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Revision of RTS 14: Guidelines for Installing Pedestrian Facilities for People with Vision Impairment

Tactile Ground Surface Indicators & Audible Tactile Traffic Signals

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Abstract

There is increasingly more emphasis placed on accommodating the most vulnerable road users, pedestrians, in road design. Within this road user group there are several subgroups, all of which have unique needs.

RTS 14 is a Land Transport Safety Authority (LTSA) publication, first produced in 1997, that provides guidance on installing pedestrian facilities for people with vision impairment. The two facilities recommended by RTS 14 are tactile ground surface indicators (TGSI) and audible tactile traffic signals (ATTS).

This paper examines the first revision of RTS 14, detailing key points of content as well as changes and additions from the first publication.

Project Background

The LTSA commissioned Beca Carter Hollings & Ferner Ltd (Beca) in March 2003 to update and revise the scope of RTS 14. The purpose of this project was to enable a high standard and consistent approach to be adopted throughout New Zealand for the installation of pedestrian facilities for people with vision impairment.

The original version of RTS 14, published in 1997, primarily dealt with facilities for blind and vision-impaired people crossing roads. The revision of RTS 14 extended the scope to include guidance on the design and installation principles of facilities for the entire walking journey in public areas.

Just prior to the project, an update was released of *AS/NZS 1428.4: 2002 Design for Access and Mobility Part 4: Tactile Indicators*. A change in content of this Standard with respect to kerb crossings were considered by the blind community to be inconsistent with their needs, and some industry colleagues to contain examples of road crossing situations that were inconsistent with good design practice, not readily achievable and atypical of the New Zealand road environment.

Beca's brief for the project was to revise RTS 14; in particular this involved a thorough review of the section relating to TGSI through:

- Reviewing current practice and recent revisions to publications;

- Assessing the suitability of local and international standards in relation to New Zealand practice;
- Providing design principles for standard situations and how to deal with non-standard situations;
- Producing best practice examples; and
- Making installation prioritisation recommendations.

The LTSA organised surveys of blind and vision-impaired people through the Royal New Zealand Foundation for the Blind (RNZFB) and of Road Controlling Authorities. This information was fed back to Beca to incorporate into the revision. It was important that any design guidance met the needs of users. The LTSA revised that part of RTS 14 on audible and tactile traffic signals (ATTS).

The project soon expanded in scope, to include an additional section on the nature of vision impairment. This was to assist users of the guideline understand the reasons for and functions of pedestrian facilities for blind and vision-impaired people. Another section on general design principles for pedestrian facilities was also included, as it is first necessary to have designs that are friendly to sighted pedestrians, before adding features to assist blind and vision-impaired pedestrians. It became evident that some detailed application guidance was necessary. Many common existing situations are not covered in other standards, causing designers considerable difficulties and resulting in inconsistent design practices.

Understanding Vision Impairment

In order to competently design and install pedestrian facilities for people with vision impairment, it is best that the designer has some understanding of vision impairment and how people with this deficiency negotiate the walking environment.

Extent of Vision Impairment

The 2001 disability snapshot carried out by statistics New Zealand estimated that 94,700 people (81,500 adults, 13,200 children) are blind or had a vision limitation that could not be corrected by glasses or contact lenses. 7,800 of the adults are completely blind. Approximately 3% of the total adult population is blind or vision impaired. 33,600 of these blind or vision-impaired people also had hearing disabilities.

These statistics show that there are many people with vision deficiencies that experience difficulty with orientation and negotiation in the walking environment.

At the latest count 12,649 people were members of the RNZFB. Nearly two thirds of RNZFB members are aged over 65 years, as age-related eye diseases cause most blindness.

The RNZFB provides services to people with a visual acuity of 6/24 or less using the best eye, or a field of vision of less than 20 degrees. Those with a visual acuity of 3/60 or less, or a field of vision less than 5 degrees, are also eligible for an Invalid's Benefit.

