perception of block direction using the soles of the feet.

2) Warning Blocks

The following conditions must be met when installing warning blocks:

- User is able to come to a stop before the obstacle (blocks are installed 30cm before obstacle);
- Intersections are easy to identify;
- Reason for the warning is easy to identify; and
- Surface area is sufficient to enable tactile perception of block location using the soles of the feet.

(2) Common Installation Errors and How to Remedy Them

1) Manhole Covers

Directional blocks must be installed in succession or people with impaired vision will be required to search for the next block using their canes, greatly reducing their walking efficiency. Manhole covers are one cause of such discontinuity and should generally be outfitted with Tactile ground Surface Indicators.

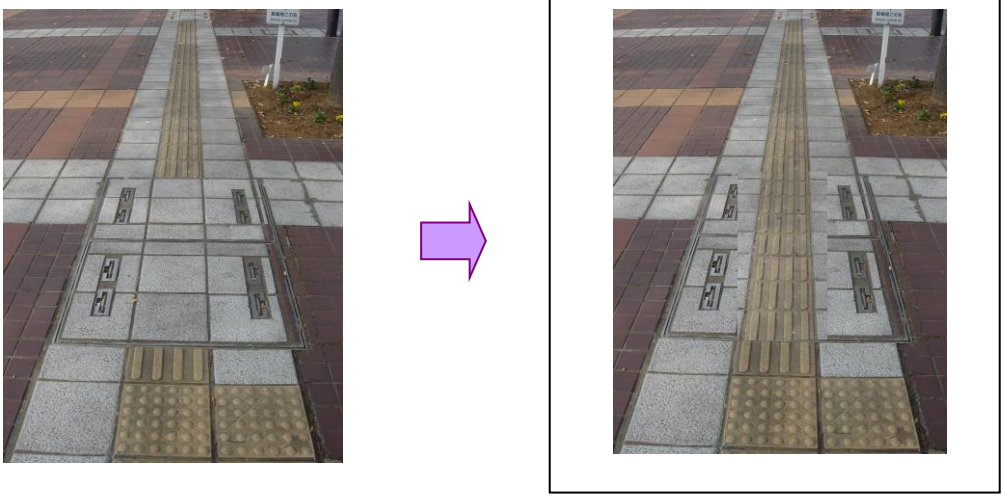


Fig. 34: As in this instance, manhole covers often interrupt the flow of directional blocks, causing people with impaired vision to lose track of which direction they should proceed. （Tokyo, Japan）

Improved Version: As illustrated here, manhole covers should be outfitted with Tactile ground surface indicators.

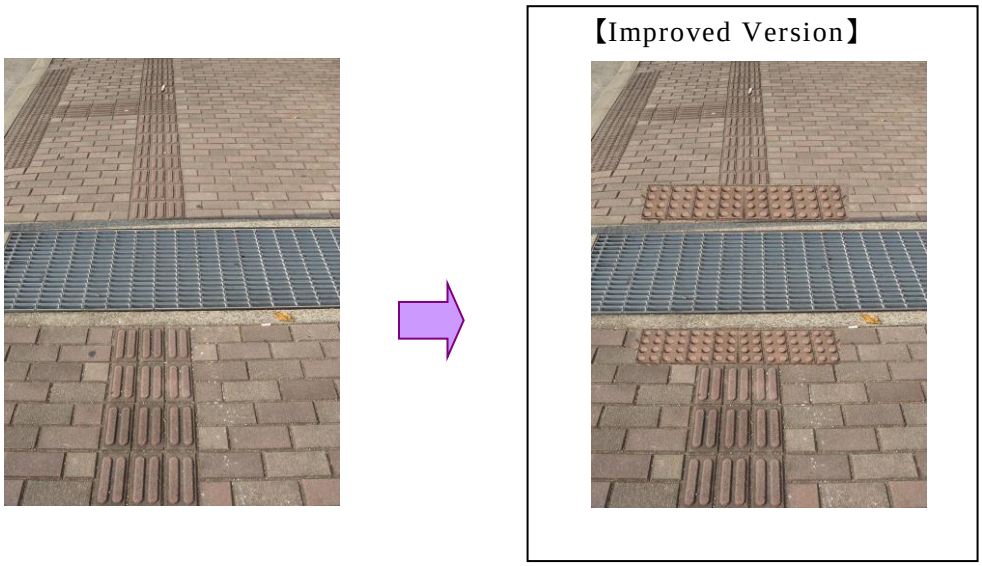


Fig. 35: In cases like this where gratings cut across a line of blocks, warning blocks should be installed before and after the grating to urge caution as in the improved version at right. （Hokkaido, Japan）

Fig. 36: Rerouting directional blocks to avoid the manhole, as in this photograph, not only looks unattractive but creates a winding course that greatly reduces the walking speed of people with impaired vision. （Hokkaido, Japan）

2) Interrupted Tactile ground surface indicators

Sequences of directional blocks must not simply trail off; they should end with warning blocks that indicate the end of the line or else people with impaired vision will spend time searching for the directional blocks that they expect to continue on. Because people with impaired vision must also search for the next block when there are gaps between one directional block and another, blocks should be installed to ensure continuity.

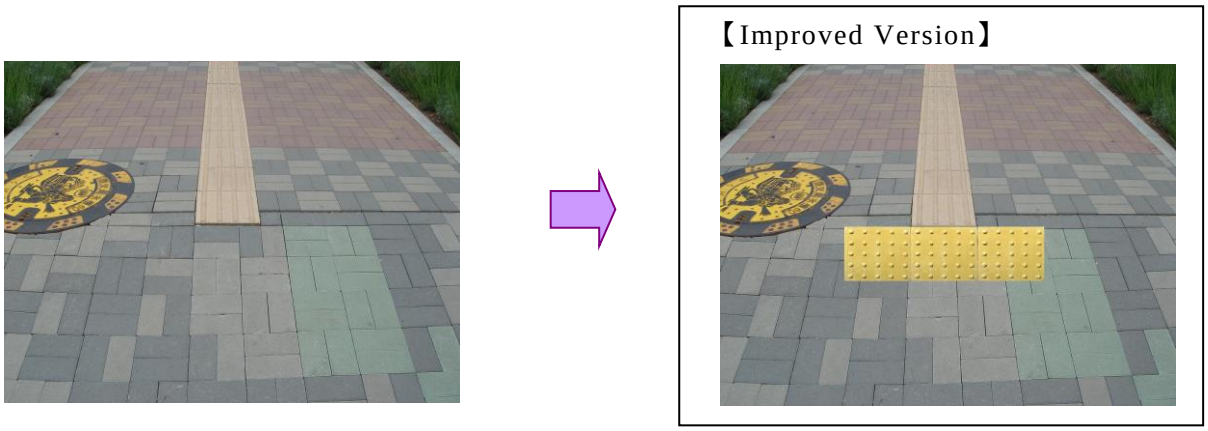


Fig. 37: Here there are no warning blocks installed at the end of a sequence of directional blocks. The suggested remedy is to clearly indicate that the line of directional blocks has ended by installing warning blocks. （Ibaraki, Japan）

3) Jurisdictional Variations in Block Size, Shape or Color

The size, shape and color of blocks often varies with jurisdictional differences between the facilities or roadways where they are installed. Although the selection of Tactile ground surface indicators must take ground surface condition and tile variations into account, uniform blocks should be used continuously wherever possible for the convenience of people with impaired vision and to maintain an attractive environment.

Fig. 38: The situation depicted here is the result of different organizations having jurisdiction over the areas to the left and the right. Both types of blocks are directional blocks but the ones on the left with raised ovals can easily be mistaken for warning blocks with raised dots. The likelihood of misreading the blocks is particularly high when walking from the right to the left. （Tokyo, Japan）

Fig. 39: Situations such as this one, where both shape and materials differ, make it difficult for people with impaired vision to walk and are also unattractive. （Tokyo, Japan）

Fig. 40: Many examples of similar errors can also be found overseas. (Taipei, Taiwan)

4）Warning Blocks Where Lines of Directional Blocks Bend

Directional blocks are best installed in straight lines, yet putting a bend in the line is sometimes unavoidable. Warning blocks should generally be installed at the point of the bend, but doing so even where the bend is at a shallow angle will increase the overall number of warning blocks used. Warning blocks require people with impaired vision to stop and determine what they are being warned about, whether a danger such as a step, an intersection or a directional board. Installing warning blocks at every bend, therefore, reduces the walking efficiency of people with impaired vision. We researched how much of a bend was perceived to be a turn by people with impaired vision and how much was perceived as straight and could be navigated without a marked decline in speed. Although there was individual variation, we determined that there is generally no need to install warning blocks if the interior angle of the bend is 135º or greater.

