REHABILITATION MANUAL 13

TACTILE GROUND SURFACE INDICATORS FOR BLIND PERSONS

National Rehabilitation Center for Persons with Disabilities
Japan Federation of the Blind

NATIONAL REHABILITATION CENTER
FOR THE DISABLED
JAPAN

(WHO COLLABORATING CENTRE)

December, 2003

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2 To undertake assessment of existing technology which facilitates the independence of people disabilities, and to disseminate such information on technology through education and training.

3 To undertake studies of community-based rehabilitation , primary health care, and other social support mechanisms for people with disabilities.

4 To undertake research and development of new equipment and devices in rehabilitation and daily life of people with disabilities.

5 To develop and prepare manuals for education and training of rehabilitation professionals.

6 To support organization of conferences and/or seminars on rehabilitation of people with disabilities.

National Rehabilitation Center for Persons with Disabilities
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Tactile Ground Surface Indicators for Blind Persons
December 26, 2003

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PREFACE

This manual is a compilation of information on tactile ground indicators for blind persons (hereinafter referred to as 'tactile ground indicator'). The following three factors are key to providing effective tactile ground indicators to visually impaired persons: standardized features for the indicators and requirements for installation, no communication barriers between the installer and the user, and establishment of the use of the indicators and training methods. The aim of this publication is to compile information that addresses these key matters into a manual relevant to the present situation in Japan and to promote the social participation of persons with visual impairment in the Asia-Pacific region.

Tactile ground indicators were invented by Mr. Seiichi Miyake, from Okayama. They were installed for the first time anywhere on the National road near the Okayama School for the Blind in March 1967, followed by installation in Kyoto and Osaka. They were introduced into Tokyo in the following year and then spread gradually throughout the country. During the process, the application of tactile ground indicators widened in scope to include railway station platforms in addition to pedestrian footways. This was partly in response to pressing need for tactile ground indicator installation in such locations to prevent persons with visual impairment from falling off the railway platforms.

The numerical targets for the installation of tactile ground indicators are currently listed in the Action Plan for Persons with Disabilities. The Action Plan for Persons with Disabilities released at the end of 2002 contains the following projects. 'Renovation of existing government facilities under the jurisdiction of the Ministry of Land, Infrastructure and Transport where front office operations are conducted. Such renovations include the installation of handrails, ramps, tactile ground indicators, toilets for persons with disabilities, automatic doors, elevators (total floor area of more than 1,000m2), and this project is to be completed by fiscal year 2010.' 'Promotion of the elimination of steps, improvement of tactile ground indicators, the installation of toilets for persons with disabilities in basically all facilities including existing railway stations, bus terminals, and passenger-ship or air terminals where the average number of users per day is 5,000 or more. This project is expected to be complete by fiscal year 2010.'

According to White Paper on Persons with Disabilities issued in FY 2002, the adoption rate of tactile ground indicators in JR's railway-related facilities with average daily passenger traffic of more than 5,000 was 99.0%: (936 stations out of 945 stations) at the end of FY 2001. The rate for 15 private railway companies was 95.9% (957 stations out of 998 stations), and for the Teito Rapid Transit Authority and the public subways was 100% (all 548 stations surveyed).

There is no doubt that the tremendous demand from the visually impaired played a major role in bringing about such a high rate of adoption, but the role of the government in standardization was also significant. Standardization of tactile ground indicators started with the 'Guideline for Tactile Ground Surface Indicators for Blind Persons' issued by the then Ministry of Construction in September 1985, followed by the enactment of the "JIS T 9251:20001 Tactile Ground Surface Indicator for Blind Persons" in September 2001.

Chapter 1 of this publication is mainly based on the 'JIS T 9251:2001' and chapter 2 is based on the guidelines set by the then Ministry of Construction. Chapter 3 is based on the practical training provided by this center in the area of walking training for visually impaired persons as part of the courses of independent living skills training at our Training Center and rehabilitation for persons with visual disabilities at our College.

I'd like to express my special thanks to Japan Association for the Blind for contribution of this manual in collaboration with staffs of our Training Center.

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Chapter 1.
Shape of Tactile Ground Indicators

1. Principles upon which the Shape of Tactile Ground Indicators are Based

It has been more than 35 years since the first tactile ground indicator was installed. Currently in Japan, a concrete tile about 60 mm thick is generally set into an asphalt pedestrian road for outdoor use, and a thin reinforced plastic tile about 5 mm thick is glued onto a floor for indoor use. The color is generally yellow as this hue is more visible to persons with low vision. This is because yellow contrasts sharply against most background surfaces.

At first, tactile ground indicators were concrete tiles with 48 dome-shaped dots arranged in parallel; however, since their introduction, various types of indicators have been developed, including bar tiles, tiles with oval-shaped dots and dot tiles arranged in a zigzag configuration. Thus in Japan, various types of tactile ground indicators are now being used. Information transmitted by tactile ground indicators to visually impaired people can be summarized as follows.

- To alert the individual to hazards in the immediate location or in the direction the individual is headed
- To indicate a safe direction of travel

Various attempts have been made to improve the transmissibility of these two kinds of information. In order to transmit the intended information from the indicators to the visually impaired correctly, it is important to convey the right information and also it is preferable to avoid any inconvenience to other pedestrians.

The function of the tactile ground indicators, once they are installed, is to help the visually impaired remain correctly orientated and aware of the surrounding environment while moving around. Thus, the requirements for tactile ground indicators can be summarized as follows.

a Patterns of tactile ground indicators must be easily detected through sense of touch

b It must be easy to detect any change in the patterns of tactile ground indicators

c Detectability of patterns mentioned above with white canes

d It must be easy to walk on tactile ground indicators (stability, easy to change direction, direct sensation of bumps)

e Indicators must be easily detected by not only by the blind but also by people with low vision

f Consistent pattern of arrangement when being installed in a sequence

In order to establish a shape meeting these requirements, Agency of Industrial

Science and Technology of the then Ministry of International Trade and Industry, undertook fundamental research on tactile ground indicators from 1996 to 1998, and studied how easily various patterns could be detected. Based on the results of the study, 'Methods for estimating the ease of bump recognition of tactile tiles by the visually impaired through their soles of shoes' (TR T 0006:1999) was announced by the Industrial Standards Committee in 1999. This TR, in Japanese only, is listed on the website of this committee. (URL: http://www.jics.go.jp/newstopics/tpk/tp908blk.htm: accessed on 12/12/2003)

Meanwhile, a report on the research mentioned above is also available. (URL: http://unit.aist.go.jo/pubrel/indusstain/ljis/theme/final/finalreports/yudou/index.htm. English version, http://unit/aist.go.jp/pubrel/indusstan/ljis/theme/final/finalreports/yudou/e-report.htm)

'JIS T 9251:2001 Tactile ground indicators for blind persons' was enacted based on the results.

2. Shape of Tactile Ground Indicators Based on JIS T 9251

JIS T 9251 specifies two types of tactile ground indicator: one, a dot tile with dot bumps, and the other, a bar tile with bar bumps.

1) Dot tiles

(1) Shape of dot bumps on a dot tile

A bump on a dot tile has to be a half-domed shape with a flat top. Figure 1-1 shows the plain and elevation/side views of the dot bump. The

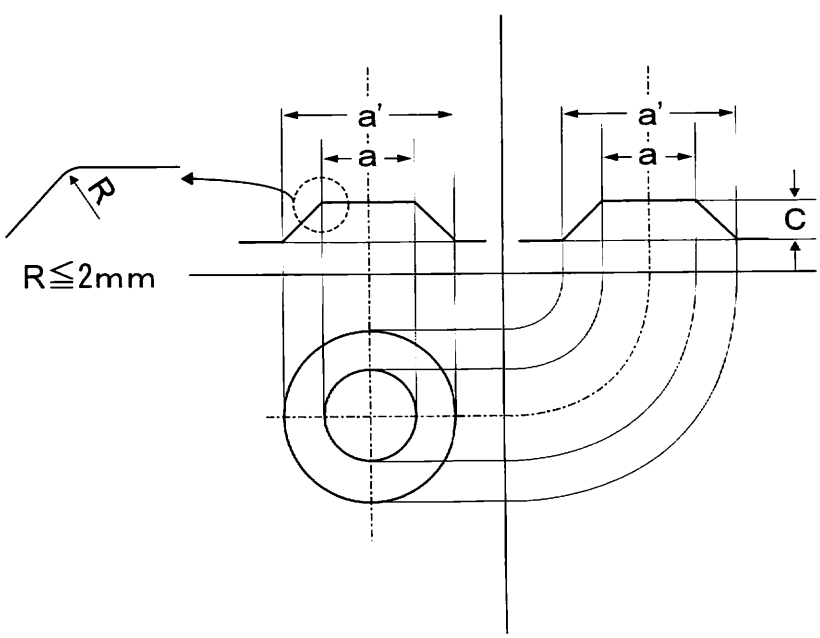


Figure 1-1: Shape of a dot bump

diameter of the top of the bump (a) is 12 mm, and that of the bottom (a') = (a) + 10 mm, and the height of the bump (c) is 5 mm. Tolerance for (a) and (a') is (+1.5 -0) mm each and that of (c) is (+1.0 -0) mm. When a product alteration is made to create round edges to prevent corners from chipping or people from stumbling, (R) at the corner must be less than 2 mm.

(2) Size of a Dot Tile

The size of a dot tile shall be no less than 300 mm square (including joints) with dots arranged in parallel. The minimum number of dots on one tile is 25 (5 dots×5 dots). The term "no less than 30 mm" refers to the size of a standard unit for a tactile ground indicator, and when a tile is larger than this, the number of dots shall be increased accordingly while maintaining the same pattern.

When several tactile ground indicators are laid, the interval between two dot centers of two adjoining tiles shall not exceed the interval between two dot centers (b) on one tile by more than 10 mm so as to maintain equal spacing between dots across the entire dot tile surface.

(3) Parallel Arrangement of a Dot Tile

The arrangement of dots is specified as parallel as shown in Figure 1-2. The interval between dots (spacing between dot centers) (b) is set at 55-60mm with tolerance of (+1.5 -0) mm. When the side is 300 mm in length, 5×5 = 25 dots shall be arranged. When the dimension exceeds 300 mm, the

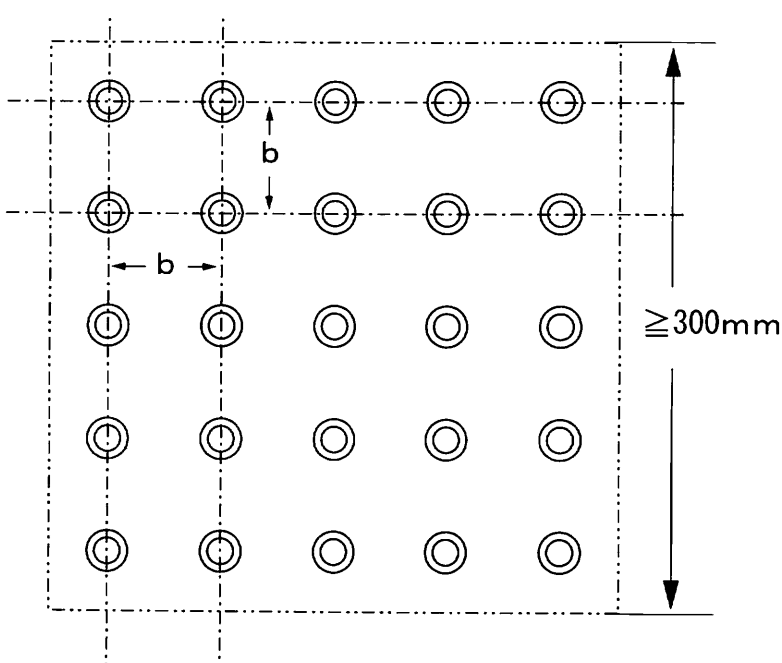


Figure 1-2: Parallel arrangement of a dot tile

number of dots needs to be increased in relation to the size of the tile. Based on calculations, 5×5 dots gives a 60 mm interval on a 300 mm-tile, and 7×7 dots gives a 57.1 mm interval on a 400 mm-tile, and 9×9 dots gives a 55.6 mm interval on a 500 mm-tile. Therefore, the interval between dots is defined within a range of between 55 and 60 mm.

Furthermore, the interval range of 55-60 mm was determined in order to keep consistent spacing between dots and to establish a standard unit for tactile ground indicators, the number of dots, and the length of (b) when several tiles are installed side by side. This range enables the installer to choose one of the interval options within this range as a standard distance when several tiles are laid side by side, but it does not allow the installer to vary the intervals (b) within one tile.

2) Bar Tiles

(1) Shape of Bars on a Bar Tile

Bars on a bar tile are rectangular in shape as shown in Figure 1-3. The edge corners are sharp because they might be confused with dot tiles if they were semi-circular in shape.

Regarding the size of bar bumps, the width of the top surface area of the bar (a) is specified as 17 mm, that of the bottom of the bar is set as (a') = (a) + 10 mm, and the tolerance is (+1.5 -0) mm. The length of the bar is specified as d≧270 mm (d' =d +10 mm). Any length is acceptable in

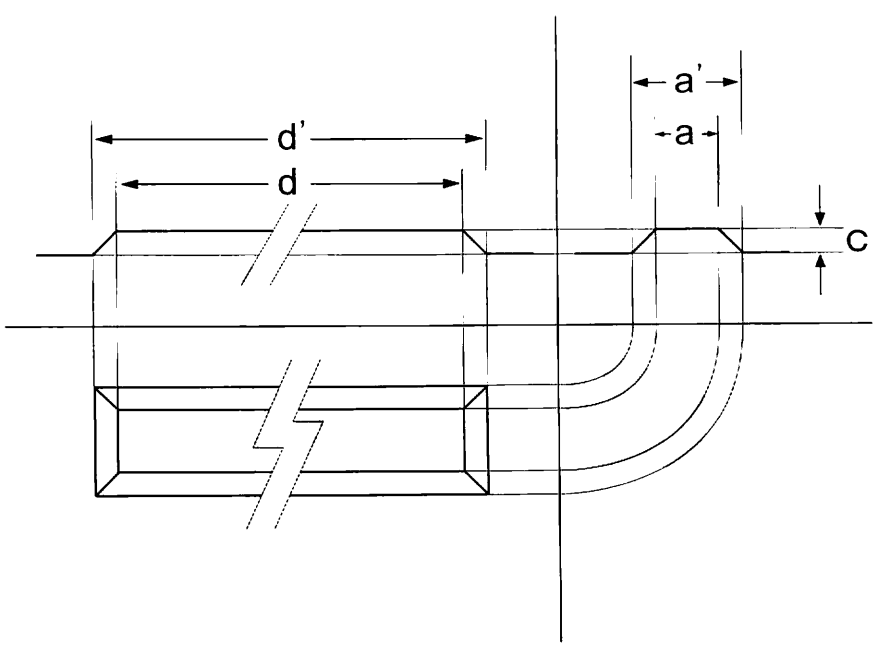


Figure 1-3: Shape of a bar on a bar tile

principle; however, in reality, when the installation and the drainage of rainwater are taken into account, it is more practical to divide bar tiles into an appropriate length. Based on the standard unit for tactile ground indicators, the minimum length of a bar shall be 270 mm.

