

THE APPLICATION OF TACTILE GROUND SURFACE INDICATORS (TGSI's) ON INTERSECTIONS IN SOUTH AFRICA

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ABSTRACT

The correct implementation, application as well as construction of pedestrian ramps in South Africa have created much confusion and controversy for the last 9 to 10 years. Not to mention the correct inclusion of Tactile Ground Surface Indicators (TGSI) or Blister paving as some may call it, on pedestrian ramps and intersections.

The disputation concerning the matter is largely due to a lack of information available in South Africa (SA), or contradicting information, where bits and pieces are mentioned. To make matters worse, the available information is also outdated to current international standards and requirements.

About thirteen (13) integrated rapid public transport networks (IRPTN) are under various stages of planning and implementation in SA. Along these Bus Rapid Transit (BRT) routes, thousands of intersections would be impacted by the projects and need upgrading and redesign to some form or the other. Mostly, all BRT stations would also be in the median at or close to intersections and safe and convenient passage is required to get pedestrians to and on BRT busses. This includes the less able, be it temporary or permanent and people with disabilities.

A few years ago (2010), GIBB researched the application of TGSI's on intersections and developed the ***Standard Construction Detail and Design Standards for Intersection Pedestrian Crossings affected by the Bus Rapid Transit Infrastructure***, incorporating international best practice, in consultation with the Department of Transport, South African Bureau of Standards (SABS), some Universal Access Consultants and some Disability Alliance groups.

This paper gives a brief overview of the developed standard book of drawings and shows a few implemented examples in South Africa.

1. BACKGROUND

South Africa is focusing on and investing heavily in infrastructural development. This includes largely infrastructure that is used by the general public on a daily basis, like schools, hospitals, stadiums, BRT Systems, trains, stations, airport upgrades and road and intersection upgrades. Historically, Non-Motorised Transport (NMT) would not have been included into the designs and traditional transport planning. Walkways and cycle paths was generally done as an afterthought and sometimes not at all.

At National, Provincial and Local Government levels, Non-Motorised Transport has been identified as a priority area. It has now reached the stage where it is accepted, promoted and prioritized as the most feasible and sustainable mode of transport in the city.

The biggest buzzwords in the engineering industry and the transport sector today, are;

- **Non-motorised transport (NMT) and**
- **Universal access (UA)**

Non-Motorised Transport is transport that requires human energy. These are in the form of bicycles and tricycle, rickshaws, hand push carts, wheel barrow and human portage, rollerblades, skate boards, push scooters, wheelchair travel etc. NMT includes transport that required the use of animal power for example, horse drawn carts, donkey carts, bullock cart, horse riding etc. The largest portion of Non-Motorised transport is walking. Walking plays a considerable role for long as well as short trips in rural settings, as well as urban areas for accessing mechanized modes of transport.

The recognition of NMT as a major mode of transport is embodied in a number of national, provincial and municipal legislation, policies and frameworks and need to be taken into consideration by NMT Planning and for universal access.

'Inclusive Design' or 'Universal Access', takes everybody into consideration, throughout the travel chain, in any environment, be it rural or urban. A universal design approach to the built environment, results in the necessity to totally remove obstacles that can hinder the progress of people, regardless of their age, ability or status in life, people pushing a trolley or a pram, people with a temporary illness or injury, people with any kind of disability, be it visual, mobility or hearing. This can be any trip hazard, level difference between two surfaces, a flight of stairs or even a single stair or step. Uneven footways, kerbs, bollards or street clutter also hinder movement.

The application of kerb ramps assist access onto footways for everybody, including people with disabilities and the inclusion of Tactile Ground Surface Indicators (TGSI's) on pedestrian ramps at road crossings assist the mobility of visually impaired by providing information about the approaching road and direction of travel to cross the road safely as well as from what direction the traffic is approaching in the case of controlled crossings.

If one has designed or built an intersection or a rapid transit system for example, that is for some reason or the other not accessible by someone; then one has discriminated against the person according to the Equality and Prevention of Unfair Discrimination Act (2000).

2. INTRODUCTION

Some of the biggest infrastructure development and transport investment projects ongoing in South Africa, are the BRT projects. Currently there are 13 projects in various phases of design and construction in South Africa. All have a high focus on NMT and universal access.