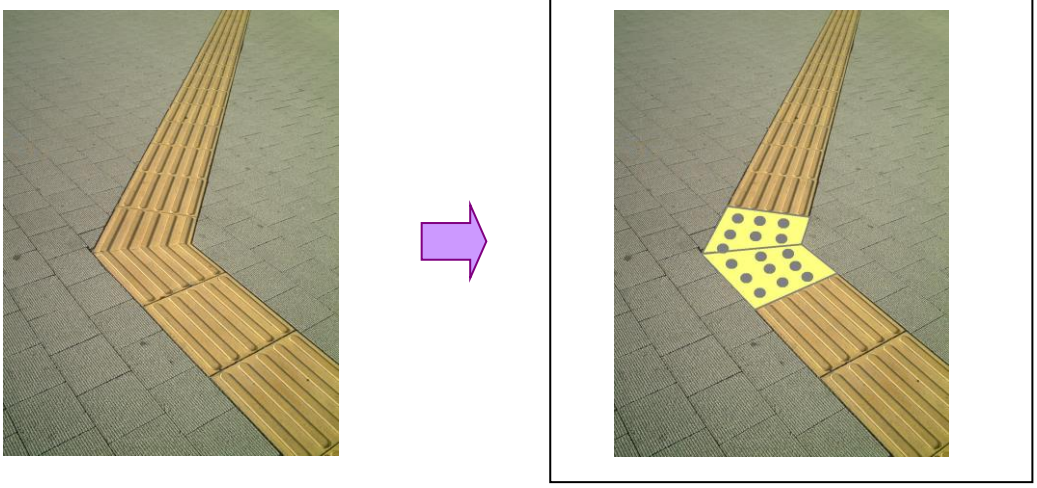


Fig. 41: The angle here is 130º so warning blocks should be installed as in the improved version. （Kanagawa, Japan）

Fig. 42: Installing warning blocks at shallow bends such as these means people with impaired vision must frequently come to a stop. （Nagasaki, Japan）

Fig. 43: Many similar examples of the overuse of warning blocks can also be found overseas. (Hong Kong)

5) Unnecessary Warning Blocks Amid Directional Blocks

Warning blocks are to be installed in locations where one wishes people with impaired vision to take notice. They act like a red traffic light and cause people with impaired vision to come to a stop and decide immediately what the warning block is trying to tell them and whether or not this information is important to them. As mentioned in the previous section, installation of excessive warning blocks leads to lower walking efficiency. At the same time, elimination of necessary warning blocks leads to lower walking safety.

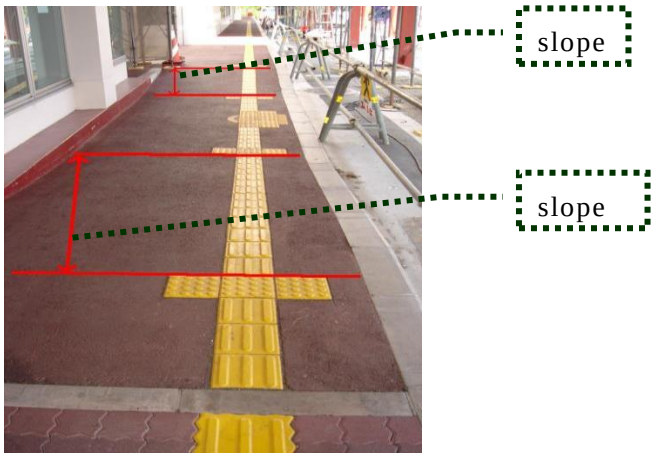


Fig. 44: In Japan, warning blocks are often installed at the beginning and end of slopes as depicted here. A gentle slope, however, poses no danger so such warning blocks are unnecessary. Here, the four groups of warning blocks installed on the two slopes are not needed. （Toyama, Japan）

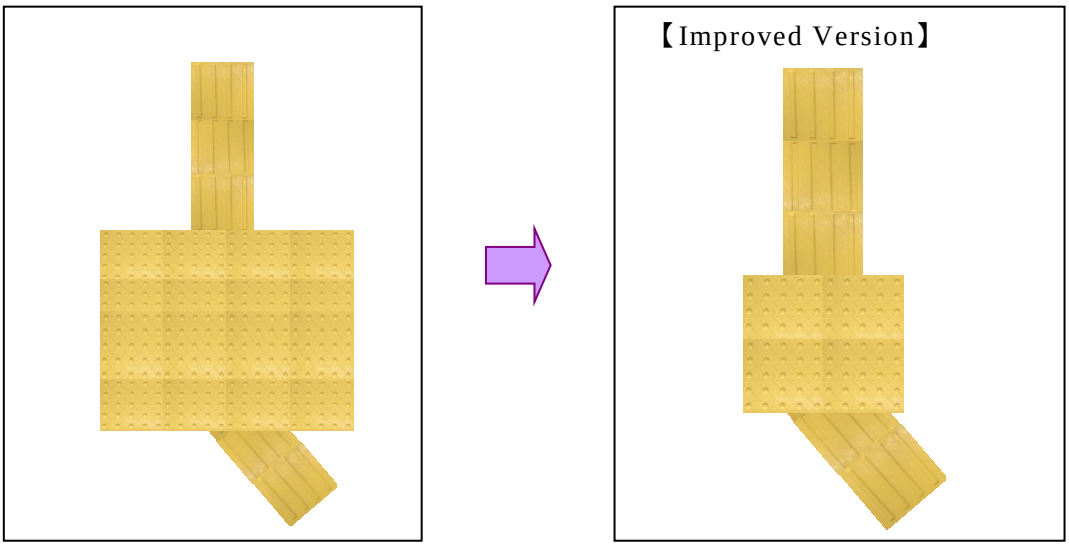


Fig. 45: This is an example of an excessive number of warning blocks installed at a bend in a line of directional blocks. Such a large number of blocks requires people with impaired vision to spend time searching about and can result in their losing track of which direction to proceed. The number of warning blocks should be reduced as in the improved version. （Kanagawa, Japan）

6) Small Blocks

Because people with impaired vision use the soles of their feet to determine whether a given block is a directional block or a warning block, fine distinctions are difficult to make. It is difficult, therefore, to identify blocks that cover only a very small surface area. In particular, very small warning blocks located where users should come to a stop (such as before crosswalks, stairs or walls) risk going unnoticed by people with impaired vision who may then run into a wall or step out into a crosswalk.

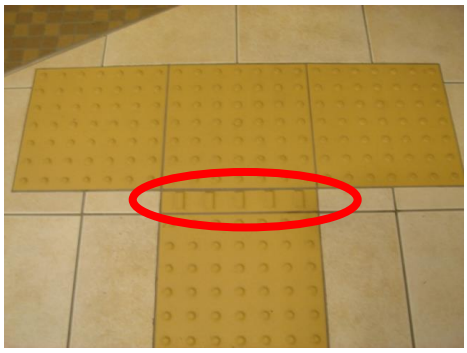


Fig. 46: A directional block of but 5cm width sandwiched between warning blocks, as pictured here, will go unnoticed by people with impaired vision. （Tokyo, Japan）