(2) Size of a Bar Tile

There is no specific standard set for the size of a bar tile except that there shall be at least four bars on a tile.

Intervals between bar centers (b) are, as shown in Figure 1-4, set at 75 mm with a tolerance of (+15 -0) mm. When four bars are arranged at 75mm intervals, the width of the tile measured vertically to the bars becomes 300 mm. As for the length of the tile, in addition to the length of the top surface of 270 mm, the interval between the adjoining edges of two tiles shall be less than 30 mm including 10 mm of the length of the adjoining pavers. Based on this, it is fair to say that the minimum size of a bar tile is also 300 mm square.

Meanwhile, the contour of a tactile ground indicator in the JIS Standard is drawn with chain lines (imaginary lines) so as to make either type of tile more easily distinguished; however, what is specified here is the pattern, not the actual size of the tile.

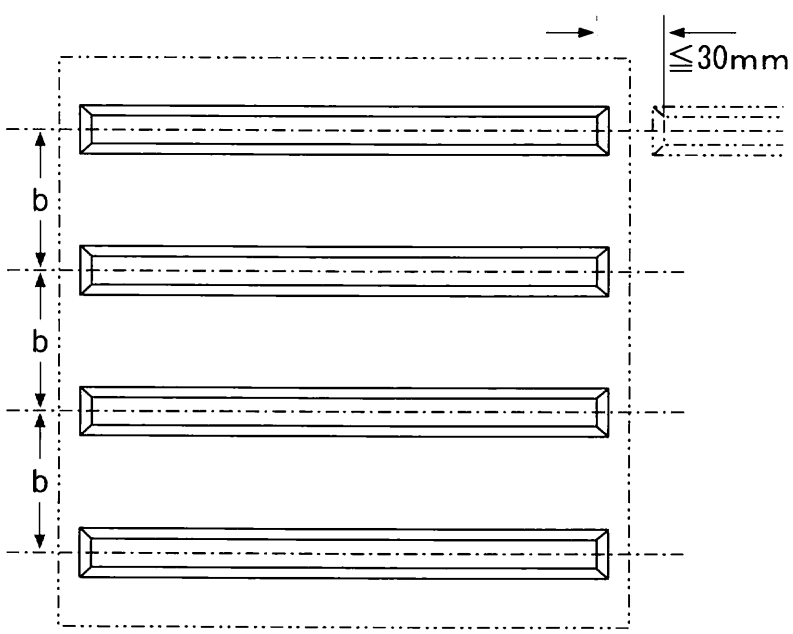


Figure 1-4: Shape of a bar tile

(3) Depth of Grooves and Tolerance

The depth of a groove on both dot and bar tiles (c) is set as 5 mm. This is determined based on experiments to find the appropriate depth that is detectable but does not at the same time represent an obstacle to pedestrians. In addition, in order to secure the minimum depth of 5 mm, both tiles have a tolerance of "+1 mm". The width and length at the bottom, (a') and (d'), are calculated based on the depth of 5 mm and an angle of 45 degrees.

3. Shapes not in Compliance with JIS T 9251

Many types of tactile ground indicators are being used in Japan other than the ones stipulated in JIS T 9251. JIS T 9251 was established in 2001, and the objective was to standardize various patterns that were already in wide use. It is not expected that the existing indicators will comply with JIS requirements immediately, as this would be difficult, and therefore, the co-existence of those in compliance and not in compliance with JIS requirements will continue for some time.

The decision to reject the following types at the time of the establishment of JIS standard was based on the "Report of Fundamental Research on Standardization Relating to Tactile Tiles for Guiding the Visually Impaired" conducted by Agency of Industrial Science and Technology of the then Ministry of International Trade and Industry from 1996 to 1998. In order to clarify the intent of this report, an outline and the reasons for the rejection are provided below.

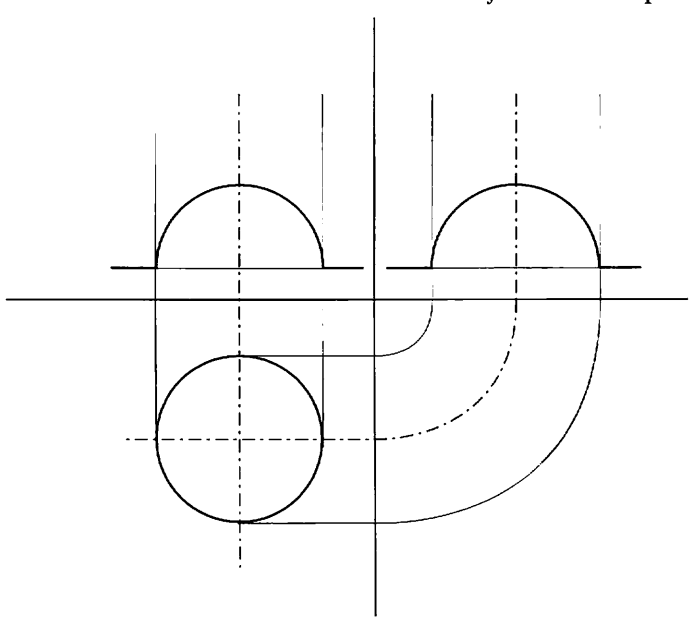


Figure 1-5: Dome-shaped dot tile
(Sample of tile rejected by JIS T 9251)

1) Dome-shaped Dot Tiles

A dome-shaped dot tile has dome or cylinder tops instead of flat tops as shown in Figure 1-5. Some suggested that domes were slippery, so this shape was excluded from the standardization experiments. It is assumed that less dome-shaped tiles are now used as they give a sharper sensation to soles of the feet than semi-dome types.

2) Oval-Shaped Bar Tiles

As Figure 1-6 shows, the bar of an oval-shaped bar tile is shaped like an oval with semi-circular edges. The round edges are the reason for the rejection because the detection rate (the percentage of subjects able to recognize the tactile ground indicators) was low and it could not be easily distinguished from dot tiles, and because it did not have the required length.

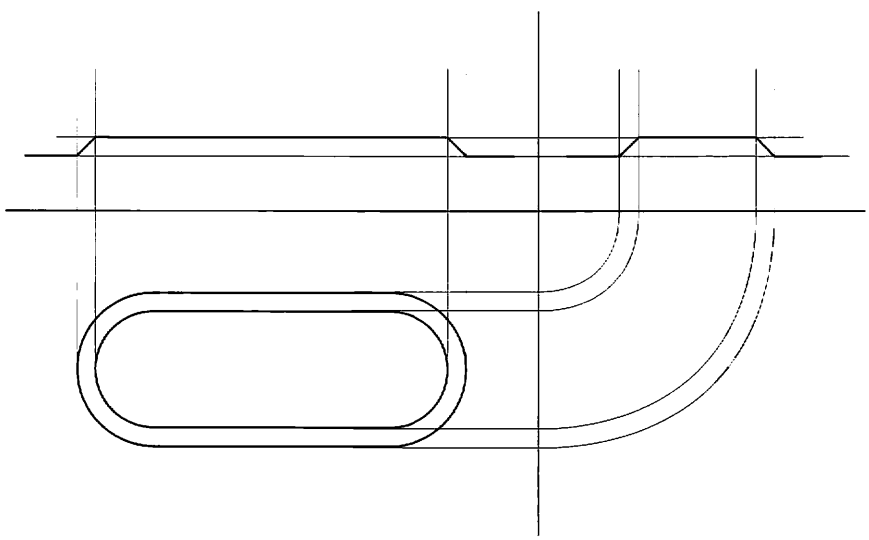


Figure 1-6: Oval-shape bar tile
(Example of tile rejected by JIS T 9251)

3) Zigzag Arrangement

In addition to the dot tiles with a parallel arrangement as described in Figure 1-2, there is a dot tile whose dots are arranged in zigzag pattern as shown in Figure 1-7. Experiments showed that it was very difficult to differentiate between zigzag and parallel arrangements, meaning that it was difficult for the tiles to transmit different messages when they were installed. Thus, only the parallel arrangement was selected.

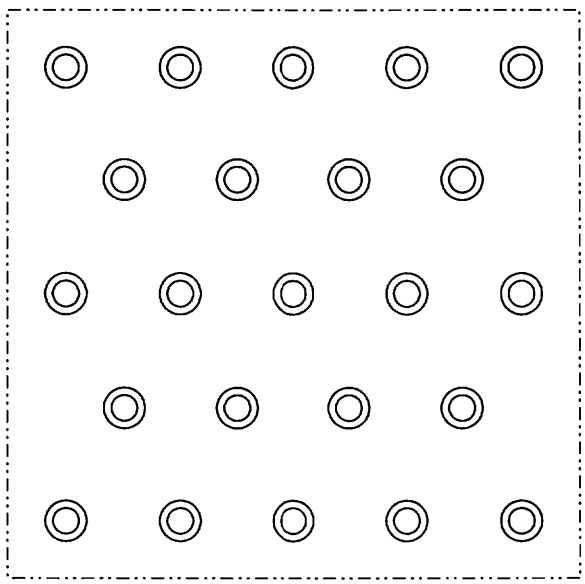


Figure 1-7: Zigzag arrangement
(Example of tile rejected by JIS T 9251)

4. Other Requirements

JIS T 9251 stipulates a shape and size for tactile ground indicators to fulfill the requirement that two messages need to be effectively transmitted: one, to act as a guide to the direction of travel and two, warning of a hazard or danger. In order to add more functions to tactile ground indicators, it is necessary to examine other possible configurations.

Color is a factor of particular importance. Many people with low vision do not necessarily walk on the tiles, but travel along the tiles by following the color. In other words, an important factor required for tactile ground indicators is, besides the message transmissibility through tactile perception, to select colors that contrast strongly against the surrounding road surface regardless of weather. In Japan, yellow is thought to be most visible on asphalt road surfaces, and many tactile ground indicators are yellow for that reason. Additionally, other important factors include durability, ant-friction properties, and non-slipperiness.

Nonetheless, tactile ground indicators, when they are installed for the convenience of the visually impaired alone, may become an obstacle to people in wheelchairs or cause the elderly to stumble. In addition, the development of universal designs that include aesthetic considerations within their scope is expected to provide more effective and efficient tactile ground indicators in the future.

Chapter 2.
Method of Installation of Tactile Ground Indicators

1. Installation Principles of Tactile Ground Indicators

1) Installation where directional indication is necessary

Traveling alone in open spaces always causes anxiety to persons with visual impairment since they are not able to change direction based on vision. They do not have clues to direct them to their destination, and even if they did, they might still stray from a safe path while walking. Bar tiles are installed in order to indicate the direction of travel and to guide the user to his or her destination.

2) Tactile ground indicators shall be installed to alert the user to a possible danger or to indicate access to the facilities of the destination.

There are several ways in which visually impaired persons gather information while walking. These include tactile information or muscle sense obtained via the soles of the feet, sensory information conveyed via a white cane, and auditory information such as reflected sound, etc. When a visually impaired person without a white cane is moving around in hazardous locations, they can sense obstacles in front of them through reflected sound, but they cannot sense descending steps or the depth of those steps. Using a white cane enables them to gather more information: and needless to say, the more information they have, the more chances there are to increase safety when they encounter potential hazards. Therefore, as an effective safety measure, dot tiles shall be installed at potentially hazardous locations such as stairs, railway platforms, or pedestrian crossings. They shall also be installed where guidance is necessary and shall be installed at the end of bar tiles to indicate the entrance to buildings, the location of information boards, or forks in roads.

2. Notes on Installation of Tactile Ground Indicators

1) Simplicity and Sequence

The installation of tactile ground indicators should be targeted and minimized as far as possible in order to provide accurate information regarding direction of travel or position. The more tiles are used, the higher the possibility of confusing persons with visual impairment as well as creating obstacles to other pedestrians including people in wheelchairs, the elderly, or mothers with strollers, etc. (Figure 2-1)

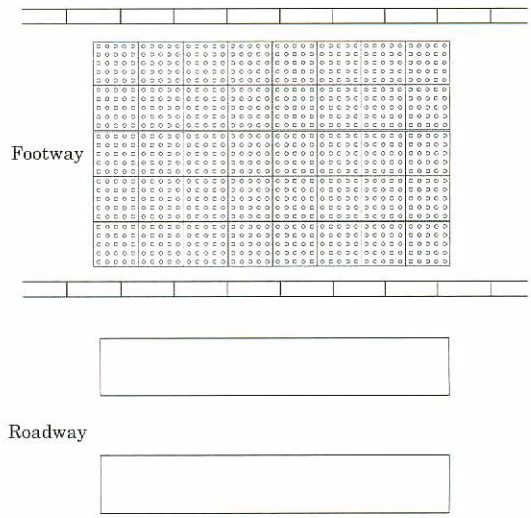


Figure 2-1: Example of undesirable installation site

Sequence is important in providing an indication as to direction. Tiles providing directional indication in a sequence should not be in principle suddenly stop in the middle of a safe path of travel. There are, however, some exceptions. For example, when a manhole cover coincides with the route of tactile ground indicators. There are two ways to deal with this situation. The first way is to end the tiles just before the

Figure 2-2: Example of stopping tiles on either side of a manhole cover

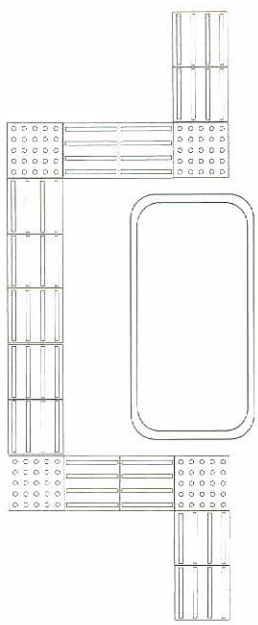


Figure 2-3: Example of placing tiles around the manhole cover

Figure 2-4: Example of road surface with uneven pavers, which makes it difficult for visual impaired people to detect tactile ground indicators

Figure 2-5: Example of an adjoining surface with low visual contrast, which makes it difficult for visual impaired people to detect tactile ground indicators

manhole cover and then continue with them immediately after. (Figure 2-2) The second way is to skirt the cover by placing the tiles around it. (Figure 2-3) In general, the latter method is used. However, when the manhole-cover is small, the visually impaired may become disorientated because of the frequent changes in direction within a small space. In such a case, the former method may enable them to maintain a sense of continuity since they can find the tiles again in just two or three steps.