A person with visual acuity of 6/24 means that a person has to be as close as 6m to see what a "normal" sighted person can see at 24m i.e. 4 times closer. Likewise, a person with a visual acuity of 3/60 means that a person has to be as close as 3m to see what a normal sighted person can see at 60m i.e. 20 times closer.

Nature of Vision Impairment

Most blind and vision-impaired people are able to see in colour; approximately 6% can see very little at all, but even that group generally has some sensitivity to light and shade.

Contrary to common belief, a loss of sight is not accompanied by an increase in the effectiveness of other non-visual senses. On the contrary 40% of blind and vision-impaired adults also have hearing disabilities. However, blind and vision-impaired people generally place more emphasis on information received via other senses, for example the sense of touch.

Mobility of Blind and Vision-Impaired People

As blind and vision-impaired people are unable to drive a motor vehicle, their independent mobility depends primarily on walking. They walk everywhere that other people walk.

To facilitate their negotiation of the road system, blind and vision-impaired people need to be able to find their way along footpaths, through open spaces and across roads. To do this, they will either move around independently or with the aid of a sighted person who will act as a guide. Those who move around independently will do so making the most of their residual sight and any mobility aids.

Those people relying on their residual sight require visual clues to be bold with high contrast for their orientation. The property line, the edge of the sealed path, the kerb, and consistently placed street furniture, such as parking meters, are commonly used clues.

The most common mobility aid used by pedestrians with poor sight to facilitate their independent mobility is a long white cane. This is used to preview the ground in front of the person to detect hazards. Previewing takes the form of sweeping the cane in an arc from one side to the other to just beyond the width of the shoulder. This technique will usually locate potential obstructions such as street furniture, provided that there is some element at ground level, and distinct changes in level such as a kerb upstand or a step. White cane users are now trained to use a method whereby the cane maintains constant contact with the ground as it is swept. This allows the user to detect the presence of distinct changes in texture underfoot.

The next most common mobility aid for a blind or vision-impaired person is a guide dog. A guide dog is trained to lead its owner around obstructions and to stop at distinct changes of level, however guide dogs are generally unable to respond to changes in texture or colour underfoot.

Key Design Principles

Blind and vision-impaired people are less able to negotiate complex walking environment than their fully sighted peers. In order to provide a friendly walking environment for blind and vision-impaired pedestrians, the following key design principles should be applied:

- ♣ Layouts of all pedestrian areas should be simple, logical and consistent. This will enable people to memorise environments that they use regularly and predict and interpret environments that they are encountering for the first time.
- ♣ Important information about the environment should be conveyed by the use of non-visual features, for example, audible and tactile features.
- ♣ Visual contrast is important to accentuate the presence of certain key features. This will enable many people to use their residual vision to obtain information.

Blind and vision-impaired people will actively seek visual clues to assist with their orientation. The property line is usually the most definitive and reliable clue; hence blind and vision-impaired people will tend to walk closer to the property line than the kerb. The envelope where pedestrian tend to walk is known as the "Continuous accessible path of travel". It is required to provide for the needs mobility-impaired people as well as blind and vision-impaired pedestrians. This area should be kept clear of permanent and temporary obstacles at all times. It is designed to provide even surfaces, gentle gradients and smooth transitions between roads and footpaths. This concept assists in facilitating the safe passage of blind and vision-impaired people in their walking environment.

Road Crossing Points

Crossing roads is the most hazardous activity that blind and vision-impaired people perform in the road environment. When crossing roads, pedestrians must:

- ♣ Find the crossing point;
- ♣ Identify when the roadway is about to be entered;
- ♣ Determine the direction to cross;
- ♣ Determine when it is safe to cross;
- ♣ Maintain orientation while crossing the road; and
- ♣ Find the opposite kerb crossing point.

Fully sighted pedestrians will rely substantially on visual recognition to achieve these tasks, however blind and vision-impaired persons have varying degrees of visual ability.