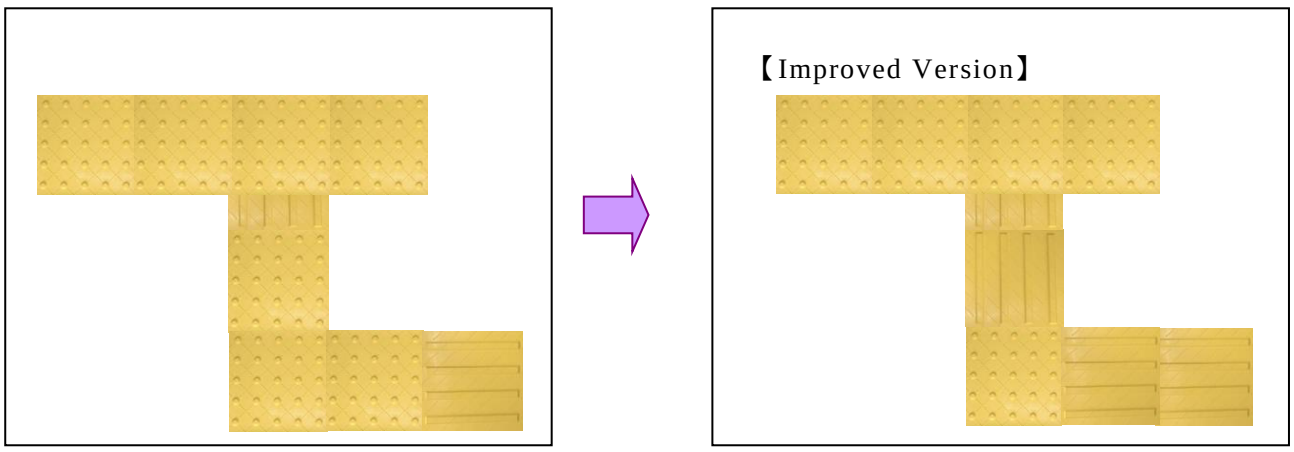


Fig. 47: In a narrow corridor where blocks must be arranged in an L-shape, one warning block should be installed at the bend in the L with directional blocks above and to the right as illustrated in the improved version here. （Tokyo, Japan）

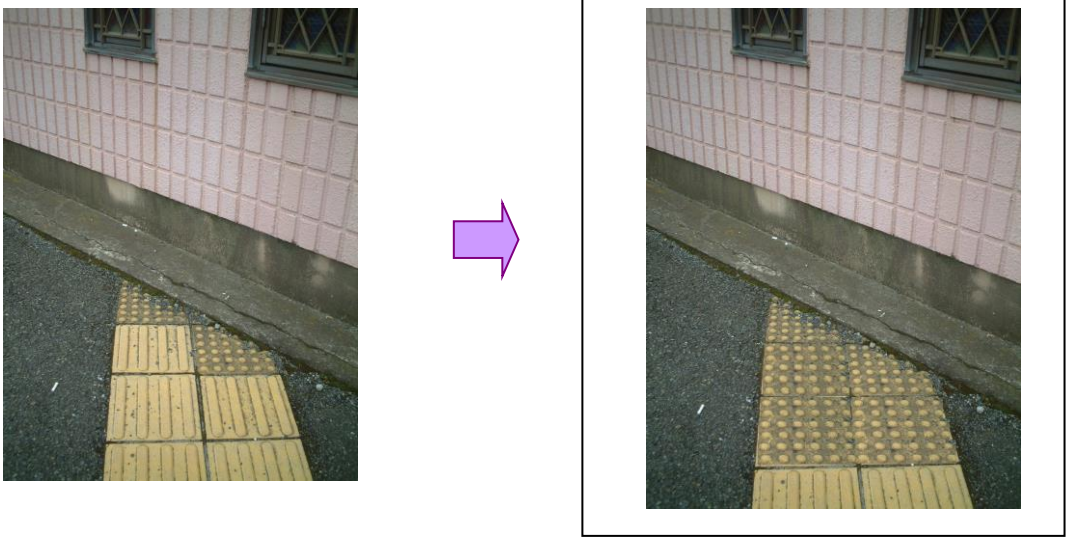


Fig. 48: Because of the small area covered by the warning blocks installed before the wall, people with impaired vision will run into the wall before noticing the warning blocks. （Kanagawa, Japan）

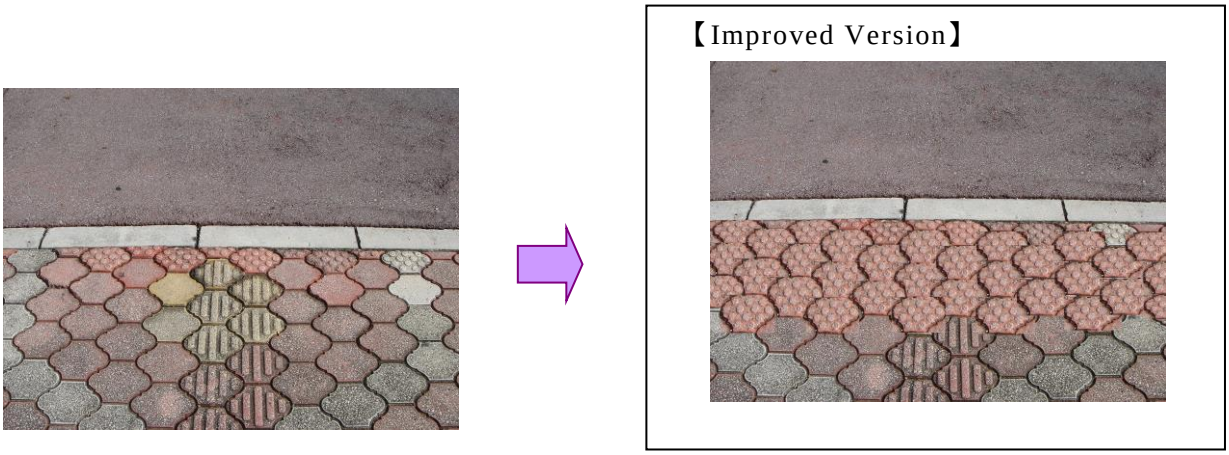


Fig. 49: In this case, the exceptionally small area covered by the warning blocks creates the danger that people with impaired vision will step out into the crosswalk before noticing them. （Okinawa, Japan）

7) Block Routes

Directional blocks should be installed in straight lines, avoiding bends wherever possible. Warning blocks can be installed at bends but these require people with impaired vision to come to a stop and take time searching out which direction to proceed. Installation routes should be planned to avoid unnecessary bends.

【Improved Version】

Fig. 50: This is an example of an unnecessary bend in a directional block installation preceding a crosswalk. The directional blocks should simply continue straight ahead as in the improved version. （Wakayama, Japan）

Fig. 51: Here, warning blocks have been installed where the row of directional blocks was shifted over to the left by the width of one block (30cm) before a crosswalk to align the directional blocks with the center of the crosswalk. As long as the directional blocks leading to a crosswalk are not too close to the crosswalk's edge, there is no need to install warning blocks and alter the course of the directional blocks in this way.（Hokkaido, Japan）

Fig. 52: Directional blocks should not be installed at the edge of walkways because some people with impaired vision, rather than walking directly on top of Tactile ground surface indicators, walk to the side while sensing the texture of the blocks with their canes. This is why it is necessary to leave 30cm open on either side of the directional blocks. Here, the guardrail immediately adjacent to the directional blocks is likely to be an impediment to walking. （Ciba, Japan）

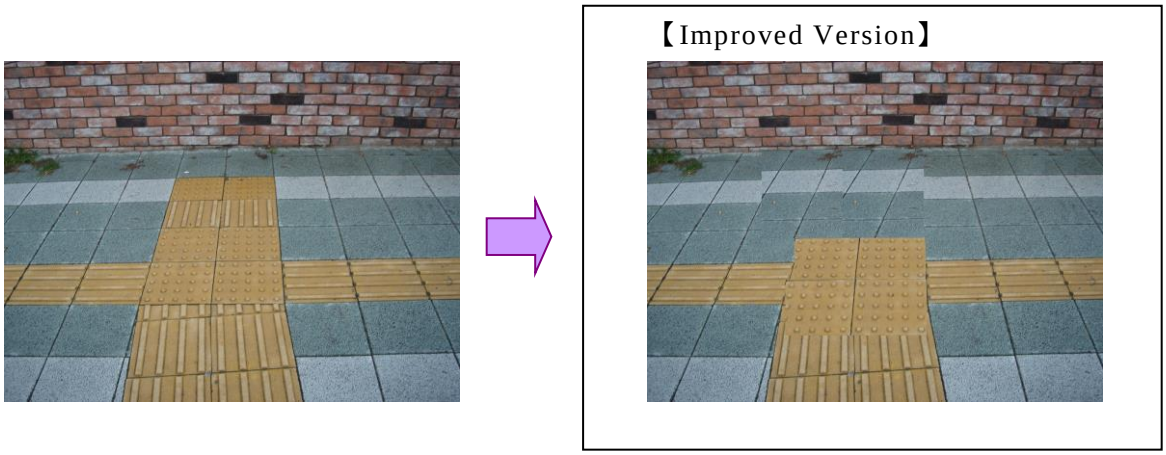


Fig. 53: Here, a single row of directional blocks leads to the wall followed by warning blocks signaling the end of the line. These blocks are unnecessary. As in the improved version, the warning blocks signaling the intersection alone are sufficient. （Wakayama, Japan）

8) Crosswalks

Crossing the road is said to be one of the most stressful situations for people with impaired vision. In general, two rows of warning blocks should be installed before crosswalks to bring users to a stop.