2) Contrast to the Adjoining Surface (tactile and visual senses)

Visual impaired people who have learned how to walk with a white cane detect the tactile ground indicators by sweeping the tip of the cane across the road surface. If the adjoining surface is paved with uneven pavers, this makes the detection of tactile ground indicators more difficult when a cane is used. (Figure 2-4) Therefore, it is recommended to choose a smooth and seamless adjoining surface when installing tactile ground indicators.

Most visual impaired people who are partially sighted are able to detect tactile ground indicators by sight. It is therefore important to provide a high visual contrast to the immediately adjacent surface. (Figure 2-5)

3) Separate use of dot tiles and bar tiles

(1) Installation of Dot Tiles

Dot tiles shall mainly be used to alert people who are visually impaired to potential hazards, or to inform them of the position of the facilities of their destination. At a place where tactile ground indicators are installed, safety can be secured by encouraging them to halt and information can

easily be transmitted. Dot tiles are generally installed in such a way that the front edge of the tile is no closer than 30 cm from the edge of the hazard such as stairs, pedestrian crossings, road boundaries, and accesses to the buildings, etc in order to avoid the vision impaired from stepping into the hazard or hazard area.

(2) Installation of Bar Tiles

Bar tiles shall mainly be used to provide directional indication where a person with vision impairment wishes to gain access to a facility at the intended destination. Bar tiles shall be installed in such a way that bars are aligned parallel with and along the centerline of the required direction of travel.

(3) Combined Dot Tiles and Bar Tiles

When dot tiles are installed in conjunction with bar tiles, they shall be installed as closely as possible to each other since visually impaired people will feel some anxiety if they were to be installed apart. If gaps are unavoidable, at the corners for example, it is recommended to fill the gaps with the same patterned tiles. (Figure 2-8)

There is an exception for white cane users, however, when the dot tiles are interrupted by a manhole cover. (Figure 2-2)

(4) Width of Tiles to be Installed

Tactile ground indicators shall have in principle a minimum width of 60 cm (two tiles when the width of a tile is 30 cm.) in the direction of travel when the visually impaired person takes the first step. This width has been

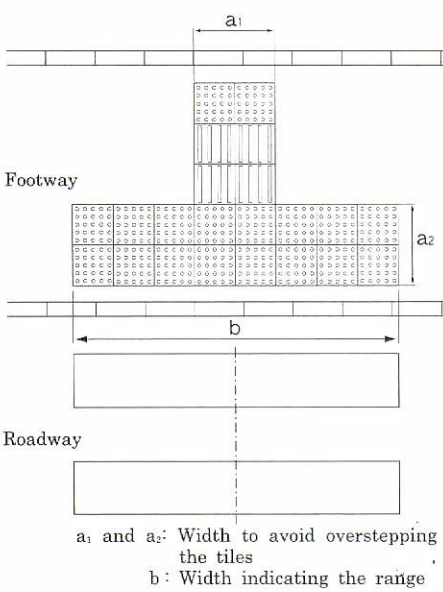


Figure 2-6: Example of installation of tactile ground indicators

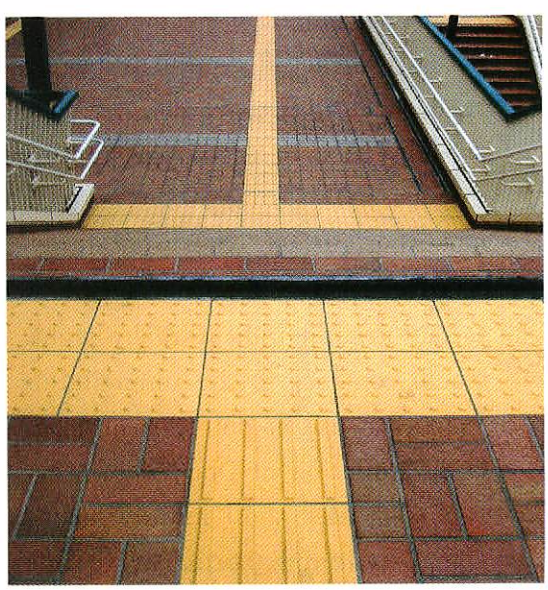


Figure 2-7: Dot tiles installed the full width of the stairway

arrived at through a consideration of the following factors. When the average length of a stride of an adult male is assumed to be 75 cm and the average shoe size is 25 cm, a width of about 50 cm means they will not easily overstep the tiles. In addition, it is easy to install two tiles when the size of one tile is about 30 cm. (Figure 2-6 a_1 and a_2)

Tactile ground indicators that are used to indicate a continuous straight path of travel should be aligned with a minimum width of 30 cm in such a way that they are intersect at a right angle to the pedestrian path of travel.

When dot tiles are mounted where there is a specific width such as stairways or pedestrian crossings, it is recommended to install them over the full width of the path of travel. (Figure 2-6, b) Stairs can be particularly hazardous; a fall may occur if dot tiles are not installed across the full width of the stair. (Figure 2-7)

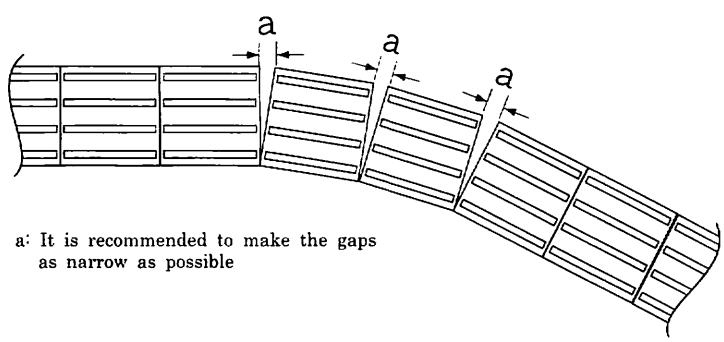


Figure 2-8-1: Example of tiles installed without alteration

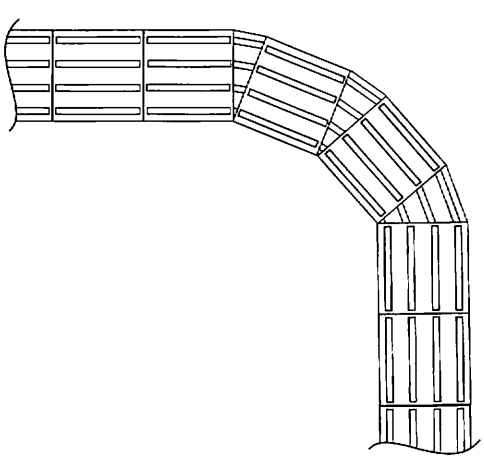


Figure 2-8-2: Example of filling gaps with tiles having the same pattern

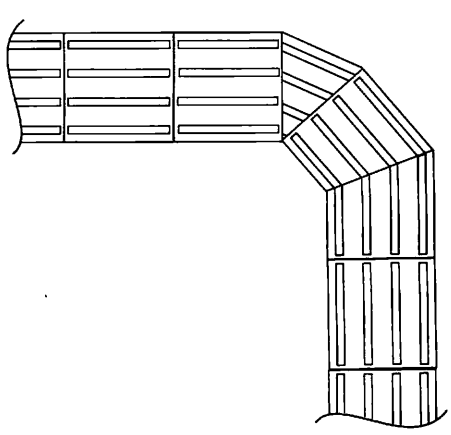


Figure 2-8-3: Example of tiles altered to fit a curve in the road

(5) Installation in the Form of a Square without Alteration

Tactile ground indicators may need to be altered to accommodate the road conditions such as curves or deflections of guided pathways. When the angle of the curve is small, it is acceptable to lay squared tiles without alteration. However, when the gap (a) widens, there are two ways to fill the gap. One: to fill the gap with tiles of the same patterns (Figure 2-8-2), and two: to fill the gap with modified tiles (Figure 2-8-3)

There are some cases when dot tiles are aligned along the curved curb of a ramp connecting the footpath to the roadway. (Figure 2-9-1) It looks fine visually, but a person with visual impairment could easily loose their orientation and deviate from the required direction at this curb. Therefore, it is recommended to install squared tiles without modification as Figure 2-9-1 shows.

(6) PR Activity of Installed Routes

It is important to disseminate information on installation principles as well as that on installed routes in order to make the best use of tactile ground indicators.

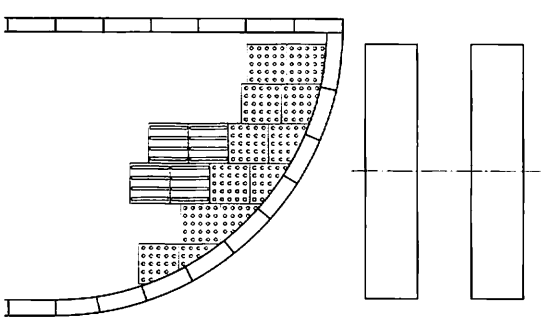


Figure 2-9-1: Example of dot tiles applied to fit to the curve of the curb

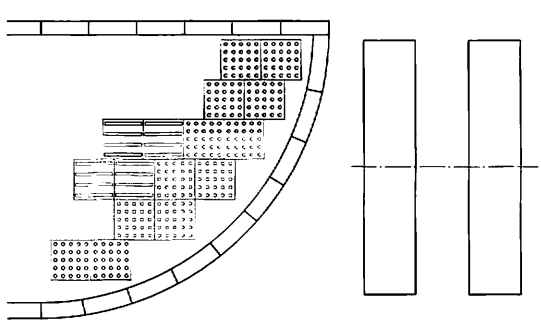


Figure 2-9-2: Example of installation of dot tiles at curb ramp without modification

3. Practical examples of installation

1) Roads

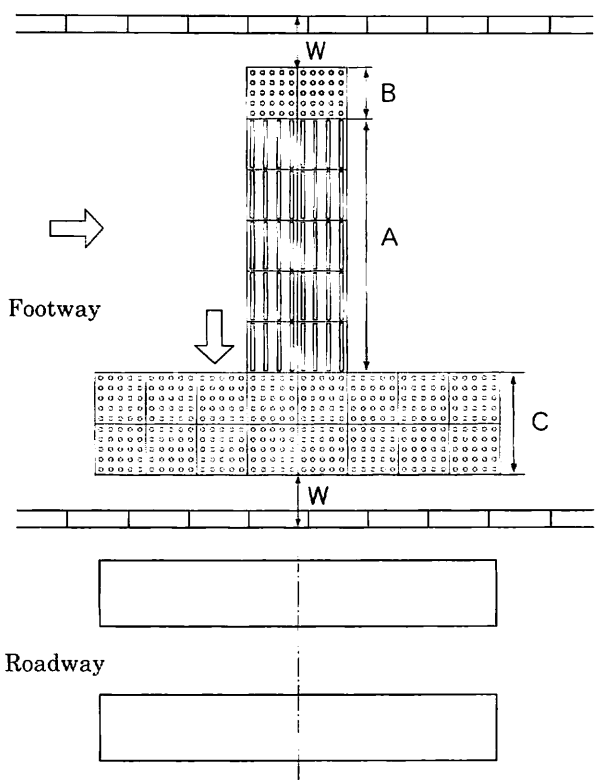
(1) Footways

Bar tiles shall be aligned in a straight line. The location of installation is preferably 60 cm away from the boundary of private properties. This may change depending on the type of private property.

(2) Pedestrian Crossings

Bar tiles are installed just before pedestrian crossings to indicate the direction of the crossing and the centerline of the crossing so that visually impaired people are able to easily find the crossing and cross it safely. (Figure 2-10) Bar tiles in the area-A have the following three roles and they are aligned according to the width of the footpath: a) to lead the visually impaired people toward a pedestrian crossing, b) to indicate the direction of travel to negotiate the crossing, and c) to indicate the center of the crossing.

The range of area-C where dot tiles are installed is preferably consistent with the width of the crossing or that of the normal accessible range.



W: about 30 cm

In the case of a wider footpath, the area-A will be expanded accordingly.