Thousands of intersections are impacted by the BRT projects and their supporting feeder bus systems. This includes kilometers of footways, thousands of pedestrian crossings as well as cycle facilities and bus stops that will need design and upgrading.

Everything has to then be integrated with other facilities as per the Non-Motorised Transport (NMT) policies and Master Plans.

When GIBB got involved in these projects, the question was asked regarding what the correct treatment and design for pedestrian crossings and universal access along these routes and corridors should be.

An investigation process followed, that included research of a bunch of local documents and sources. GIBB noticed inconsistencies in guidelines, standards, interpretations applications, overall design and approach. South Africa was also found not to be in line with the latest universal access guidelines and best practices.

It was during this process, GIBB noticed how outdated the current SANS 784:2008 “Design for access and mobility- Tactile indicators” is with International best practice as well as international guidelines on the subject of tactiles, pedestrian crossings and kerb ramps. SANS 784 is an Australian and New Zealand Standard which was adopted by SA in 2008, but is actually a 2002 Standard on Disability Discrimination. *SANS 784:2008* is also going through a review and consultation process to rewrite.

Due to the outdated, contradicting and limited information, it is no wonder the confusion that exists between engineers, designers and architects about the correct way to implement the tactile dropped kerbs, today.

Something had to be done. South Africa needed one updated document that was in line with international best practices and standards on the application of TGSI's. South Africa needed a document that is applicable to local conditions, sustainable, but at the same time universal.

3. TACTILE GROUND SURFACE INDICATORS (TGSI'S)

It is crucial to understand how visually impaired people move around and the techniques they use. By understanding this as well as the needs of other disabilities, you can move forward designing facilities that will truly be universal in access provision.

Important information about the environment should be conveyed by the use of non-visual features, for example, audible and tactile features. Visually impaired people generally place more emphasis on information received via other senses, for example the sense of touch.

Whatever mobility aid is being used, a kerb up stand is an essential indicator of the edge of the footway. However, in recognition of the needs of other pedestrians, it is accepted that it is necessary to have level or ramped crossing points. In such locations, tactile paving compensates for the absence of a kerb.

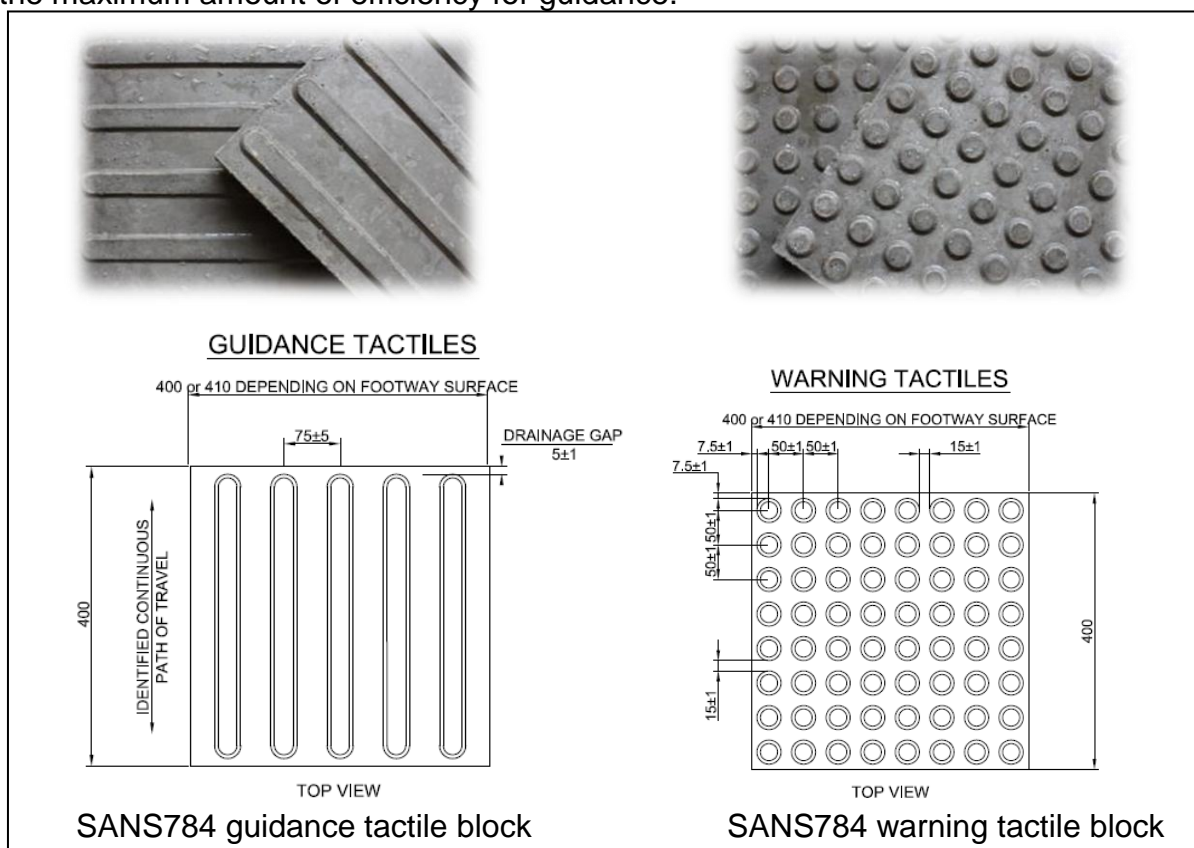
Tactiles are blocks with small extrusions or raised tactile nodules with an embossed profile that translates into information and guidance to the visually impaired, underfoot or by using a cane, when combined with other environmental information on the safe crossing of the road. TGSi mainly serves two purposes and should be exclusively used for the reserved use and insistently be installed in the same manner as per the guideline. They are:

- Direct people.
- Warn people.

The placement of the warning tactiles on the ramp warns the pedestrian of the presence of the crossing and orientates the person in the correct direction to safely cross the road along the shortest path. Underfoot detection as well as the surface contrast between the tactiles and the surrounding footway is key.

The SANS 784 tactile nodule dimensions, shapes and sizes have been researched extensively and is accepted by people with other impairments like mobility impaired wheelchair users or push cart or prams that also use the pedestrian ramp.

The nodule size and shape is so optimized that it provides the least amount of discomfort to the maximum amount of efficiency for guidance.



Discomfort is experienced with the old design used in SA due to a jolt or trip as the wheels travel over the nodule. Also for certain kinds of arthritic illnesses, the underfoot discomfort is noticeable. It was however the start of tactile pedestrian crossings in South Africa.

4. APPROACH

Many local as well as international documentation, reports, guidelines and standards were researched and used for the task of developing the contemporary standard or guideline for South Africa on TGSI's. (A list of documents can be provided upon request). The documents on their own also incorporated many other guidelines and standards as well as consultations with Institutions and workgroups of various disabilities.

Countries like South Africa, Mozambique, Malawi, India, Asia, North as well as South America, China, Ecuador and European Guidelines are all included in the guidelines investigated to date. None of the documents investigated, show what is currently shown or suggested as the design of tactile pedestrian crossing as per the current SANS 784 Standard.

All the researched information, opinions, concepts and philosophies were combined into one or two resulting layout principals. These principals were then tested with the current trend in South Africa and final layouts were derived.

Every scenario, intersection and pedestrian crossing is different and there is no ideal intersection that requires a standard application. Sound engineering judgment and understanding of the concepts and principals are required to get the best and safest layout possible in the current location.