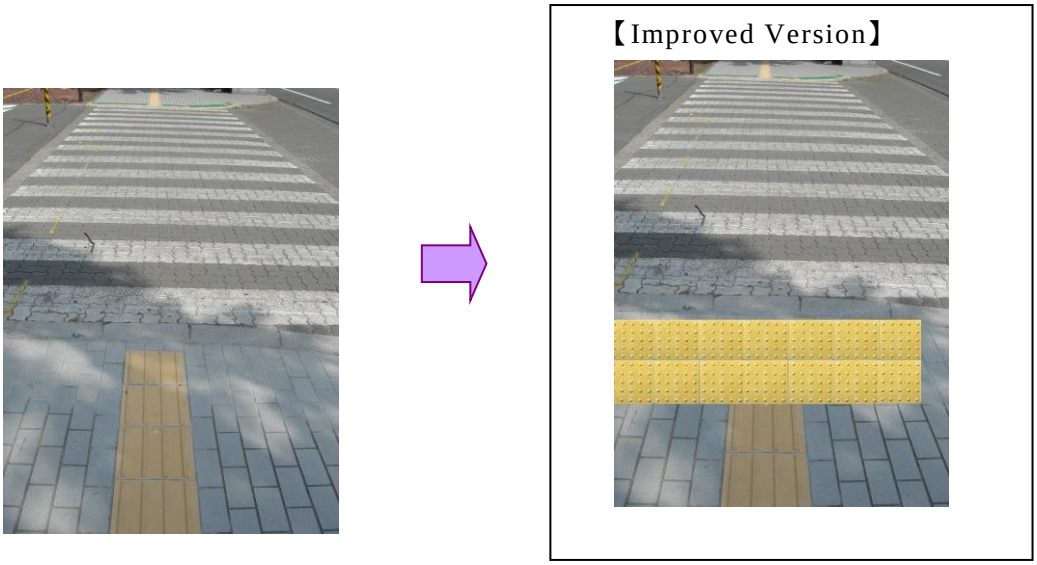


Fig. 54: Situations like this one are extremely dangerous as people with impaired vision, rather than stopping before the crosswalk, will step out into traffic as they search for the continuation of the line of directional blocks. Warning blocks should be installed as in the improved version. （Hokkaido, Japan）

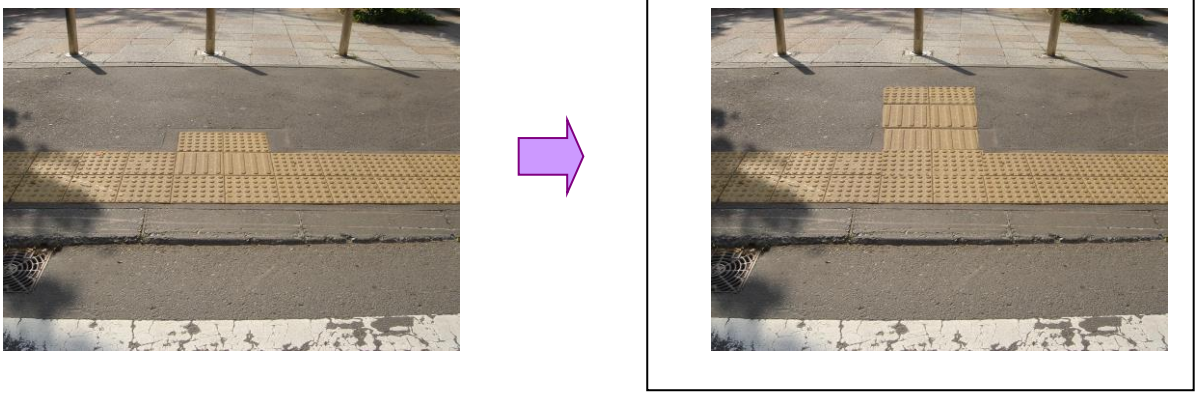


Fig. 55: It is ordinarily best to install two rows of warning blocks before a crosswalk. Where directional blocks are followed by only a single row of warning blocks, as shown here, people with impaired vision may either fail to notice the warning blocks and walk out into the road or inadvertently step over the warning blocks and come to a stop after stepping out into the road. Two rows of warning blocks should be installed as in the improved version. （Hokkaido, Japan）

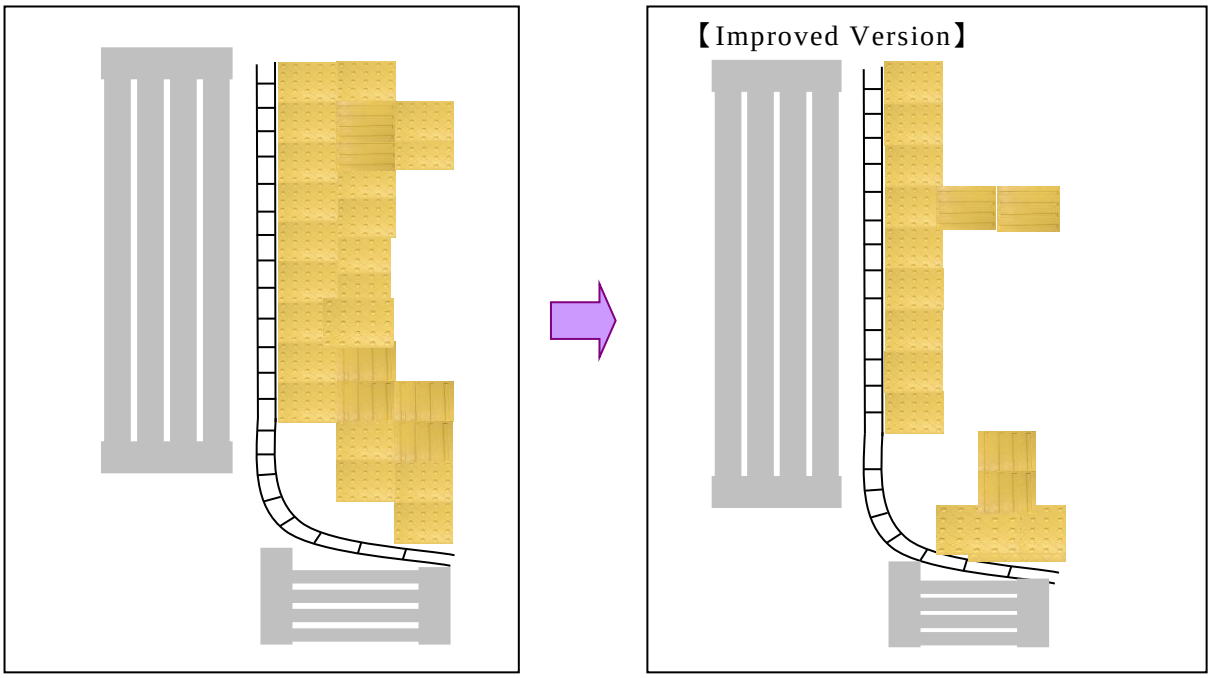


Fig.56: On narrow sidewalks like this, one sometimes sees installations where many Tactile ground surface indicators are used to mark crosswalks leading in two directions, making it difficult for people with impaired vision to determine where the blocks lead and what they are meant to warn them of. In situations like this, despite the general rule of using two rows of warning blocks before crosswalks, the number of blocks should be adjusted as needed to prioritize ease of identification by users. The improved version makes it easier to determine the position and orientation of the crosswalks by using single rows of warning blocks that are installed to completely cover the edges of the sidewalk. （Ishikawa, Japan）