Figure 2-10: Installation example at pedestrian crossings

a. In the case where a pedestrian crossing is angled

Where a crossing is angled, it is recommended to install bar tiles in such a way that the bars are aligned with the direct line of travel across the road. (Figure 2-11 and Figure 2-12)

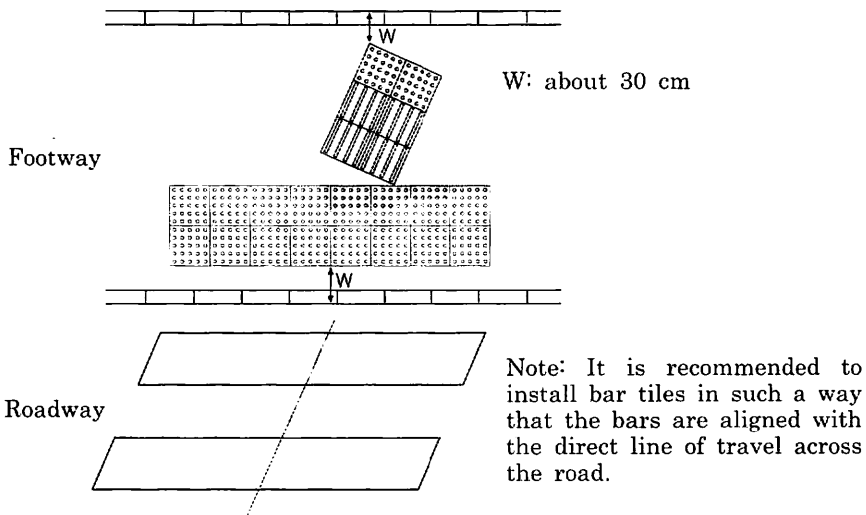


Figure 2-11: Installation example when a crossing is angled

b. In the case of traffic islands

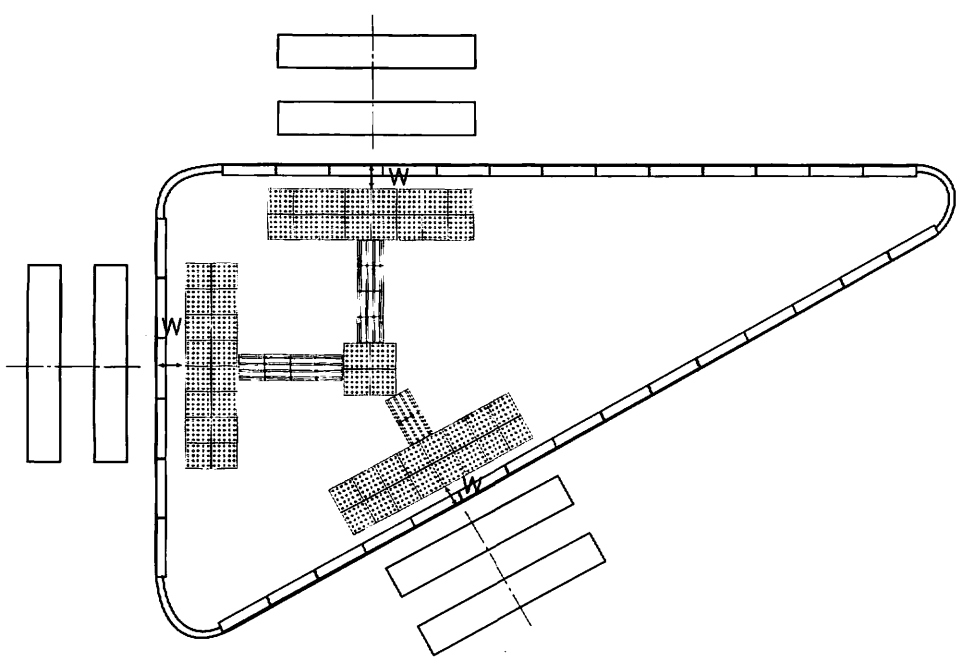
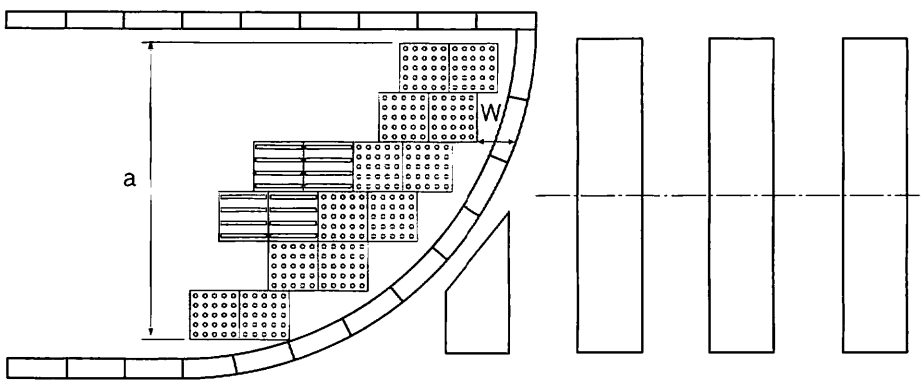


Figure 2-12: Installation example on a traffic island

(3) Curb Ramps

Curb ramps are largely classified into two types: a curb ramp with only one direction of a pedestrian crossing (Figure 2-13); and a curb ramp diverging into two or three directions. (Figure 2-14). In all these situations, the position and direction of travel is indicated by bar tiles

In this case, it is recommended that the area of (a) is identical to the width of the pedestrian crossing or normal accessible range.



Note: It is recommended that the area of (a) is identical to the width of the pedestrian crossing or normal accessible range.

Figure 2-13: Example of a curb ramp with one direction of a pedestrian crossing

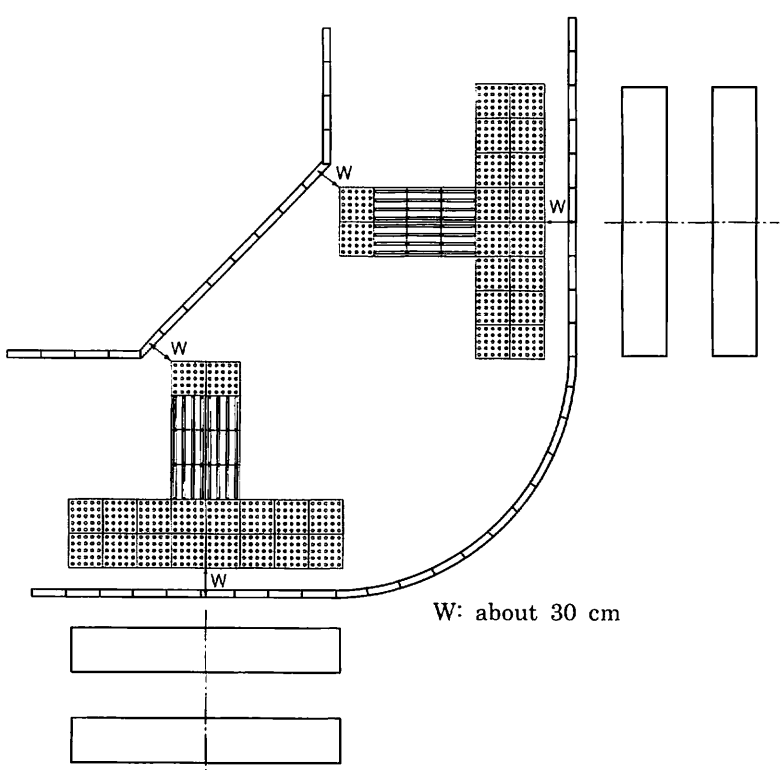


Figure 2-14: Example of a curb ramp with two different directions of pedestrian crossings

(4) Approaches to Underground Crossings

Tactile ground indicators shall be installed at the approaches to underground crossings and subway concourses in the same manner as regular crossings. (From Figure 2-15 to Figure 2-17)

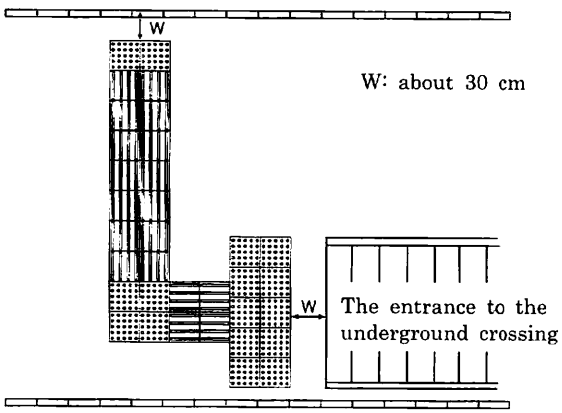


Figure 2-15: Example of installation (1) at the exit and entrance of the underground crossing
(The situation where the direction of the entrance to the underground passage, etc corresponds to the direction of travel of the footway)

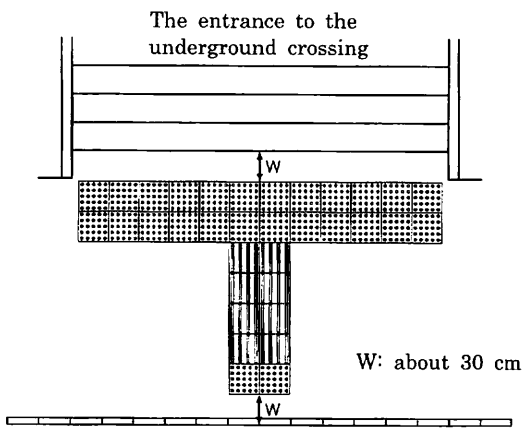


Figure 2-16: Example of installation (2) at the exit and entrance of the underground crossing
(The situation where the direction of the entrance to underground passage is at right angles to the direction of travel of the footway)

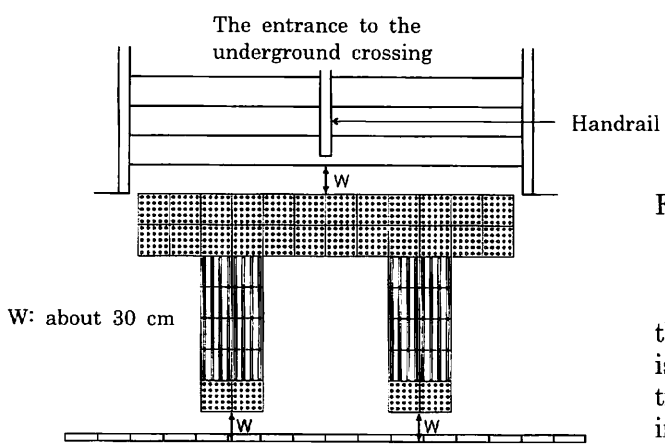


Figure 2-17: Example of installation (3) at the exit and entrance of the underground crossing
(The situation where the direction of the entrance to underground passage is at right angles to the direction of travel of the footway and a handrail is installed in the center of the stairway)

(5) Medians

At medians, dot tiles and bar tiles shall be installed: the former to indicate the width of the crossing, and the latter to indicate the travel direction and the centerline of the crossing. (Figure 2-18 and Figure 2-19)

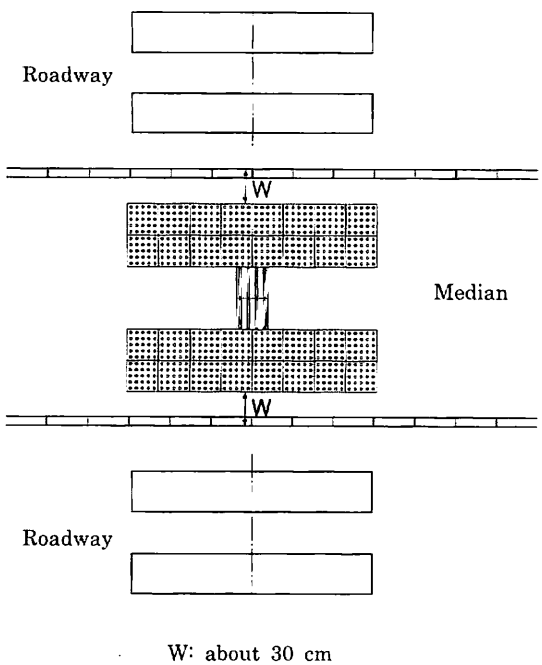


Figure 2-18: Example of wide median

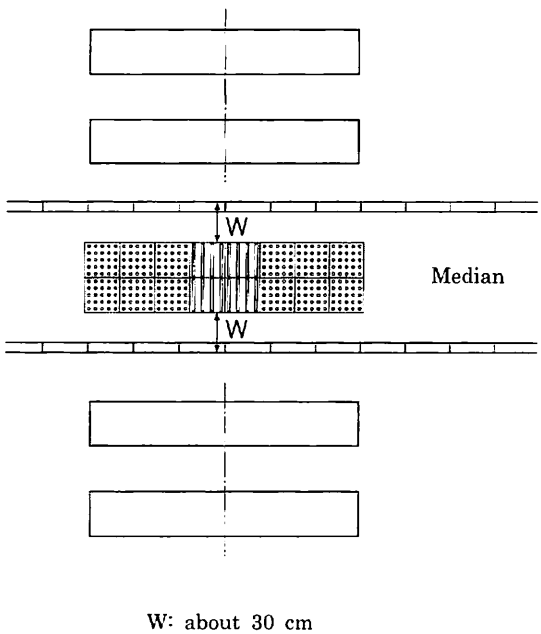


Figure 2-19: Example of narrow median

(6) Bus Stops

Tactile ground indicators shall be installed to indicate the bus entrance at bus stops. There is no need to indicate the exit of the bus as this would create confusion. (Figure 2-20 and Figure 2-21)

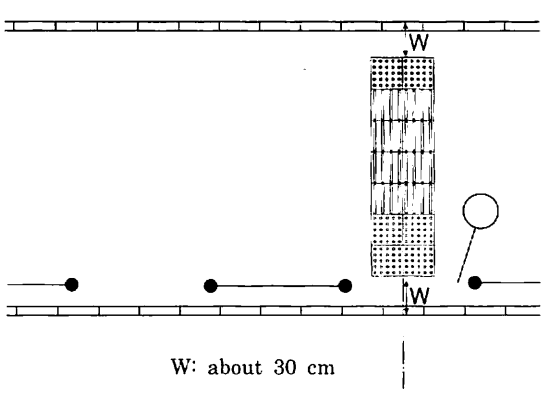


Figure 2-20: Bus stop (wide footpath)

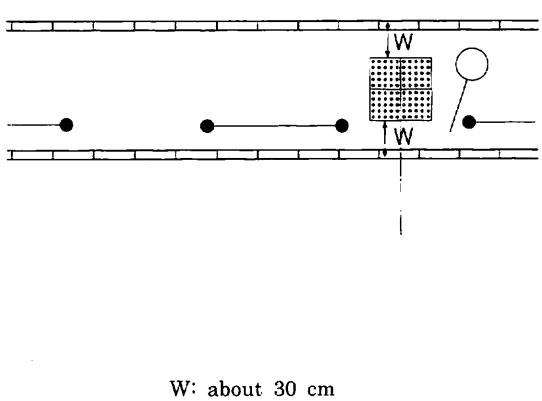


Figure 2-21: Bus stop (narrow footpath)