The design of crossing points at intersections aims to achieve the following competing design objectives:

- ♣ Separate road crossing points for each direction;

- ♣ Kerbs aligned so that they are crossed perpendicular to the path of travel;
- ♣ Crossing points located in the direct line of the continuous accessible path of travel;
- ♣ Having pedestrians cross in a predictable location, visible to drivers of vehicles (particularly those turning left);
- ♣ Clear visual contrast between the footpath and roadway so that those with partial vision can distinguish the footpath / roadway boundary;
- ♣ Shortest possible crossing distance; and
- ♣ Slow vehicle turning speeds.

Large kerb corner radii compromise nearly all of the above objectives, and put pedestrians at risk. Intersection designers should ensure that kerb corner radii are not being designed to an inappropriately high value based simply on occasional motor vehicle convenience.

A kerb ramp is the usual facility for road crossing points. Some aspects of the kerb ramp design specified in *NZS 4121: 2001, Design for Access and Mobility – Buildings and Associated Facilities*, were considered to not represent best practice in New Zealand. The most significant difference between NZS 4121: 2001 and RTS 14 being the grade of the kerb ramp. The LTSA considered a maximum grade of 1:8 (specified in NZS 4121: 2001) to be too steep, primarily for elderly and mobility-impaired people and hence RTS 14 recommends a normal maximum grade of 1:12. There are also differences in the application of the haunchings on the side of kerb crossings.

The best road crossing design principles for blind and vision-impaired people are not always conducive to the needs other road user groups and vice versa. Many blind and vision-impaired people walking independent of a mobility aid may only recognise the edge of the footway by stepping off a full height kerb. It would therefore be inherently sensible to provide full height kerbs at all road crossing points. However, mobility-impaired and elderly pedestrians need to have level kerb crossing points to assist with their accessibility and mobility requirements. A survey of RNZFB members in March 2003, found that crossing points with “lipless, wheelchair-friendly kerbs” were difficult to detect and “blended, same-level kerbs” even harder to detect.

As required by law, it is now usual design practice in New Zealand to install “lipless, wheelchair-friendly kerbs” at all road crossing points. Other features need to be provided to compensate blind and vision-impaired people for the absence of their most reliable clue of the footpath / roadway interface, a full height kerb, or at least a lip at the bottom of the kerb ramp. The blind community in New Zealand accepted the new lipless kerb ramps on the understanding that tactile ground surface indicators (TGSI) would be used. This is reflected in NZS 4121: 2001, however it is not mandated by law, so many new lipless crossings are being installed without TGSI.

Tactile Ground Surface Indicators (TGSI)

TGSI are textured surface features built into or applied to walking surfaces. They provide blind and vision-impaired pedestrians with visual information and sensory information underfoot. The two types of TGSI are Warning Indicators and Directional Indicators.

Warning indicators consist of a series of truncated domes and alert blind and vision-impaired pedestrians to pending obstacles or hazards on the continuous accessible path of travel that could not reasonably be expected or anticipated using other tactile and environmental cues. Warning indicators act much like a stop sign, indicating to blind and vision-impaired pedestrians that they should stop to determine the nature of the hazard before proceeding further. They do not indicate what the hazard will be.

Directional indicators consist of a series of raised bars and give directional orientation to blind and vision-impaired people and designate the continuous accessible path of travel when other tactile or environmental cues are missing.

When combined with other environmental information, TGSI assist blind and vision-impaired people with their orientation.

Visual Contrast

TGSI should provide a high visual contrast to the adjoining walking surface, either light-on-dark or dark-on-light, so that most blind and vision-impaired people can detect their presence visually as well as by surface texture change.

A 70% visual contrast to the adjoining surface is recommended. Research by Bentzen et al (2000) indicated that the colour 'safety yellow' is so salient, even to persons having very low vision, that it is highly visible even when used in association with adjoining surfaces having a contrast of as little as 40%. An LTSA survey (March 2003) of 200 Royal New Zealand Foundation for the Blind (RNZFB) members found that the colour and contrast of TGSI with the adjoining surface is very important.