Fig. 57: Directional blocks are increasingly installed within crosswalks, something extremely effective for people with impaired vision. When crossing the road, people with impaired vision try to be particularly careful not to proceed in the wrong direction. Should they stray greatly from the intended path they may be unable to reach the far side of the road and instead stray into the road. However, using blocks of the same shape as ordinary directional blocks, as in this example, is dangerous because users may not realize they are in a crosswalk. Specially shaped blocks such as those shown in Fig. 58 should be used in crosswalks. （Miyazaki, Japan）

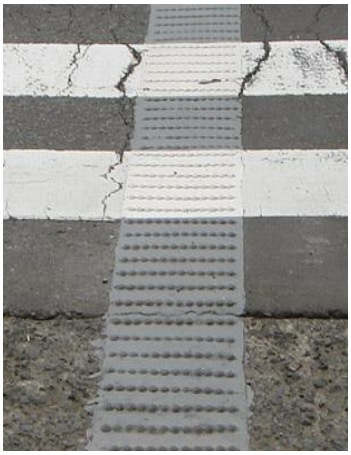


Fig. 58: The specially shaped directional blocks used for "escort zones" within crosswalks.

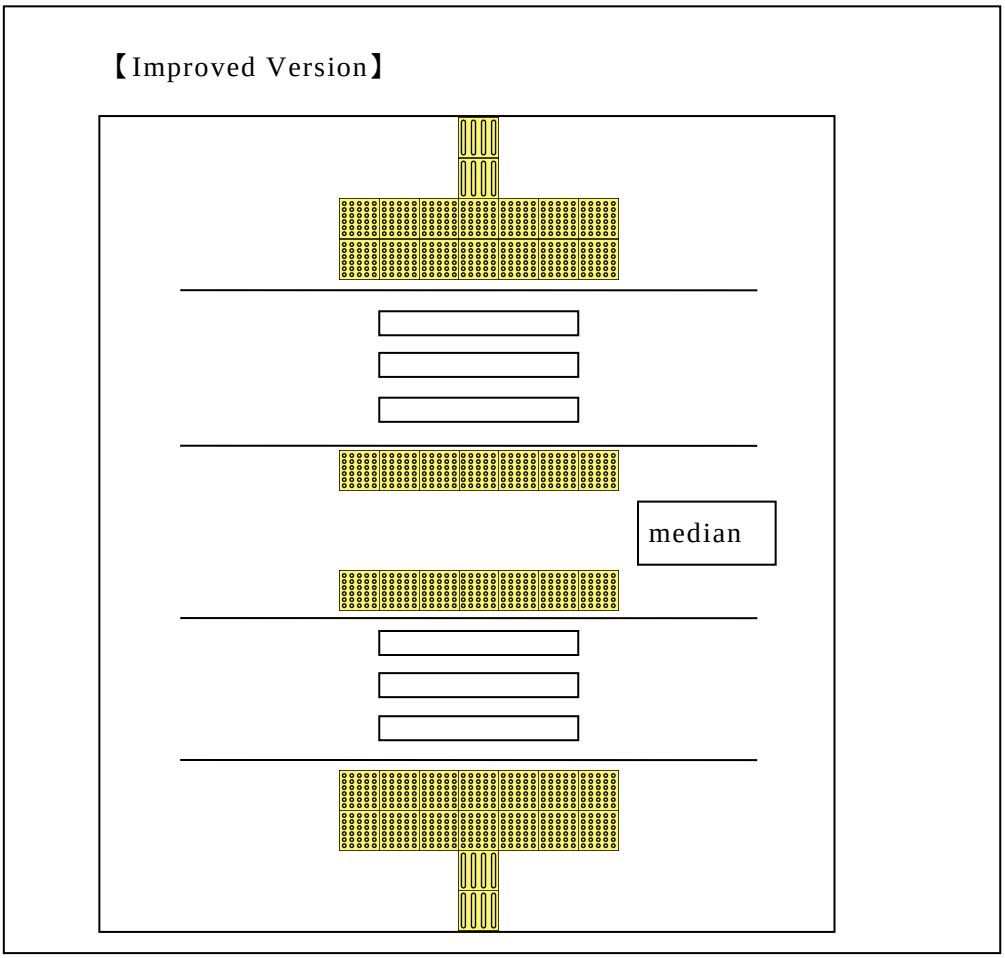
Fig. 59: An example of a crosswalk with escort zone.

Fig. 60: Many crosswalks are outfitted with pushbutton-operated signals for pedestrians. In this case, a pushbutton accessible to people with disabilities has been installed. Installations of directional blocks leading to such pushbuttons are rarely seen, yet are helpful in enabling people with impaired vision locate the pushbuttons. （Hokkaido, Japan）

Fig. 61: Examples of numerous Tactile ground surface indicators installed before crosswalks, which can cause people with impaired vision to lose their way, are often seen overseas as well as in Japan. (Kuala Lumpur, Malaysia)

Fig. 62: Covering the sidewalk with blocks as in this example makes it impossible for users to determine where the crosswalks are or which direction to proceed. (London, UK)

Fig. 63: Wide medians like this one can cause people with impaired vision to mistakenly think they have crossed the road, so blocks need to be installed in accordance with the proper rules. Blocks installed over the entire surface, as is the case here, are cause for user confusion. Accordingly, installations should be consistent in using double rows of warning blocks at either end of the crosswalk and single rows of warning blocks on either side of the median. （Hokkaido, Japan）



9) Intersections

Warning blocks should be installed at the intersections of lines of directional blocks. Without such warning blocks, people with impaired vision may fail to notice the intersection and become disoriented. A square composed of nine warning blocks should be used at right angle intersections on broad walkways, but for narrower walkways the number of warning blocks should be reduced as appropriate to avoid situations where the entire walkway is covered with blocks.

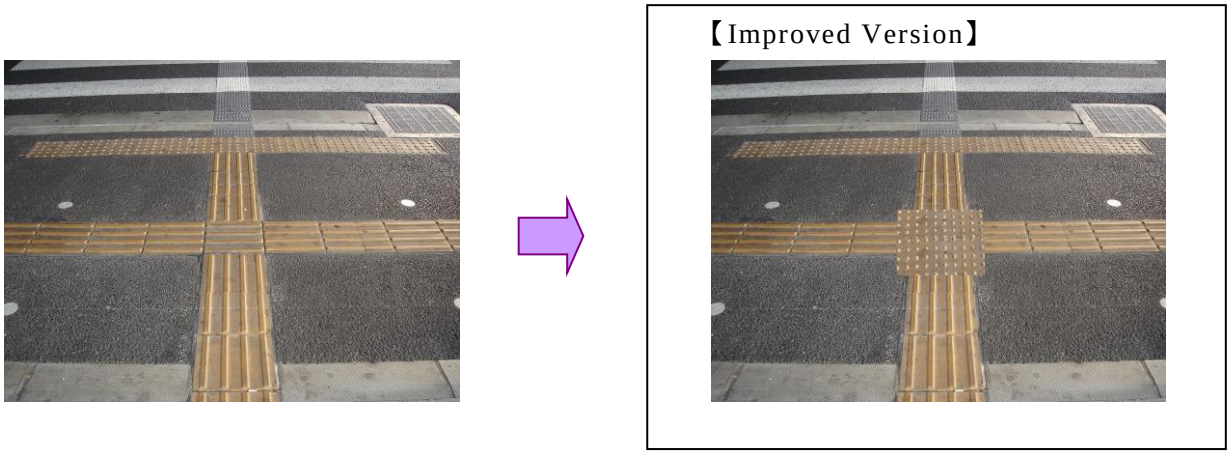


Fig. 64: Here the lack of warning blocks where the directional blocks cross means that people with impaired vision may not notice the intersection, particularly when moving across the frame from one side of the other. Warning blocks should be installed as in the improved version. （Saga, Japan）