(7) Curves/Deflections and Turning Points

A straight path on the footway is directed by a line of single bar tiles. At turning points, in principle, dot tiles are installed to alert the visually impaired that a turning point exists. (Figure 2-22 and Figure 2-23)

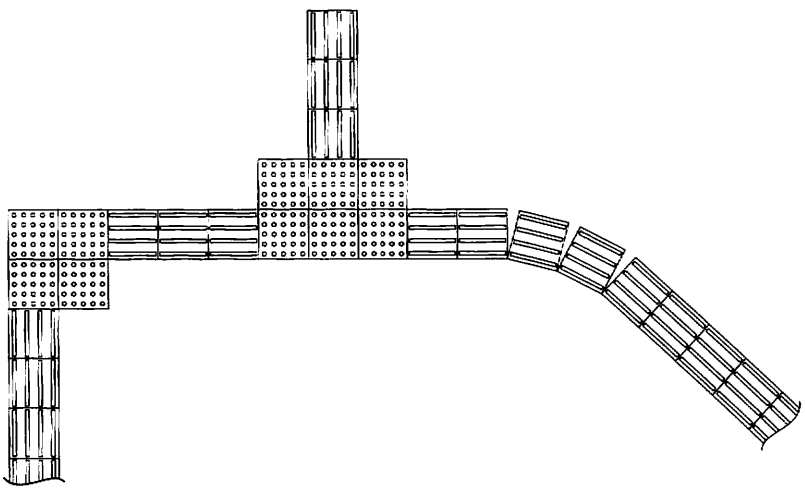


Figure 2-22: Example (1) of curves/deflections and turning points

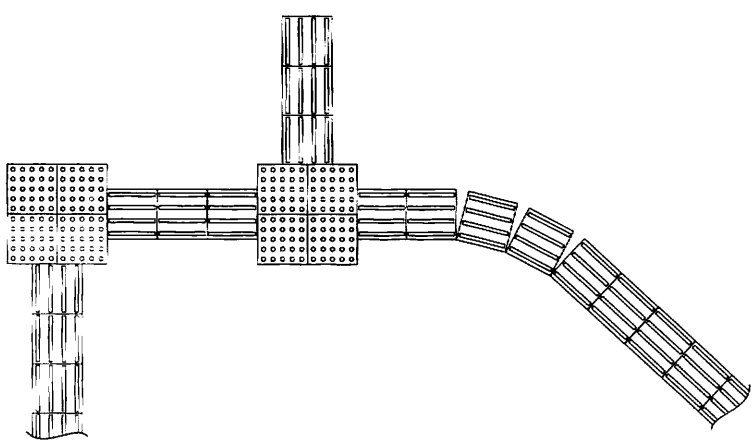


Figure 2-23: Example (2) of curves/deflections and turning points

2) Public Transport

(1) Railway Platforms

Dot tiles are aligned parallel to the railway tracks at a railway platform where the set back for the hazard must be at least of 80 cm. Additional set back distance is provided here on the assumption that vision-impaired people may not be able to come to a complete stop as soon as the warning signs from the dot tiles are detected. In other words, this is to secure an extra safety margin even if one additional step is taken. It is recommended to extend the dot tiles installed parallel to the railway tracks and to install fall prevention fences at both ends of the platform. (Figure 2-24)

Direction to stairways shall be in line with the installation principles provided for a turning point. (Figure 2-25)

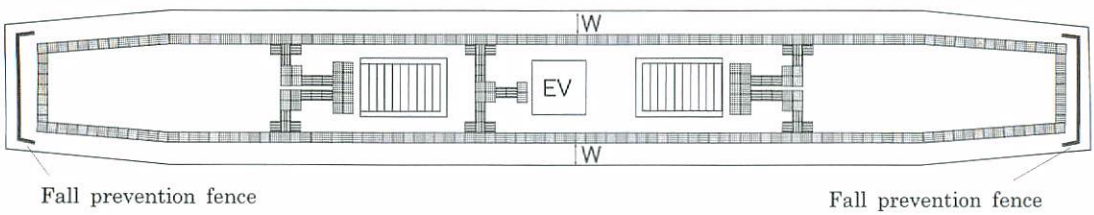


Figure 2-24: Example of installation at platforms

(2) Ticket Gates

Bar tiles are used to lead to ticket gates, and dot tiles at the ticket gates are to alert the visually impaired of their presence. (Figure 2-26)

Figure 2-25: Example of guiding from platform to the stairway

Figure 2-26: Example of installation at a ticket gate

(3) Concourses

Bar tiles are used to guide individuals straight through a concourse, avoiding crowded areas such as ticket machines, approaches to the station offices, or ticket windows. On an extended line, the travel route diverges into several bar-tile routes leading to ticket machines, ticket gates, stairways, and elevators, etc. (Figure 2-27)

Figure 2-27: Example of installation at concourses

3) Public Facilities

(1) Access to facilities

Bar tiles are used to lead to access points to public facilities, and they shall be installed at a location in line with the position of pathways on the premises, etc. (Figure 2-28 and Figure 2-29)

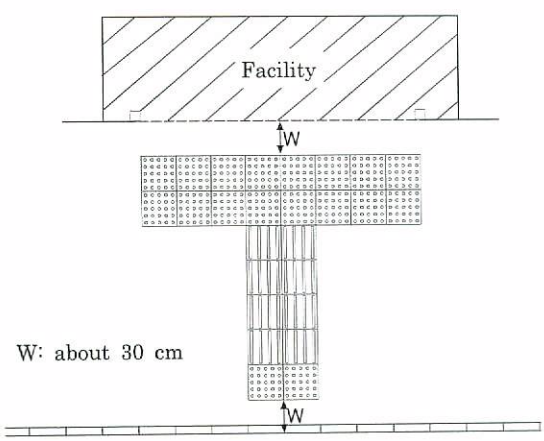


Figure 2-28: Example of installation where there is single pedestrian access

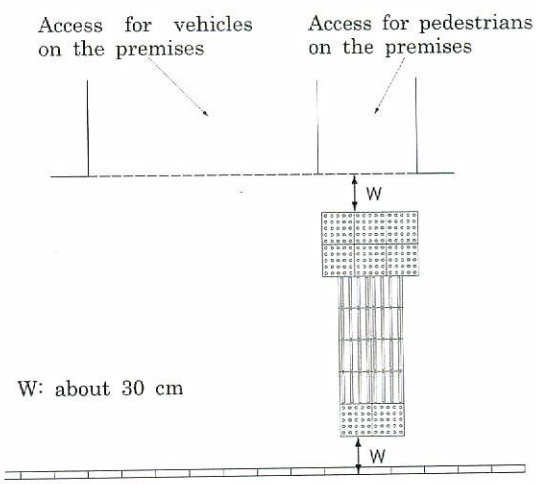


Figure 2-29: Example of installation where there is access for vehicles next to the pedestrian access

(2) Stairways

Tactile ground indicators shall be installed in accordance with the position of overhead walkway facilities. (Figure 2-30 and Figure 2-31)

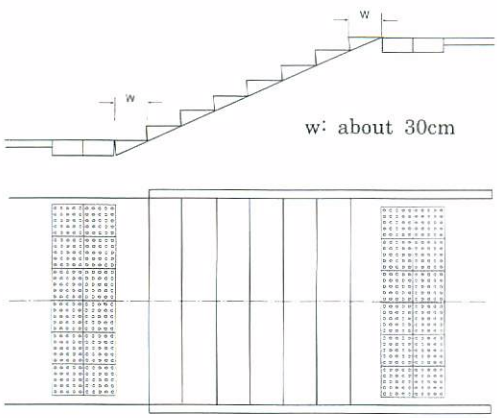


Figure 2-30: Example (1) of installation at stairway

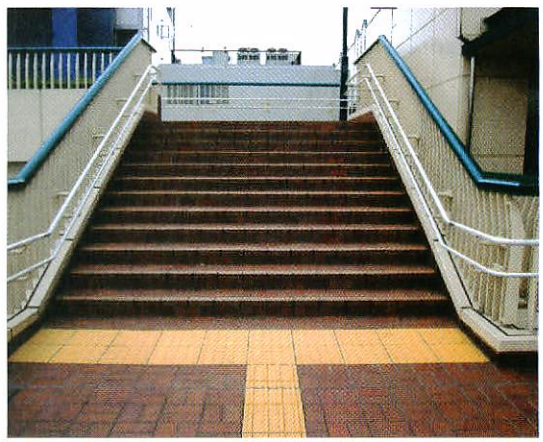


Figure 2-31: Example (2) of installation at stairway

(3) Elevators

Bar tiles shall lead to the spot directly in front of the touch button panel for the elevator, and dot tiles shall indicate the position of the switch. The reason why pedestrians with visual impairment are not led to face the elevator door is that dot tiles indicating the position of the elevator would become an obstacle to people in wheelchairs, and it is also to avoid a collision with people coming out of the elevator.

Figure 2-32: Example of leading to an elevator

Chapter 3.
Mobility with Tactile Ground Surface Indicators

1. Basic Travel Skills for Persons with Visual Impairment

1) Protection and Trailing

(1) Protection

"Protection" is the ability to move about independently indoors with maximum safety. It can be further divided into upper body protection and lower body protection.

While in the protection position, maintain an upright posture without swinging the arms and place the upper arm so that it is at an angle to the target object. In other words, while passing along corridors or through doors, the upper arm is extended out to the side horizontally to allow easy detection of vertically placed objects. When passing by objects on the floor such as desks or handrails, the upper arm is held downwards.

A. Upper body protection

This is to protect the upper body, and at the same time, to detect, through the tactile sense, any object that comes into contact with the body.

The correct posture, as Figure 3-1 shows, is to raise one arm to the shoulder level with the forearm in front of the body and keep it there and cover the body.

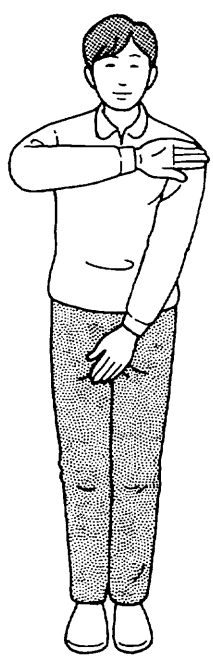


Figure 3-1: Upper body protection

B. Lower body protection

This is to protect the lower body and at the same time, to detect, through the tactile sense, any object that comes in contact with the lower body.

The correct posture, as Figure 3-2 shows, is to lower one arm to the midline of the body, and hold the back of the hand about 15cm away from the body facing the direction of travel so that the arm is slightly extended forwards.

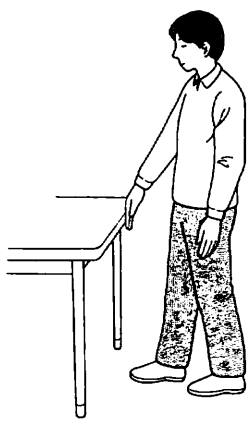


Figure 3-2: Lower body protection

(2) Trailing

This is a technique used to walk along a passageway using the walls or handrails in order to get to the destination. By using an object such as walls, it is possible to transform space information into object information through the tactile sense.

When walking, extend the arm next to the side of the wall at 45 degrees, and follow the wall with the ring or small finger placed on the wall. The finger and hand should be relaxed and slightly bent to avoid injuries and the arm is extended forward.

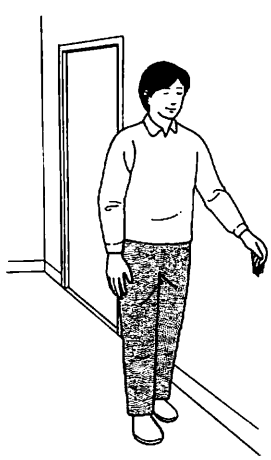


Figure 3-3: Trailing

2) Basic Cane Techniques

(1) White Cane

There are two types of white cane: folding canes and straight canes. The purposes of using white canes are mainly a) to secure safety, b) to gain information and c) as a symbol of 'blindness', and the canes enable visually impaired people to travel more safely and efficiently.

The white cane consists of three main parts: grip, shaft and tip (a bottom tip). Every part must be high quality in terms of durability and transmissibility. It is recommended that tips are replaceable since they eventually wear out. The length generally recommended as optimum for a white cane can be defined as the distance from the ground to a point 2 to 3cm above the pit of the stomach measured perpendicularly.

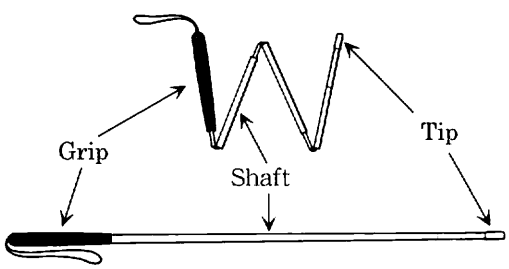


Figure 3-4: Type of white cane/ names of parts

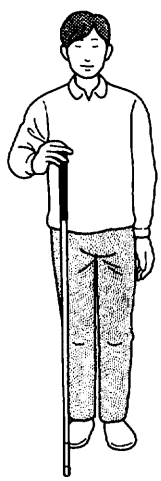


Figure 3-5: Length of white cane

(2) Basic Cane Techniques

A. Touch technique

Touch technique is the basic technique needed to move around safely and efficiently. This technique informs the cane user about the obstacles or grades two steps away.

a) Basic grip

Place the grip in the middle of the palm. The cane is held so the index finger points down the length of the cane, and the rest of the fingers and the thumb are curled around the grip, with the back of the hand facing to the side.

b) Starting Position

The hand which holds the cane is placed at the level of the body's midline and away from the body. The cane is held at around waist height.