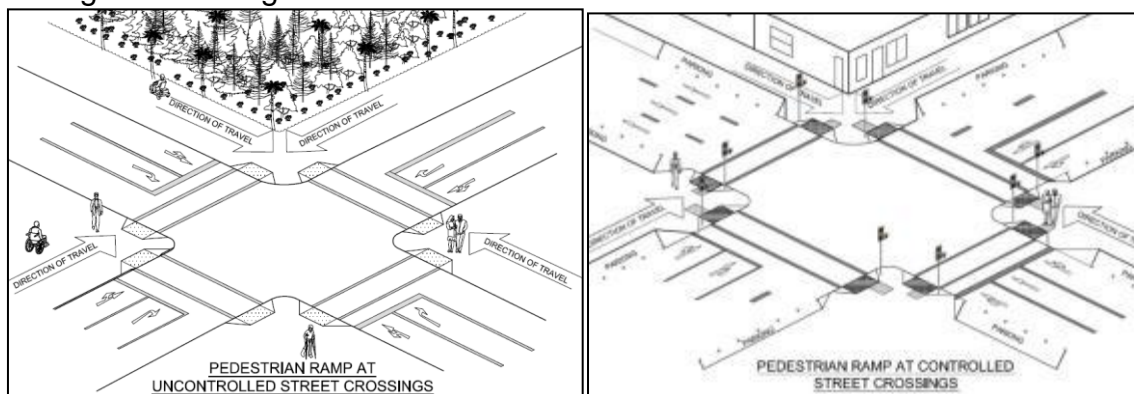
After a lengthy investigation and consultation exercise, the GIBB team developed the **Standard Construction Detail and Design Standards for Intersection Pedestrian Crossings affected by the Bus Rapid Transit Infrastructure**, incorporating international best practice, and consultation with the National Department of Transport, South African Bureau of Standards (SABS), Universal Access Consultants and some Disability Alliance groups.

As a result of this initiative, the GIBB team was invited to serve on the SABS sub-committee for updating *SANS 10400-S, Facilities for Persons with Disabilities* that was approved and published in June 2011

The TGSI guide is now extensively used by The City of Tshwane and has also been adopted by the City of Johannesburg into their "Complete Streets" guideline.

A brief overview of the document.

The drawing book provides more detailed information on a range of layouts and scenarios that will be encountered in the field and applies the design philosophies of the tactile layouts to the intersections. The document mainly distinguishes between controlled and un-controlled pedestrian crossings in urban and residential settings. The drawings can be used as a guide to designers.



Un-controlled street crossing.

Controlled street crossing.

The main difference between tactile layout of a controlled and un-controlled crossing is that the controlled crossing has a guidance section of tactiles at the back that will guide a visually impaired person to the crossing. The side approach of the guidance tail to the warning tactile also tells the visually impaired person from which side the oncoming traffic can be expected when entering the road. Un-controlled crossings do not have a guidance tail and is placed as far as possible in such a position that it will fall within the path of a pedestrian walking along the sidewalk.

- **Page 1, 2 & 3** of the document is the cover page, index and TGS dimensions
- **Page 4** provides a collage of basic drawings of different angles of the un-controlled pedestrian crossing layout. It should be noted that sizes of standard pedestrian crossings and ramps differ between a rural scenario and an urban, city scenario, where the demand is obviously more, hence the standard size being more. The preferred gradients for kerb ramps are 1:20. An acceptable gradient is 1:15 with the steepest gradient of 1:12. A gradient of 1:8 as shown in the SANS 784, is contradicting with other SA standards and international best practice. A 300mm buffer strip in the form of a flat concrete kerb is installed at the bottom of the ramp, flush with the road surface or slightly raised, but not more than 10mm. if it is more than 10mm; it is classed as trip hazard to international standards.



Uncontrolled pedestrian crossing.



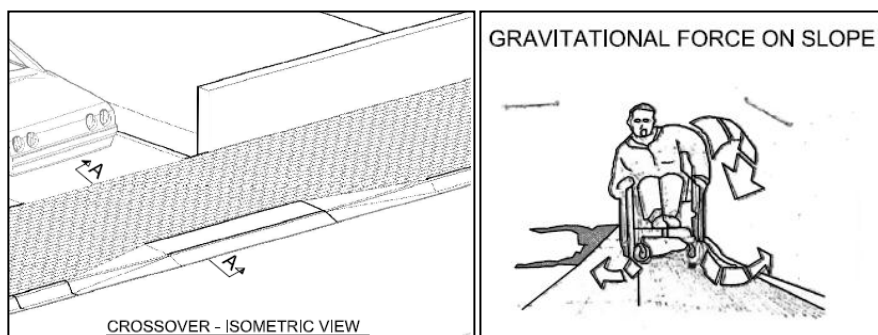
Controlled pedestrian crossing.