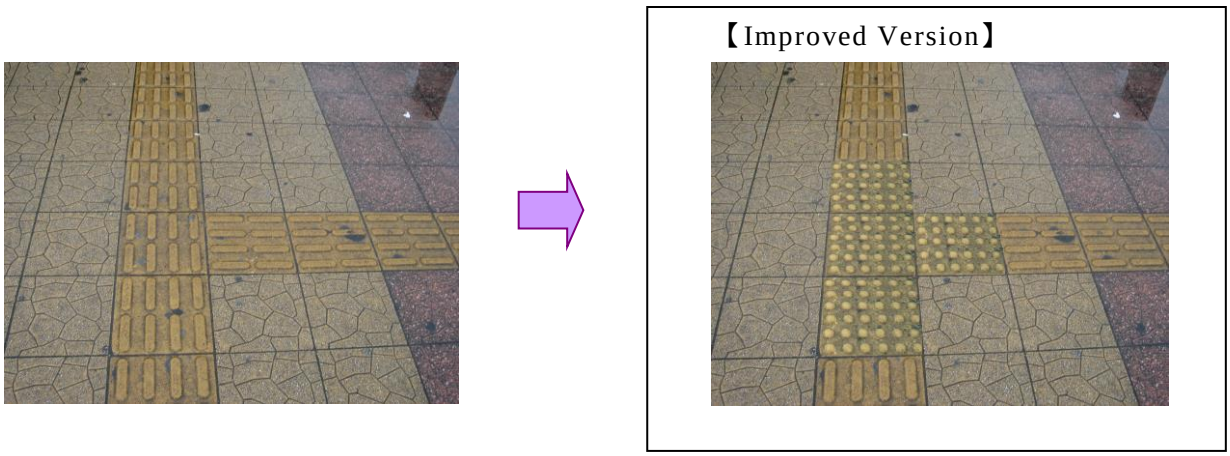


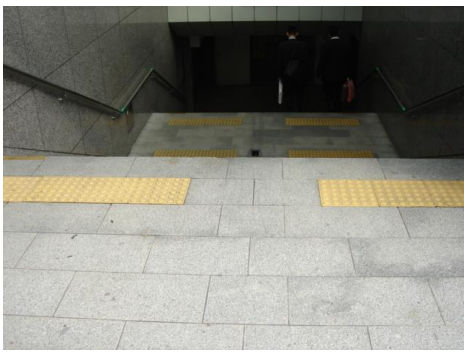
Fig. 65: Warning blocks are sometimes not installed at T-shaped intersections, but should be installed as in the improved version. （Chiba, Japan）

Fig. 66: Similar errors are also common overseas. (Taipei, Taiwan)

Fig. 67: Warning blocks are sometimes installed in this manner at T-shaped intersections, but such warning blocks will go unnoticed by people with impaired vision who are moving along the path composed of white directional blocks. (Seoul, Korea)

10) Stairs

Warning blocks should be installed before stairs. In principle there should be two rows placed about 30cm from the edge of the stairs. Installing more warning blocks than necessary can make it difficult to determine what the warning is for, potentially causing people with impaired vision to fall down the stairs as they search about for an answer.



【Improved Version】

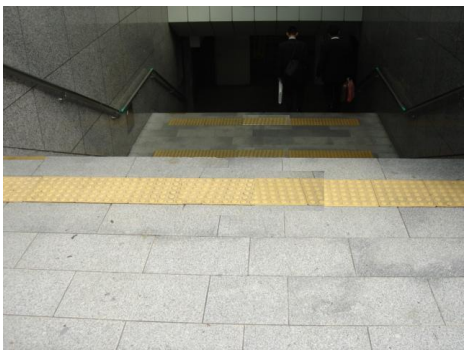


Fig. 68: Here, the line of warning blocks installed at the top of the stairs is truncated. A person with impaired vision arriving at the open gap would fail to come to a stop as there are no warning blocks. There is a real danger of falling down the stairs. The line of warning blocks should be continuous as in the improved version. （Toyama, Japan）

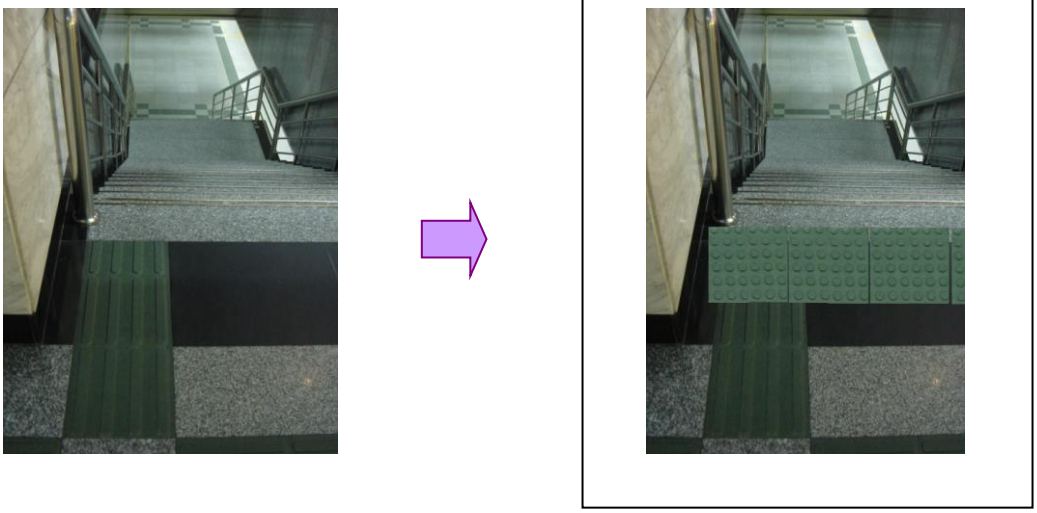


Fig. 69: Here there are no warning blocks at the top of the stairs. Unable to stop, people with impaired vision may fall down the stairs. (Guangzhou, China)

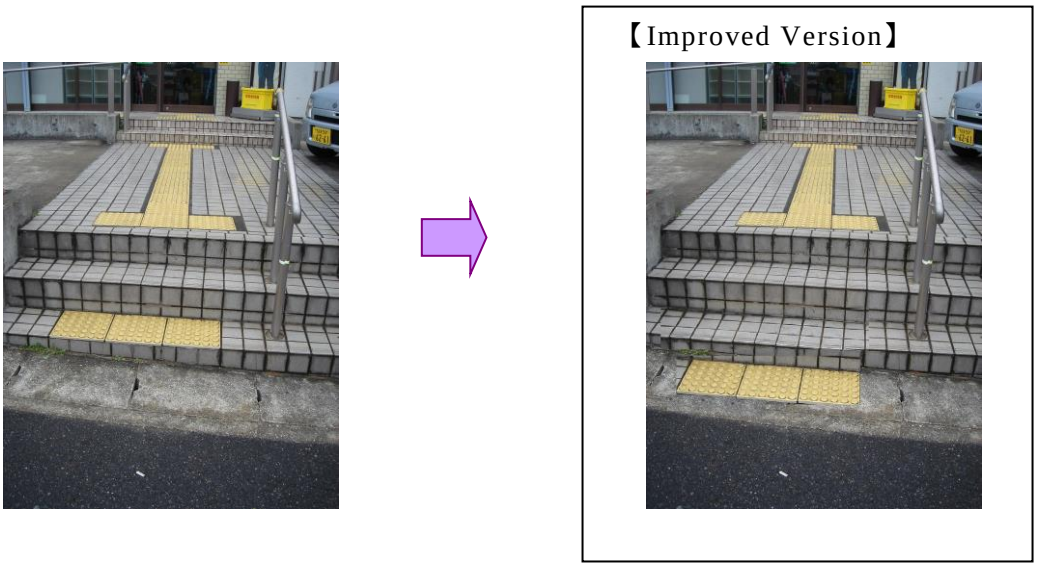


Fig. 70: Warning blocks should generally be installed at the top of stairways and on the ground or floor following the final step. Here, the warning blocks at the bottom of the stairs have been installed not on the ground level but on the final step. People with impaired vision coming down the stairs will sense the warning blocks and determine that they have reached ground level. Because in fact they have an additional step to go, this may lead to accidents such as falls or twisted ankles. Warning blocks should be repositioned as in the improved version. （Aichi, Japan）