Figure 3-6: Grip of white cane

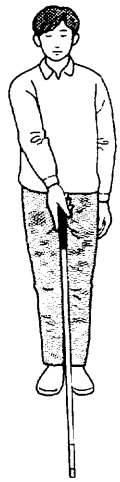


Figure 3-7: Starting position

Figure 3-8: Starting position (side view)

c) Cane Control Technique

While fixing the wrist at the body's midline, swing the tip in an arc across the front of the body by moving the hand from side to side. The arc range is correct when the tip of the cane is visible a few centimeters on either side of the shoulders.

In front of the body, the cane is moved in a low arc, just 2 or 3 cm above ground. Thus, the cane tip makes contact with the ground at two points a few centimeters beyond shoulder breadth.

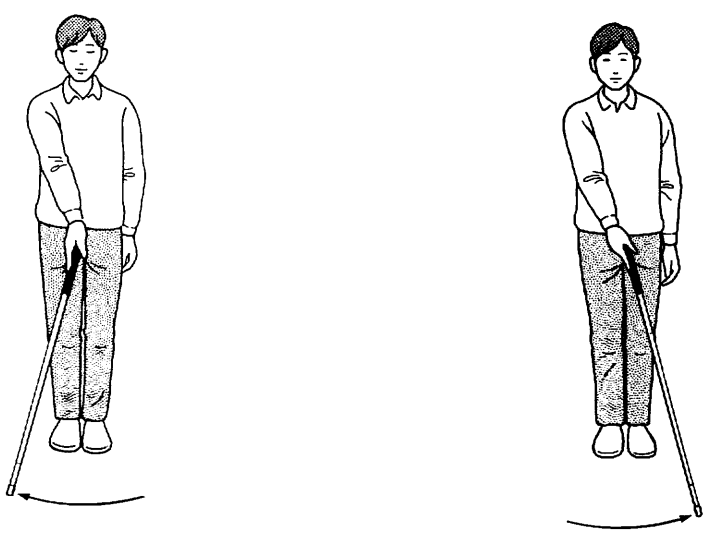


Figure 3-9: Cane control technique

Next, the rhythm of the cane swing and the correct timing for walking are explained. As the right foot moves forward, the tip of the cane checks the ground in front and a little bit to the side of the opposite foot. As the left foot moves forward, the tip of the cane checks the ground in front and a little bit to the side of the opposite foot. The foot should touch the ground at the same time the cane comes into contact with the ground.

B. Constant Contact

The constant contact technique means keeping the cane tip constantly in contact with the ground instead of lifting it off. By sliding the tip sideways along the floor surface, more information about the travel surface is obtained to allow safer movement. This technique is particularly useful when moving across a smooth surface or a possibly hazardous area such as railway platforms.

C. Shoreline Technique

In the shoreline technique, the cane runs along the tactile ground indicators, the edges of footpaths or wall of buildings. The basic technique is the same as the touch technique or constant contact technique, however, one side of the swung cane must touch the edge. It is an important technique when walking along using tactile ground indicators or for detecting a turning point indicated by tactile ground indicators.

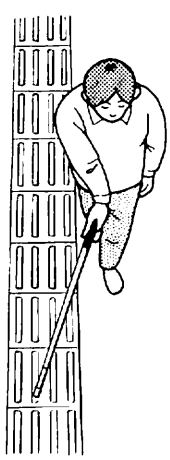


Figure 3-10: Shoreline technique

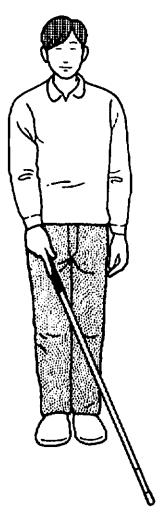


Figure 3-11: I.D. technique

D. I.D. Technique

This technique is generally used by people with low vision who are able to navigate using their residual vision. The grip is held in the same way as the touch technique and the wrist is twisted inward. In this case, it is all right to curve the index finger around the grip with the thumb held straight against the cane grip. The cane is held diagonal against the body's midline, holding the grip at the waist level, bringing the tip of the cane a little bit to the side of the opposite foot.

The cane is held steadily and slightly off the ground.

3) Moving Around with Residual Vision

Persons with vision impairment often use their residual vision as a way of collecting information on the surrounding environment. Most of the tactile ground indicators are colored yellow; their clarity/luminance create a clear contrast with the adjoining pavement. It is therefore easy to see the indicators on the road surface, enabling visual impaired people move around using their residual vision. However, someone with particularly poor residual vision may not always be able to identify an object correctly; therefore, there is a possibility that an object detected by residual vision may be misidentified, thus increasing the risk of travel. It is recommended, therefore, to discuss with trainees whether they should use their residual vision or rely more heavily on the other senses to ensure safe movement.

An orientation and mobility specialist shall instruct trainees so that the utilization of residual vision and the white cane techniques complement one another. The combined use of the visual information and white cane means that the various senses can be appropriately utilized, depending on the nature of a given situation. It must be also noted that excessive reliance on vision could actually reduce the safety of the visually impaired. Moving around with residual vision also requires basic techniques such as formulation of a mental map and knowing how to remain orientated while walking. However, such techniques are often neglected when the vision impaired rely too much on residual vision. It is necessary to understand the significance of the visual information received and to exercise judgment selectively when helping trainees recognize landmarks from among the available visual information.

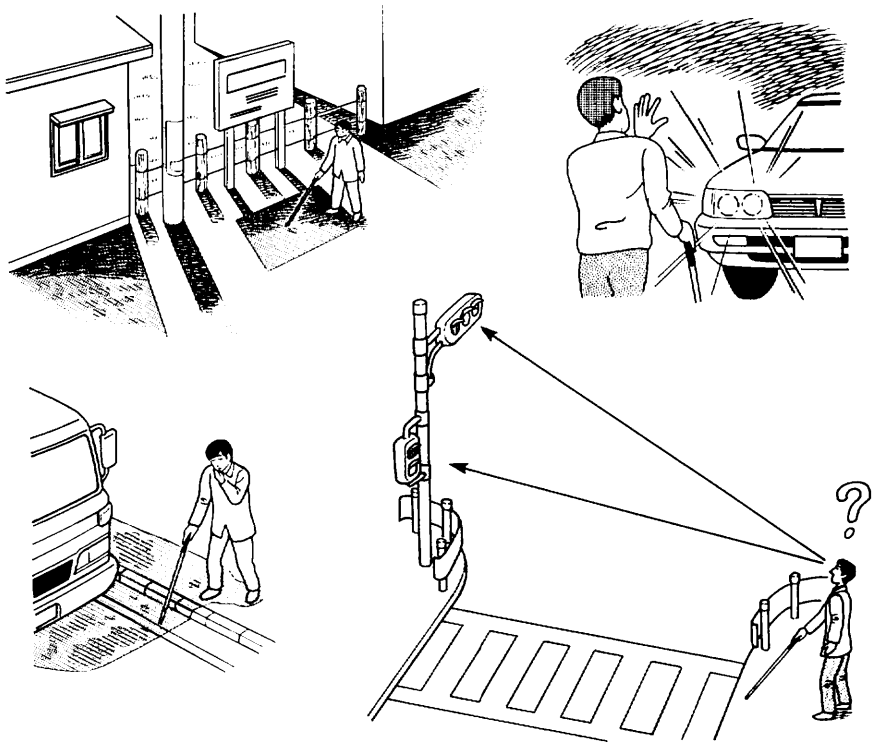


Figure 3-12: Environment in which a person with low vision has difficulty seeing

Optical aids shall be used depending on an individual's vision. Optical aids come in a variety of forms depending on the purpose. These include monocular aids used to view objects far away and light-filtering glasses to prevent glare. It is recommended to work in conjunction with specialists who train persons with low vision in order to provide effective training.

A. Monoculars

A monocular is used to view objects far away, which are hard to see for people with low vision. The appropriate form of training is provided depending on the objective, e.g., seeing signs, signals, and fare tables or timetables at railway stations.

Figure 3-13: Monoculars

B. Absorptive lenses

Many people with low vision find ambient or fluorescent lighting of normal intensity too bright. Using special lenses that cut out glare, the light-filtering glasses make the daily life and movement of people with low vision easier.

Figure 3-14: Absorptive lenses

The walking conditions of people with low vision changes as light intensity in the surrounding environment changes. Difficulties in adjusting to lightness or darkness can actually impair their sight further in bright or dim environments. Light-filtering glasses shall be used or training on night travel shall be provided according to specific user needs.

2. Practical Examples of Walking using Tactile Ground Indicators

What must be stressed is that tactile ground indicators are not perfect. Visual information must be used effectively and safely for individuals with less vision impairment, and safe and efficient movement can only be made possible after receiving the necessary training on the combined use of white canes and residual vision for those with more severe impairment. However, it is recommended to use tactile ground indicators after choosing the walking method appropriate for the level of residual vision of the visually impaired and their overall capacity to walk safely.

1) Stairs

The constant contact technique is used to detect dot tiles at the start and end of the steps or at stair landings. When the tiles are found, the condition of the steps should be examined. When a visual impaired person can make use of some residual vision, the high contrast between the tiles and the neighboring floor surface is an important clue to the presence of the steps, and in this situation the use of vision is generally effective. However, the condition or depth of the steps must be ascertained by using a white cane or from the slope of the handrail.

(1) Finding Stairs and Ascending/Descending

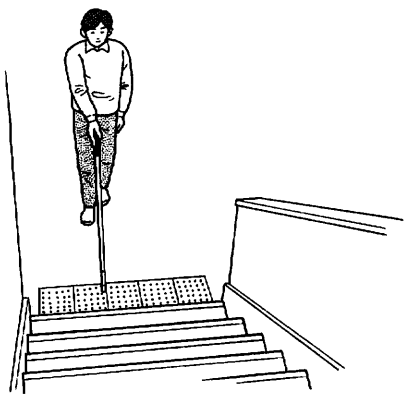


Figure 3-15: Finding stairs (ascending)

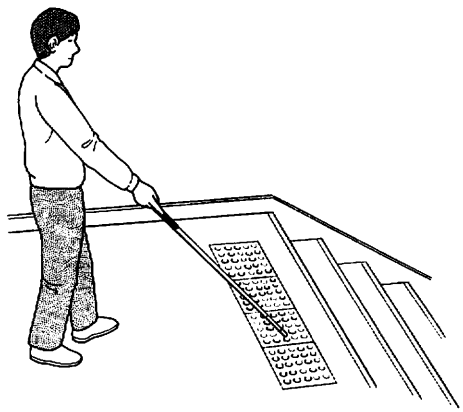


Figure 3-16: Finding stairs (descending)

Get close to the stairs using constant contact and stop when the dot tiles in front of you are detected.

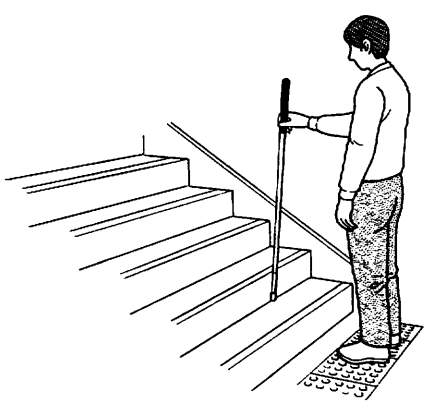


Figure 3-17: Confirmation of stairs (ascending)

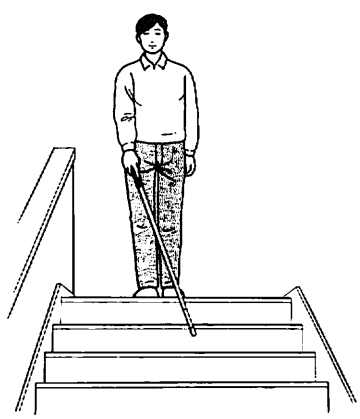
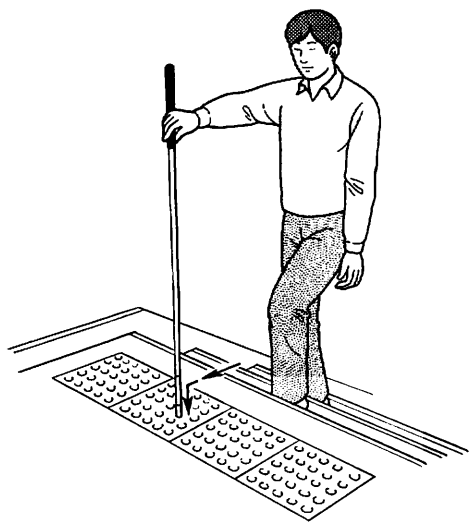


Figure 3-18: Confirmation of stairs (descending)

Regardless of whether you are ascending or descending, once a starting position is confirmed, place the cane tip on the next step to find out about the depth and slope of the stairs.

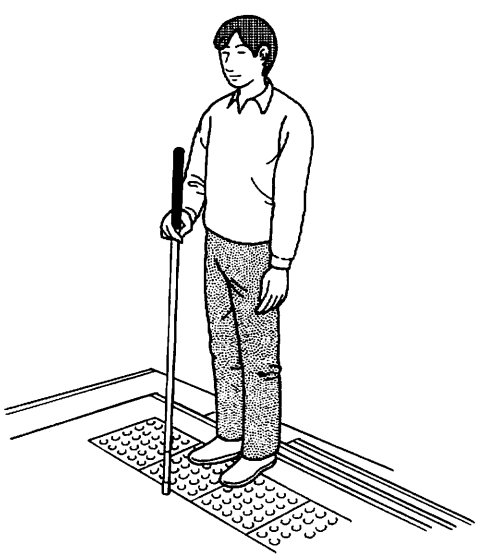
(2) Finding the Last Step or Landing

When the white cane does not touch the next step and it can be swung widely, there is only one more step left. Find the dot tiles indicating the end of the flight of stairs by sliding the white cane forward, with the body leaning forward while ascending.



While maintaining the position of the cane tip, ascend the steps up to the top. Using the pressure sensation from the soles of the feet, one may reconfirm through the dot tiles indicating the end of the flight that the steps have been successfully negotiated.

Figure 3-19: Negotiating stairs (ascending)



When white canes are used, the last step is detected by touching the floor with the cane tip.