RTS 14 recommends 'safety yellow' as the preferred colour

Where to Install TGSI

The revision of RTS 14 specifies situations where TGSI are to be installed and situations where their use is recommended, but not mandatory. In the latter situation, there is usually an alternative of redesigning the feature for which the TGSI is providing warning or guidance.

Warning indicators must be installed for:

- Life threatening hazards where serious falls may occur, such as at railway platforms or wharves;

- Vehicle hazards on roads where the footpath is not separated from the roadway by an abrupt change of grade of 1 in 8 (not recommended design) or by a vertical kerb more than 30mm high (not suitable for elderly and mobility-impaired pedestrians);
- Approaches to stairways, ramps, escalators and moving walkways;
- The presence of level railway crossings; and
- Overhead impediments or hazards other than doorways (e.g. wall mounted objects and archway structures), with a clearance of less than 2m from ground level, in an accessible open public space with no clearly defined continuous accessible path of travel.

Warning indicators may also be installed for:

- Busy vehicle crossing points such as: shopping centres, bus stations and large public car parks, where other design solutions are not appropriate; and
- On footpaths ahead of inappropriately located street furniture in the continuous accessible path of travel and not detectable by a blind or vision-impaired person using the aid of a white cane.

Directional indicators must be provided where a person must deviate from the continuous accessible path of travel to gain access to:

- A road crossing point;
- Public transport access point; or
- Significant public facility e.g. public toilets or information centre.

They may also be used to provide directional guidance:

- Across open space from one point to another; or
- Around obstacles in the continuous accessible path of travel (where warning indicators are insufficient).

Installation Principles

The literature review of international and local standards and manual indicated several different approaches to installing TGSI. The installation principles established for RTS 14 were deemed to best meet the needs of the road user group that they are intended for, blind and vision-impaired pedestrians, and also provide a framework for achieving a consistent approach to the installation of TGSI throughout New Zealand. The four fundamental installation principles for warning indicators are:

- Coverage of the full width of all kerb ramps, median cut throughs, stairs and escalators, or of a minimum width of 900mm in all other cases;
- Located at least 300mm from the edge of the hazard so that a person has time to react to the TGSI without walking into the hazard; (the setback is measured in the direction of the pedestrian route, and not perpendicular to the kerb)

- At least 600mm deep so that a person will not inadvertently step over the indicators; and
- Alignment of the front and back edges perpendicular to the crossing direction so that blind and vision-impaired people can align themselves correctly with the crossing direction.

The four fundamental installation principles for directional indicators are:

- Aligned parallel with and along the centreline of the required direction of travel;
- A minimum of 300mm wide where used to define the continuous accessible path of travel across an area of open space, so that people can readily maintain contact with the indicators;
- A minimum of 600mm deep when intercepting the continuous accessible path of travel to direct users to a road crossing point or access public transport; and
- Always used in conjunction with warning indicators.

Non-Typical Situations

The installation principles were tested on a wide range of pedestrian facilities to check the practicality of installing TGSI following these principles. We found that TGSI could be installed with relative ease in most situations, however the design of many intersections was incompatible with installing TGSI. The main problems related to a lack of space, large kerb radii, narrow footpath widths and poorly located kerb crossings. Strategies were prepared on how to ameliorate these issues at intersections. Generally, when TGSI cannot be installed in accordance with the installation principles, it is likely that the intersection design is sub-standard. Improving the design of an intersection will usually benefit other pedestrians apart from the blind and vision-impaired people.

Layout Examples

Layout examples of how TGSI should be installed (both descriptive and/or diagrammatical) were produced for most formal and informal pedestrian facilities in the New Zealand road environment. These included road crossings at intersections, mid-block and medians, as well as installations for access to public transport, busy vehicle crossings and even railway stations.