Fig. 71: Warning blocks are sometimes installed on each step of a stairway. Such warning blocks are unnecessary. (Taipei, Taiwan)

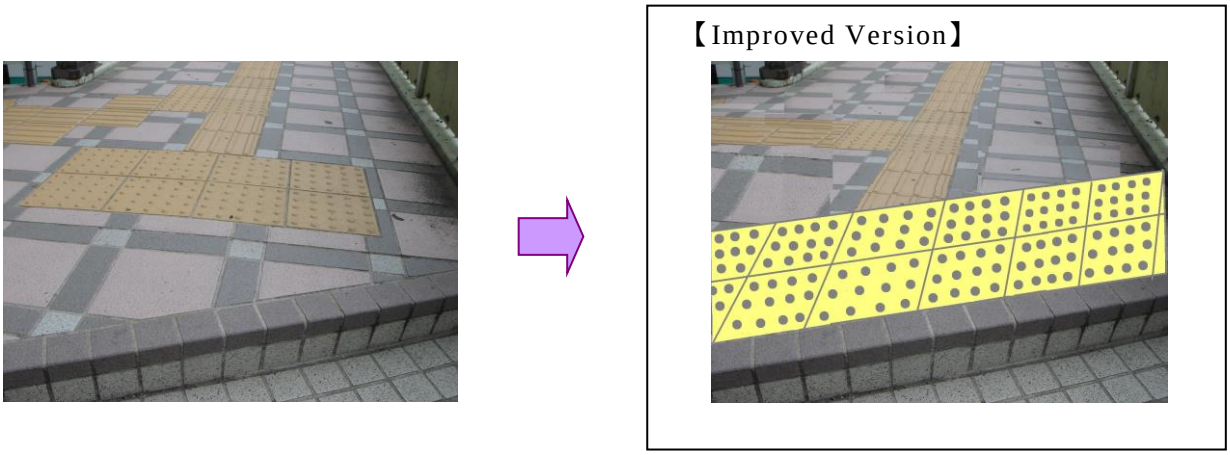


Fig. 72: Here, warning blocks have been installed in a way that is neither adjacent nor parallel to the edge of the stairs. （Nagasahi, Japan）

Fig. 73: Situations like this one where there are many warning blocks installed make it difficult for people with impaired vision to determine what is in their surroundings. There is a danger that they could fall down a stairs or an escalator while searching about. Double rows of warning blocks are sufficient before both stairs and escalators. （Toyama, Japan）

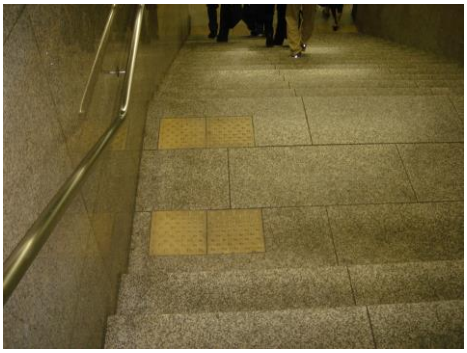


Fig. 74: In general, single rows of warning blocks should be installed at the beginning and end of stair landings. It is inappropriate to install them only near handrails rather than across the entire width of the stairs, as shown here. The elderly are the primary users of handrails at rail stations. Because of the danger of collision with the elderly, many people with impaired vision do not use handrails when ascending and descending stairs. （Osaka, Japan）

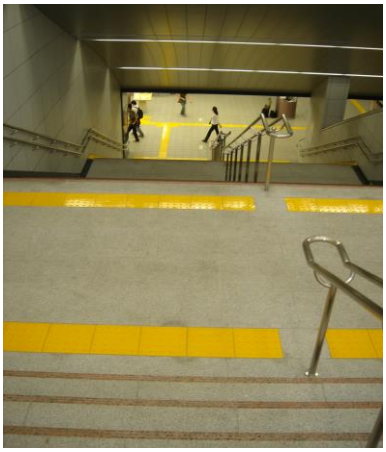


Fig. 75: Warning blocks should be installed across the entire width of the stairway, as shown here. The one-block interruption at the center of the rows of warning blocks is due to the position of the handrail. （Ibaraki, Japan）

11) Before Escalators

Warning blocks should be installed close to the entrances to escalators.

【Improved Version】

Fig. 76: Here the warning blocks are located too far from the entrance to the escalator, and should instead be installed as in the improved version. （Tokyo, Japan）

12) Errors at Platforms

Railway platforms are extremely dangerous locations for people with impaired vision. To prevent people from falling onto the tracks, it is customary to use warning blocks alone rather than directional blocks along platform edges. It is best if such warning blocks measure the JIS standard 30cm square.

Fig. 77: Here the warning blocks measure only 15cm wide. There is the risk that people with impaired vision may inadvertently step over the blocks and fall onto the tracks. Warning blocks measuring 30cm square should be used on platforms. （Nagasaki, Japan）

13) Before Gates and Doors

Warning blocks should be installed before gates and doors to make their presence known. Otherwise, people with impaired vision may run into them when they are opened.

Fig. 78: Warning blocks should be installed before gates. （Chiba, Japan）

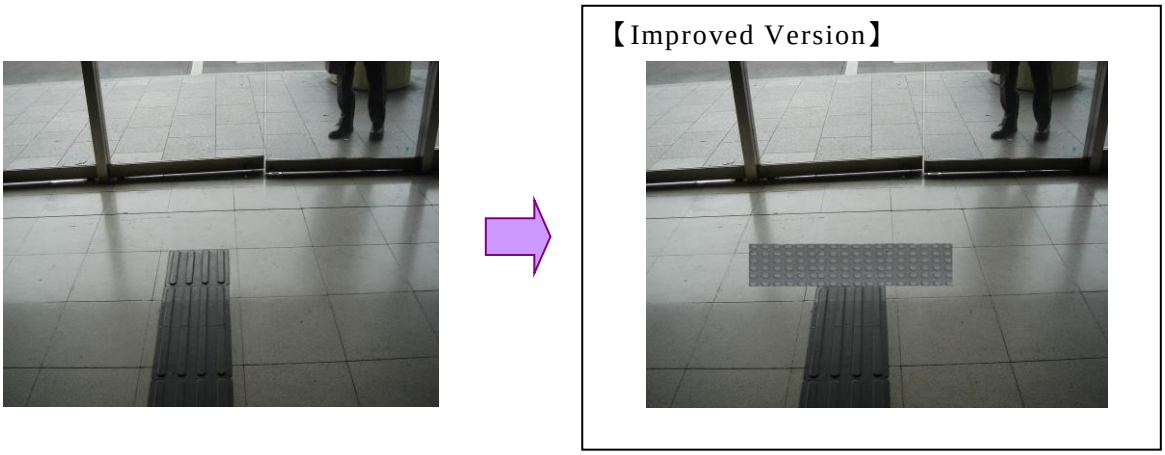


Fig. 79: Here a line of directional blocks ends without warning blocks before a door. Because people with impaired vision will continue toward the door without stopping, there is the risk that they could hit their head on the edge of the door should it happen to be open. Warning blocks should be installed as in the improved version. （Osaka, Japan）

14) Slopes

Many users of wheelchairs, baby strollers and four-wheeled walkers for the elderly feel that Tactile ground surface indicators create a barrier for them. Wheelchair users, in particular, are bothered by the tendency of Braille block protrusions to change the orientation of their front wheels and make it more difficult to hold a course. Other problems include the loss of bodily stability due to vibration and the slipperiness of Tactile ground surface indicators installed outdoors. At the same time, many people with impaired vision prefer to use stairs with clearly defined steps when moving up or down a level. Collisions may occur between wheelchair users and people with impaired vision using slopes. For these reasons, Tactile ground surface indicators should not be installed on slopes.

Fig. 80: As depicted here, the protrusions on Tactile ground surface indicators can cause wheelchair wheels to change direction, making it difficult to move forward.