Figure 3-20: Confirmation of the end of the flight (ascending)

Figure 3-21: Travel on the stairs (descending)

Handrails are not uniformly installed along the slope of the stairway. Sometimes the handrail becomes flat a few steps before the end of the stairs. Thus, there are times when it is difficult to detect the beginning or the end of the stairs by the form of the handrails. Depending on the physique or stride of a visually impaired person, there are cases when the white cane touches the floor surface instead of the dot tiles. This is fine as long as the tip of the cane or the foot sole touches the floor or dot tiles and it is confirmed that there are no more descending steps.

After stepping down on to the floor, make that the travel direction is safe and proceed forward.

Figure 3-22: Confirmation of the end of the flight (descending)

When there is a landing, repeat the procedure used for finding a step as well as those for descending/ascending.

2) Elevators

Bar tiles installed at elevator facilities lead to a point directly in front of the elevator buttons. However, just detecting the presence of dot tiles installed at the elevator hall does not enable a visually impaired person to know which direction he/she is facing. When the tiles are detected, one needs to find the wall using constant contact, then, find the position of the door and buttons by searching the wall using the cane, hands and fingers. (Figure 3-23)

When an audible indicator is not installed, someone with visual impairment does not know which direction the elevator is going in. Thus, it is sometimes necessary to ask others and confirm whether it is descending or ascending.

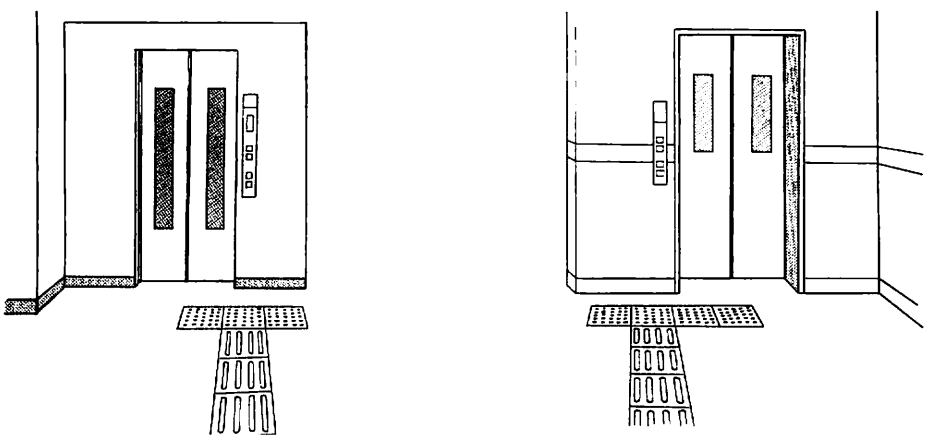


Figure 3-23: Various configurations of tactile ground indicators in front of elevators.

(1) How to Find the Elevator Button

Move the white cane while pressing it against the wall to detect the irregular surface presented by the buttons.

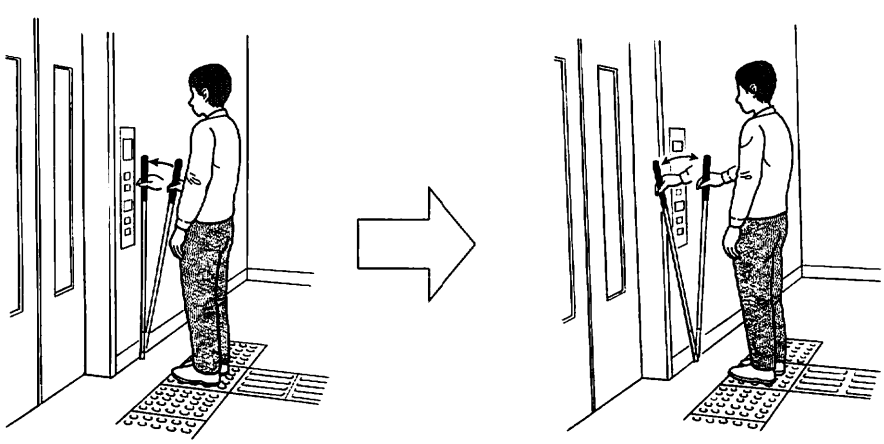


Figure 3-24: How to find the elevator button

3) Finding a Facility Entrance

Detect bar tiles using constant contact. Following the guide of the bar tiles, shoreline along the bar tiles with the cane or move along with one foot on the bar tiles. Find dot tiles indicating the entrance of the facility by using the white cane or through the soles of the feet.

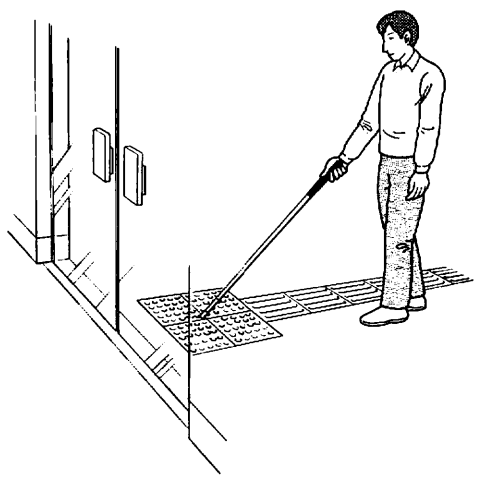


Figure 3-25: Finding a facility entrance

Standing on the dot tiles indicating the entrance, move the white cane forward to detect the borderline between the edge of the bar tile and the entrance. It must be noted that there are times when the door opens automatically as soon as one steps on the dot tiles. If there is no automatic door, move the white cane side to side while pressing it against the door to find the knob or handle of the door.

Figure 3-26: Finding a door

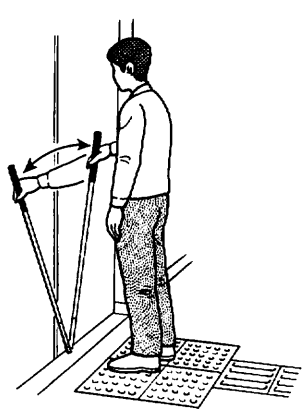


Figure 3-27: Confirming the presence of a door

4) Traveling Through Lobbies

One of the difficult tasks for a visually impaired person is to walk effectively in a wide-open space. Such places are unknown and unfamiliar, and in many cases, one must move about to find tactile ground indicators with no information about their whereabouts. It is recommended to find out, in advance, as much as possible about the overall layout of the lobby and the how the tactile ground indicators are installed.

Some techniques using tactile ground indicators include trailing along bar tiles using constant contact, and the touch technique that involves keeping one foot in continuous contact with the bar tiles. In either case, it is possible to move quickly by applying orientation skills when one knows where the tactile ground indicators are installed and the travel routes.

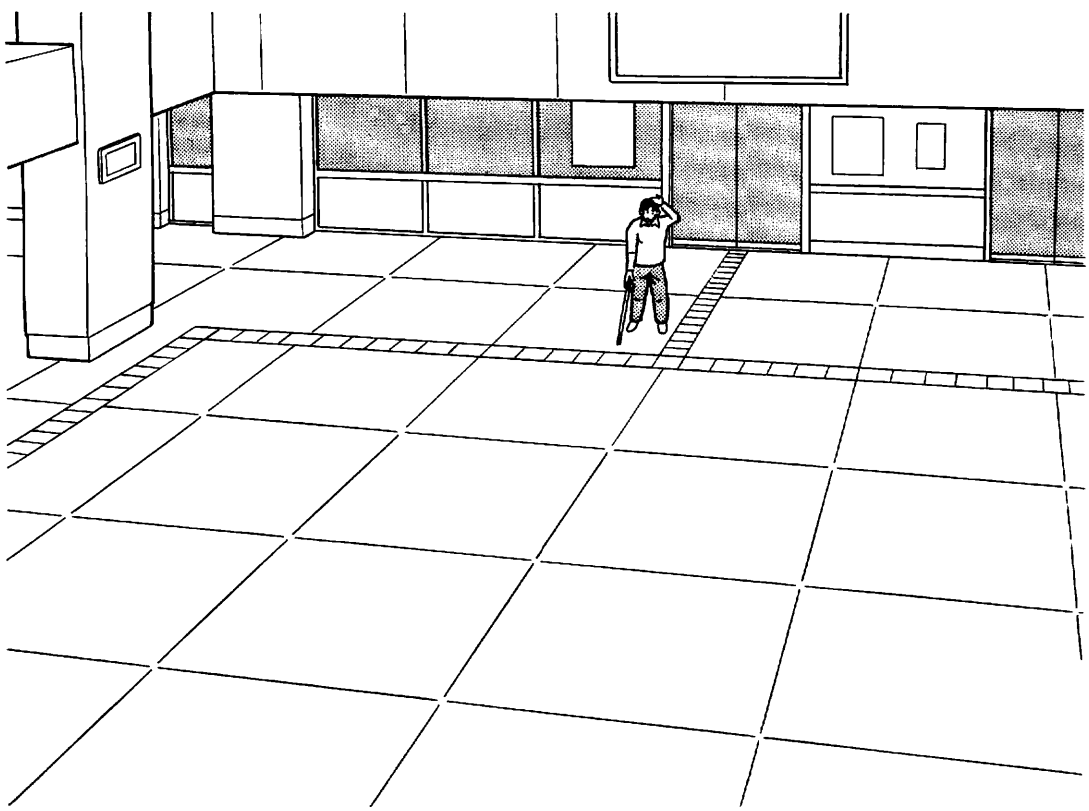


Figure 3-28: Traveling through lobbies

5) Travel on Footway

It is important to stay on the footway when traveling. To do this, a safe direction of travel can be ascertained by using the touch technique, by confirming the existence of bar tiles with the soles of the feet or by using any remaining vision. (Figure 3-29) Another effective technique is to trail along tactile ground indicators using the shoreline technique. (Figure 3-30) When a person is able to detect tactile ground indicators with residual vision, it is acceptable to use the I.D. technique.

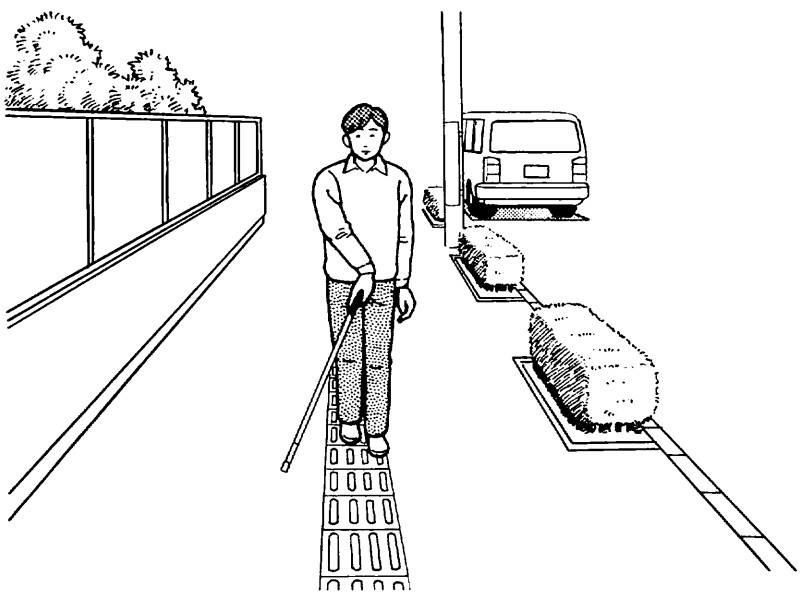


Figure 3-29: Travel on footway (Touch technique)

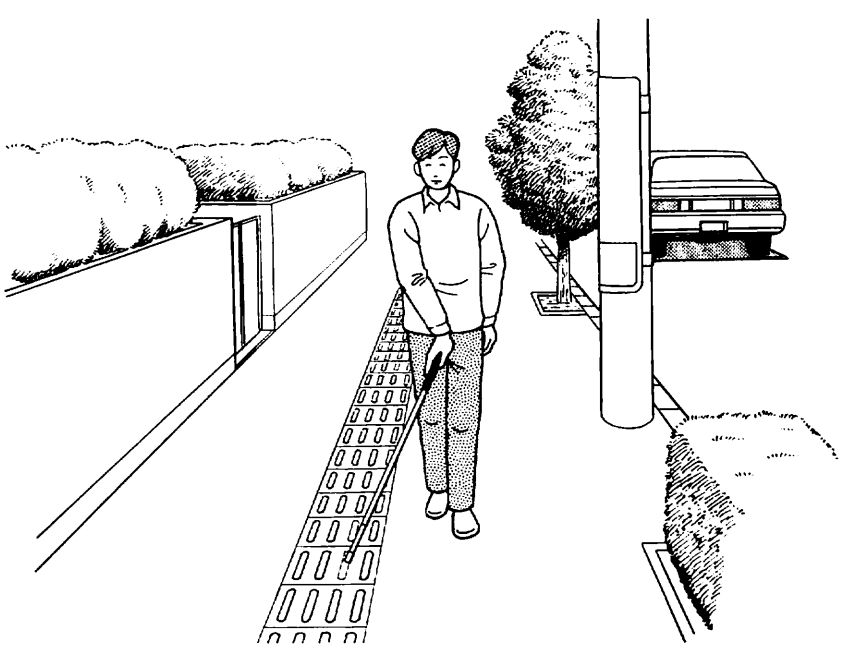


Figure 3-30: Travel on footway (Shoreline technique)

6) Negotiating a Turning Point

When bar tiles lead to a turning point, one needs to stop at dot tiles. However, it is difficult to find dot tiles at a turning point just by using the information obtainable through the white cane or the soles of the feet. In order to travel securely, it is important to understand the whole route of travel from the start to the destination, to anticipate a turning point before reaching it and to slow down when approaching it while trailing along the inside line of the bar tiles with the white cane. This makes it possible to identify the turning point with the white cane or the soles of the feet even if the dot tiles are not detectable.