Obtaining examples of good practice was very difficult, particularly where both the client and consultant reside. Those that were found were frequently covered in dirt or debris, which highlights the need for maintenance. Eventually, enough examples of good practice were sourced from throughout the country to provide an acceptable level of illustrations for RTS 14.

Audible Tactile Traffic Signals (ATTS)

ATTS convey important information to blind and vision-impaired people at signalised intersections. ATTS provides them with:

- Assistance in locating signals;
- Information to assist them with their orientation; and
- Information of the status of the pedestrian phase, i.e. cross or do not cross.

ATTS improves the safety and confident mobility for blind and vision-impaired people as well as benefiting fully sighted people with an audible reminder that it is time to cross. ATTS may also increase the safety of people with cognitive disabilities.

Pedestrian Push Button Assemblies

The audible and tactile signals are emitted from the pedestrian push button assembly. It is important that ATTS push buttons be of a standard design and installed in a consistent way. Good practice design of the push button assembly is specified in *AS 2353: - 1999: Pedestrian push-button assemblies*. RTS 14 simply endorses this standard, summarises the main features and provides some application guidance.

The standard pedestrian push-button assembly layout has an arrow above the push button. The main function of the arrow on the call box is to provide blind and vision-impaired pedestrians with directional orientation.

Design and Features of ATTS

There are two types of signals that shall be emitted by ATTS. The 'Locating Signal" and the 'Crossing Signal" have the following features:

Locating Signal

This audible signal consists of a short pip (25 ms of 1000 Hz square wave) repeating every 1.8 seconds. This is associated with a similar length four wavelengths of 145Hz vibrating tactile pulse, which are felt at the centre of the directional arrow above the push button. Both audible and vibrating tactile locating signals operate for the whole time that the 'Crossing Signal" is not sounding.

Crossing Signal

The audible crossing signal commences with a square wave that descends exponentially in pitch from 3,500Hz to 700 Hz over 115 ms. This is immediately followed by a rapidly pulsing sinusoidal 500Hz signal that decays over 35 ms, before ceasing momentarily and being repeated at 8.5 times a second for the duration of the cross signal. The duration of this signal may be restricted to a maximum time. A vibrating tactile crossing pulse similar to that of the 'Locating Signal" is also provided that repeats 8.5 times per second.

Different tones are NOT recommended for the different directions of crossing at an intersection.

A separate unique sound should be provided for exclusive pedestrian phases e.g. Barnes Dance / Scramble Crossings. The LTSA proposes to develop a standard audible signal for these situations for inclusion in the National Traffic Signal Specification.

Call Acknowledge Signal

The LTSA proposes to trial traffic signals with an audible "Call Acknowledge Signal" at intersections during the next year to assess their performance.

Audible Volume

To maximise the usefulness and minimise noise pollution, the audible signals are required to include a volume control that is automatically responsive to the ambient (background) noise level. This means that a louder tone will be produced when vehicle and other noise at the intersection is high. A quieter sound will be produced during low traffic periods e.g. at night.

Location

RTS 14 sets requirements for location of pedestrian push buttons so they will be predictably located, easy to reach and use, and separated to minimise confusion over the source of the audible signals.

Installation

Status of RTS 14.

RTS 14 is a best practice guide. It is written in the same style as a standard so that compliance with its requirements can be confirmed. Its use is not mandated by law. Its success depends on its adoption by Road Controlling Authorities in their asset management plans and road safety systems.

The contents on ATTS are intended to be incorporated into the *National Traffic Signals Specification*. The contents on TGSI will be incorporated into the *Pedestrian Network Planning and Facilities Design Guide.*

Priorities

Blind and vision-impaired people require these facilities everywhere. RTS 14 requires features for blind and vision-impaired pedestrians to be installed in all new designs of traffic signals and all new or reconstructed kerb crossings.

Upgrading existing facilities is long-term task. Criteria for prioritising improvements are recommended.

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