Fig. 81: As shown here, directing people with impaired vision to use the stairs instead of installing Tactile ground surface indicators on the slope eliminates the problem of inconvenience for wheelchair users. （Tokyo, Japan）

Fig. 82: Installing blocks on a slope as in this example is not appropriate. （Miyazaki, Japan）

Fig. 83: Blocks are often installed at the beginning and end of slopes, but this creates a barrier for wheelchair users. （Ehime, Japan）

Fig. 84: Similar errors are also common overseas. （San Francisco, USA）

15) Elevators

Tactile ground surface indicators installed in front of elevator entrances can cause wheelchair wheels to catch. Therefore, care must be taken to minimize the barrier to wheelchair use by installing Tactile ground surface indicators only before the call buttons rather than across the entire width of the elevator entrance.

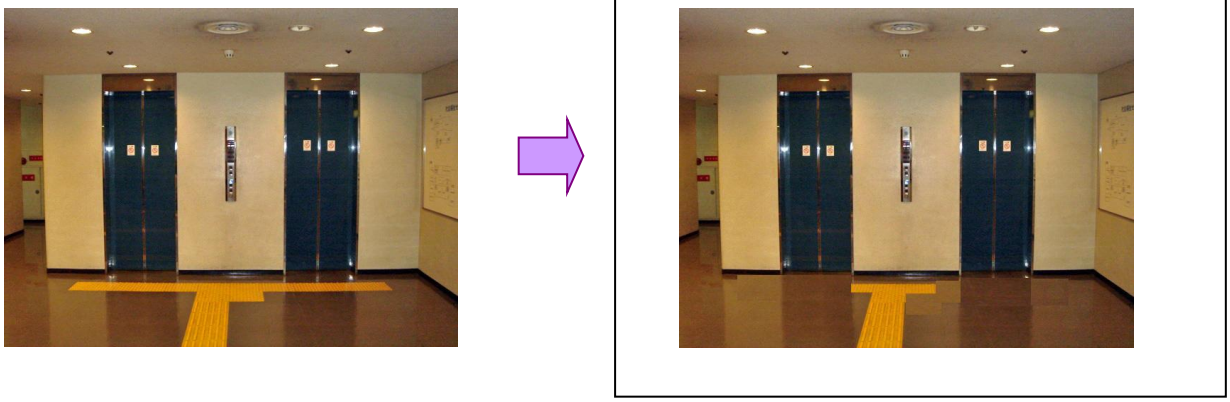


Fig. 85: Tactile ground surface indicators installed in this way create a barrier for wheelchair users. Blocks should instead be installed only before the call buttons as shown in the improved version. （Osaka, Japan）

Fig. 86: Warning blocks are sometimes installed inside elevators. People with impaired vision, however, will not lose track of the entrance within the narrow confines of an elevator. Such blocks are an obstacle to wheelchair use and should be removed. （Ehime, Japan）

16) Station Wickets

One often sees Tactile ground surface indicators installed at the wide wickets designed to facilitate passage by wheelchair users. Such blocks, however, are an obstacle to wheelchair use. Since there is no need for people with impaired vision to use the wider wickets, Tactile ground surface indicators should be installed at wickets separate from those designed for wheelchair users.

Fig. 87: Here, the wicket where Tactile ground surface indicators are installed is correctly separate from the wider wicket for wheelchair users. （Ibaraki, Japan）

Fig. 88: In fact, there are many cases where Tactile ground surface indicators are installed at the wider, manned wickets. (Kuala Lumpur, Malaysia)

17) Disabled Parking Spaces

Disabled parking spaces are designed for wheelchair-using drivers who must open their doors fully when getting in and out of their cars. People with impaired vision will never use disabled parking spaces when alone. Blocks that create an obstacle for wheelchair users should not be installed at disabled parking spaces.

Fig. 89: Here, the extensive installation of Tactile ground surface indicators at disabled parking spaces creates a barrier for wheelchair users. （Fukushima, Japan）

Fig. 90: Because disabled parking spaces are established primarily for wheelchair users, Tactile ground surface indicators should not be installed. （Chiba, Japan）

18) Post-Construction Problems

It goes without saying that when facilities or equipment to which Tactile ground surface indicators lead are moved, the position of the blocks should also be adjusted. Nevertheless Tactile ground surface indicators are often left in their original positions, creating confusing situations for people with impaired vision.

Fig. 91: Here the Tactile ground surface indicators have been left behind after the crosswalk that they marked was eliminated. There is a danger that people with impaired vision will mistakenly believe there to be a crosswalk and attempt to cross the road. （Osaka, Japan）

Fig. 92: The area filled in with black asphalt once contained some kind of equipment—probably a public telephone—yet the Tactile ground surface indicators were left as they were even after this equipment was removed. Such blocks should be adjusted when this kind of equipment is removed. （Nagasaki, Japan）

Fig. 93: Here it is impossible to follow the Tactile ground surface indicators to the bus stop due to fencing that was installed later. (Hong Kong)

19) Poor Maintenance

One often sees cases where blocks have come loose or are broken and scattered about because regular maintenance has not been conducted after installation. This not only defeats the purpose of having Tactile ground surface indicators at all but also poses a tripping risk for pedestrians and looks terrible.

Fig. 94: Because the Tactile ground surface indicators have peeled away before the crosswalk, people with impaired vision may not recognize that there is a crosswalk and step out into the road. （Kanagawa, Japan）

Fig. 95: Because the protrusions have disappeared from these warning blocks at the top of the stairs, people with impaired vision may not realized that there is a stairs and fall down. (Taipei, Taiwan)

Fig. 96: An example of broken blocks left unattended. (Seoul, Korea)

Fig. 97: Broken blocks not only pose a danger to people with impaired vision but are also a major barrier for wheelchair users.

Fig. 98: In snowy areas, snow removal efforts often result in the loss of many protrusions. （Hokkaido, Japan）

Fig. 99: The use of blocks different than those originally installed is common when Tactile ground surface indicators are repaired. The resulting mix of different specifications and shapes can lead to confusion among people with impaired vision. The loss of visual consistency is also unattractive. （Fukuoka, Japan）

Fig. 100: This photograph, taken before the Paris Opera House, shows the unattractive result of repair using a different type of blocks than those originally used. (Paris, France)

20) Obstacles Positioned Over Tactile ground surface indicators

The lack of obstacles or dangers above them is a precondition for the installation of Tactile ground surface indicators. Nevertheless, one often sees signs or other obstacles positioned in the way. These obstacles interfere greatly with the movement of people with impaired vision.

Fig. 101: One frequently sees benches placed above Tactile ground surface indicators at bus stops as shown here. Naturally, such obstructions should be avoided.

Fig. 102: Benches located above Tactile ground surface indicators at a bus stop in Thailand. (Bangkok, Thailand)

Fig. 103: A bus stop covering a line of directional blocks.

Fig. 104: Doormats designed to keep out mud sometimes cover Tactile ground surface indicators at building entrances. Such mats make it difficult to feel the protrusions on the blocks, however, and should not be used in this way. （Hokkaido, Japan）

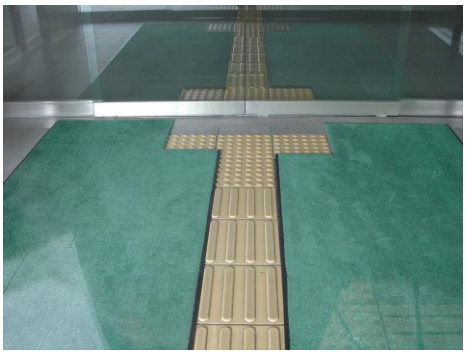


Fig. 105: Rather than cover the Tactile ground surface indicators with the mats, the mats should be shaped as shown to leave the blocks uncovered. （Hiroshima, Japan）

Fig. 106: An automated subway turnstile installed on top of a line of blocks. (Guangzhou, China)

21) Use for Other Purposes

Tactile ground surface indicators are sometimes put to uses other than facilitating the safe movement of people with impaired vision. This can be a source of confusion for people with impaired vision and can even lead to serious accidents. Tactile ground surface indicators should only be used as originally intended.

Fig. 107: Tactile ground surface indicators are sometimes used, as shown here, to create a non-slip surface at the entrances to underground parking areas. （Wakayama, Japan）

Fig. 108: Here, at the entrance to a store, Tactile ground surface indicators are used to create a non-slip surface as in Fig. 107. (Taipei, Taiwan)