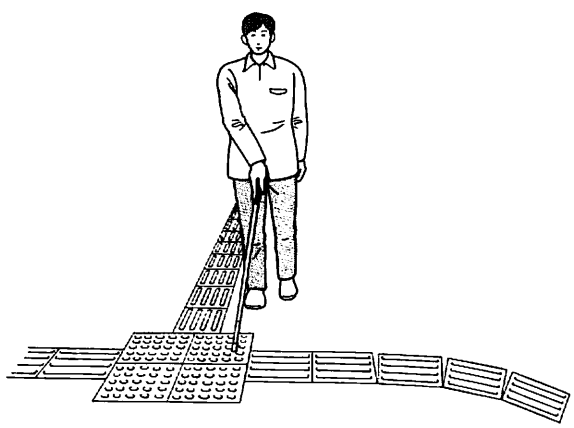


Figure 3-31: Negotiating a turning point

7) Finding Crossing Points

Bar tiles lead to dot tiles at intersections and one needs stop when dot tiles are detected. As mentioned in the previous section, (Negotiating a turning point), risks may increase when useful information is ignored when too much attention is focused on finding dot tiles. Specifically, one needs to slow down the walking speed and move the white cane from side to side using the constant contact technique to fine dot tiles. The sound of moving or idling vehicles or the movement of other pedestrians or the slope of footpath can act clues in this situation.

If dot tiles are not found, it is important not to step out on to the roadway. This can be avoided by detecting the edge of the curb between the footway and roadway using a white cane.

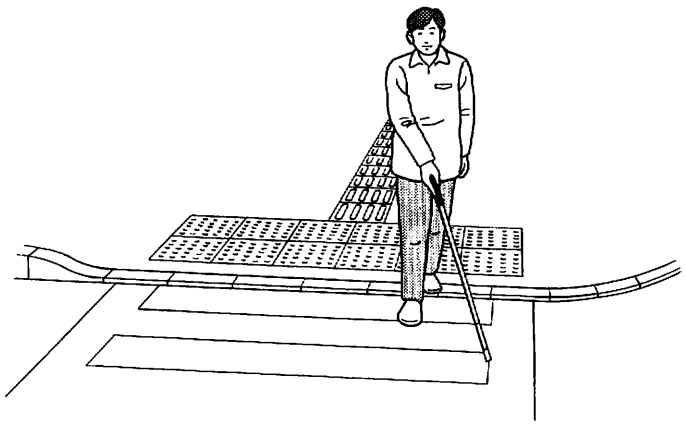


Figure 3-32: Finding a crossing point (Example of stepping out on to a roadway)

8) Crossing Pedestrian Crossings

Instructions are provided here on how to cross a road after finding a crossing point. First, understand the features of the crossing point, and find if it is a crossing controlled with signals or not.

When an individual relies only on dot tiles or curbs as directional cues, he/she may end up facing the center of the intersection, as shown in Figure 3-33. It is important to correct the direction of travel using bar tiles indicating the right direction or the sound of vehicles running parallel to the footpath.

Next, the individual needs to confirm that he/she goes back to the footpath after crossing the road. It is necessary to have received enough training so that even if the individual deviates from the right track and steps on to the roadway, he/she can return to the pedestrian crossing without panicking. Crossing the road is always accompanied by risks, and individuals should not

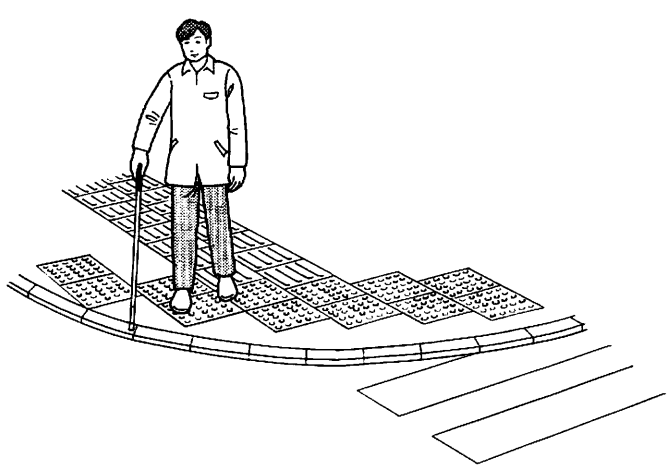


Figure 3-33: Crossing a pedestrian crossing

hesitate to ask for help whenever necessary rather than venturing to walk out onto the road alone.

9) Finding Bus Stops

Generally, tactile ground indicators are installed to help locate the entrance to the bus at the bus stop. Since installations of indicators vary depending on the width of the footways, it is necessary to find the exact location using a white cane, etc.

When bar tiles are installed as shown in Figure 3-34, it is better to walk along the roadway side of bar tiles.

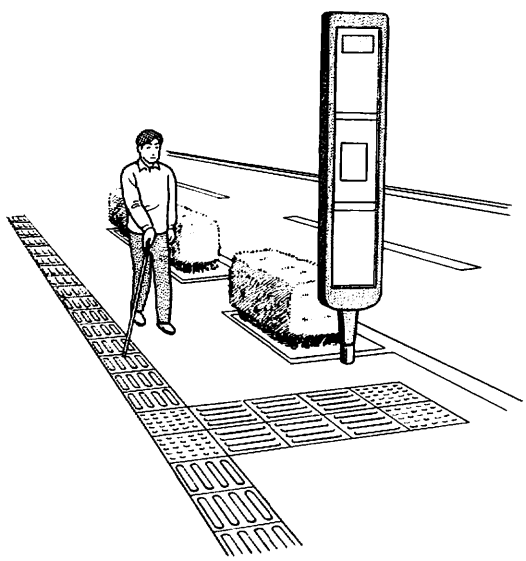


Figure 3-34: Finding a bus stop

10) Access to Public Transport

Examples are shown on how to use tactile ground indicators when boarding a train. Specific travel methods are explained below.

(1) Platforms

A. Boarding trains

Upon arriving on the platform by stairs or elevator, pay attention to the sound of the trains coming and going, walk using bar tiles, and position yourself behind the dot tiles installed parallel to the railway tracks. In Figure 3-35, a person with a cane is walking along the platform. In principle, use the constant contact technique to obtain information on the surface conditions and to keep close to the dot tiles and stay within the safe area of the platform. Walking speed must be slower than normal. When dot tiles installed parallel to the tracks are detected with the white

cane, move forward to the tiles and wait there for a train to come. (Figure 3-36) The tactile ground indicators cannot be used for getting on a train. Therefore, if you are not confident about getting on the train, it is better to ask for help.

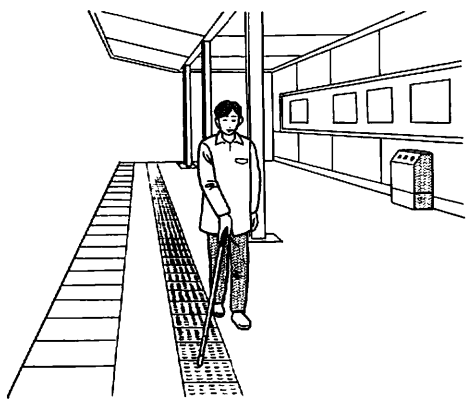


Figure 3-35: Walking along the platform

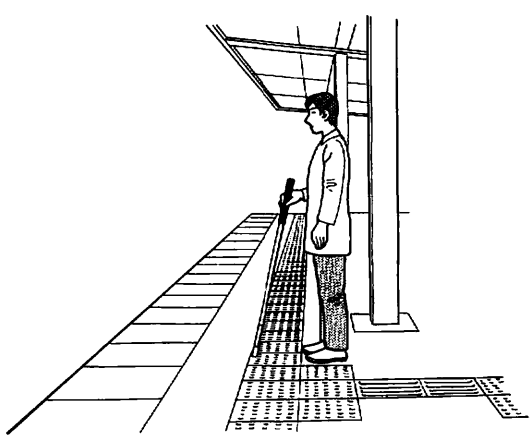


Figure 3-36: Before getting on the train

B. After getting off trains

Whenever necessary, ask for help when alighting from the train, and move forward at right angles to the train until you cross over the dot tiles. When orientation to the stairs or elevator is lost, stop for a while, and gather information through auditory clues such as movement or ascending and descending sound of passengers. Normally, bar tiles to guide travel around platforms are not installed except around stairs or elevators. Thus, if the place where you get off the train is a long way from stairs or elevators, use dot tiles instead of bar tiles.

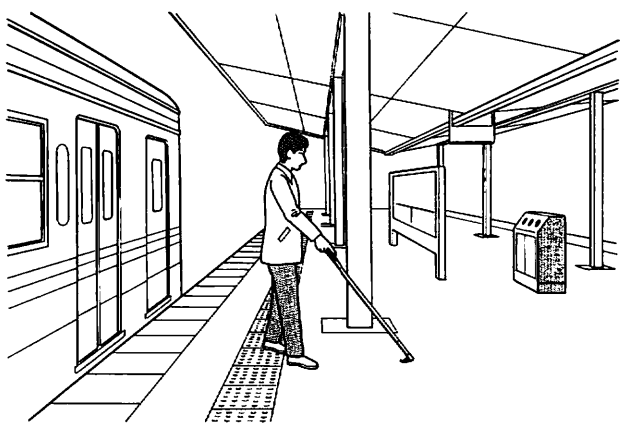


Figure 3-37: After getting off the train

C. Points to keep in mind when traveling

a) Pay close attention to the movement of trains, and move as little as possible while trains are in motion.

b) Normally, when using a white cane, you walk while simultaneously confirming the ground two steps in front. This means walking only after the safety is considered and confirmed.

c) When traveling along the dot tiles, take the safer position near to the centerline of the platform.

(2) Ticket Gates

A. Travel to ticket gates

First, find a ticket gate by walking along the bar tiles using a white cane. The sound of the flow of the passengers and ticket machines are effective clues. Since dot tiles are installed in front of and behind ticket gates, make a brief stop at the dot tiles before passing through. Normally, the passageway of the gate is narrow, so walk on the bar tiles while passing through.

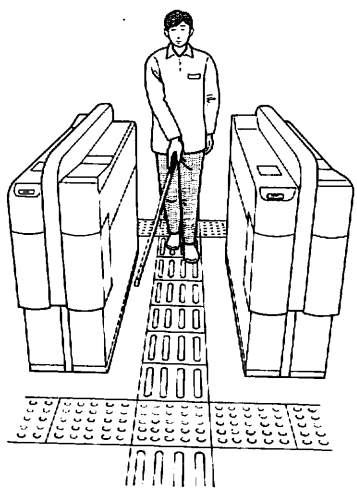


Figure 3-38: Travel to ticket gates

B. Travel from ticket gates to platforms

The spatial relationships between ticket gates and platforms are not the same in every station. They are located on the same level in some stations, and in others are connected by overbridges or underground passages. The location of the platform of your choice cannot be detected from tactile ground indicators, so it is important to know in advance the spatial relationship between the ticket gate and the platform of your choice.

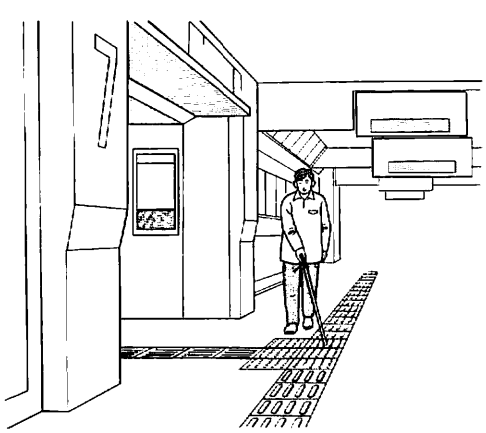


Figure 3-39: Travel to a platform

When stairs are used to gain access to a platform, one must be careful not to deviate from the correct route of travel while ascending or descending the stairs. It is important to bear in mind that there are no tactile ground indicators installed on the steps.

(3) Concourse

A concourse is a wide-open area to accommodate a large number of passengers; and therefore, it is not an easy environment for a person with visual impairment to move across. Tactile ground indicators are installed in a concourse to aid the vision impaired to move from ticket machines to ticket gates, and to help them find target objects.

When walking in a concourse, it is useful to know in advance on which side of the bar tiles ticket machines and ticket gates are located. In the picture, a person is walking on the right side of the bar tiles so that the white cane hits the turning point, which leads to the ticket gate located at the right side.

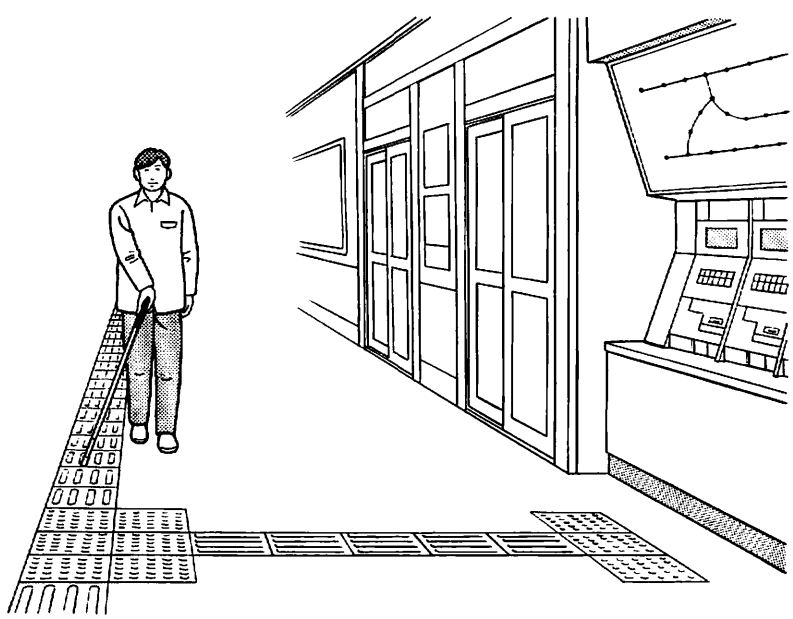


Figure 3-40: Travel in concourse

References

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2. Yuichi Shibata, author and editor/ Social Adaptability Training for Visually Impaired Persons, Nippon Lighthouse, 1990
3. Japan Road Association: Guideline and Manual of Installation of Tactile Ground Surface Indicators for Blind Persons, 1985