- **Page 5** provides a collage of basic drawings of different angles of the controlled pedestrian crossing layout. Note the guidance strip or tail provided. If the guidance tail is on the right hand side, which it generally is in South Africa, it means that the traffic can be expected from the right hand side when leaving the tactile crossing. Generally, one would also expect the pushbutton on the right hand side at arm's length when one reaches the warning tactiles. Guide dogs are mostly held in the left hand. All pedestrian ramps and tactile layouts must be in line with the angle of the crossing and direct the pedestrian straight across the road directly to the opposite pedestrian ramp.
- **Page 6** shows a combination of scenarios that will be found in the field and the basic principles where crossings are close to one another. Layout of dropped kerbs across an angled intersection is shown as well as the treatment of a narrow footway, where a pedestrian ramp is required. The drop transitions of the ramped pedestrian crossings should preferably also be at a 1:12 gradient where possible.



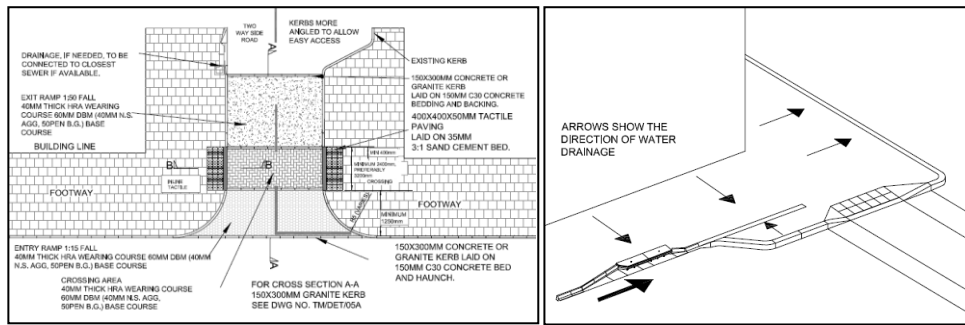
Narrow footway treatment.

- **Page 7 & 8** shows how footways could possibly be used and should be upgraded. Utility covers should be readjusted perpendicular to the kerb-line and inset-boxes can be used to minimize the visual disruption to the footways and tactile crossings. Generally the re-alignment of utility boxes requires the permission of the owners.
- **Page 9 & 10** shows the footway construction detail and limits of quality of workmanship. Paving joints should be butt-jointed and tight filled with sharp sand. Footways that are over run by vehicles need to be reinforced where appropriate. When cutting slabs around street furniture, it must be done in a neat and equal quantities.
- **Page 11** shows different paving options with and without a buffer strip behind the kerb. In some areas, there is still old heritage slate stone paving. These areas should be saved as far as possible. Old Granite kerbs can also be found in the old CBD and should be protected.
- **Page 12** describes the street furniture layout on the footways and mentions the importance not to arrange furniture in a manner that might hinder movement on the footways. Ideally, a 1.8m wide footway is required for two adult persons passing one another. A 3m wide footway is required for a busy pedestrian street.
- **Page 13** gives basic information on constructing a vehicle cross-over. Cross-overs should be level with the footway to provide a convenient level surface for pedestrians including disabled persons. Sloped surfaces are difficult to handle for someone in a wheelchair, as gravitational forces tend to pull him towards the direction of the slope and he needs extra power to control and steer the wheelchair.



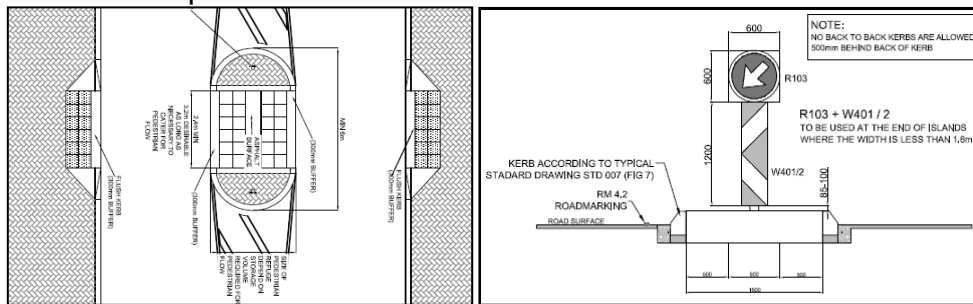
Vehicle cross-over with level footway and effect of gravitational forces on a sloped surface

- **Page 14, 15 and 16** gives guidance on the treatment of side road pedestrian crossings that are un-controlled. The application of a raised entry treatment is discussed that is level with the footway, with the required layout of tactile surfacing. Various options of Build-outs are also discussed and shown. It is important to note the drainage requirement when considering build-outs.



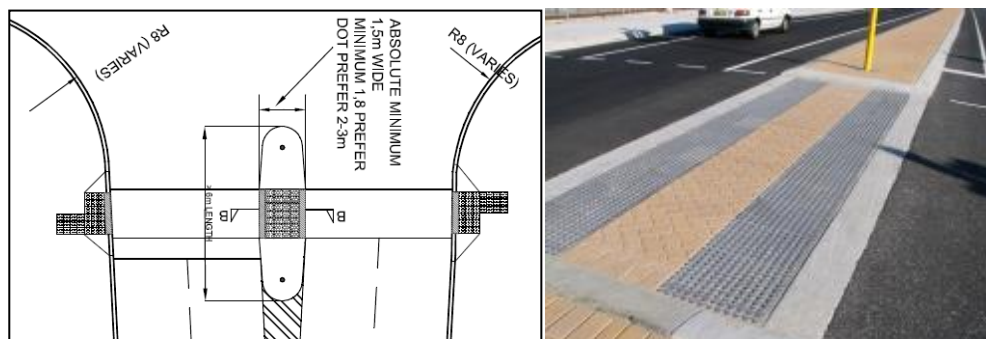
Raised entry treatment with flush crossing & Drainage directions. pavement extension / Build-out.

Page 17 shows a layout and application of tactiles on an un-controlled pedestrian refuge island. The application of tactiles to the island depends on the width of the road crossing and island. Application of the tactiles can either be laid throughout the refuge surface or in two rows on either side. The buffer strips is constructed throughout all intersections and ramps.



Uncontrolled pedestrian refuge island with warning sign.

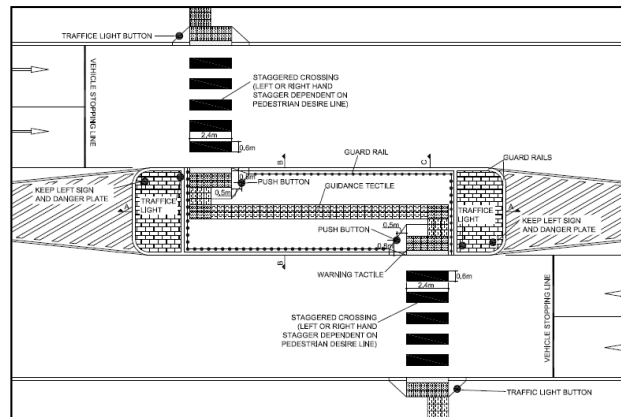
- Page 18 shows the layout and presence of a refuge island at an intersection. The refuge provides safety for the persons with visual and mobility impairments. The radius of the bell mouths plays a major role in the location of the crossing. A more ideal crossing is preferably perpendicular to the kerb. The more you push the pedestrian crossing back, the more you increase the travel distance and time for vehicles crossing the intersection as well as impact on sight lines. The balance of safety to the motorist and pedestrian has to be achieved in these scenarios.



Pedestrian refuge island at an intersection. Warning tactiles installed on a median

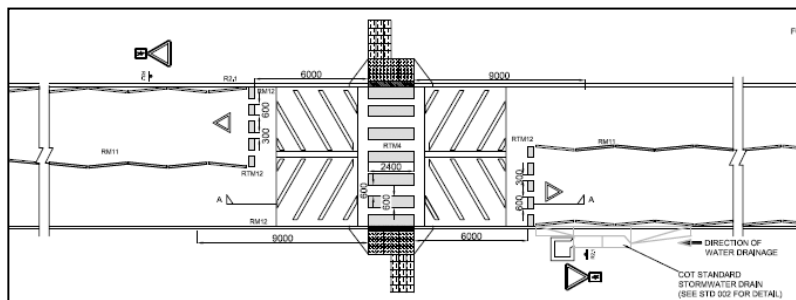
- Page 19 & 20 provides the details of a tree pit and basic cycle rack installed on the footway.

- **Page 21** shows the layout for a staggered pedestrian crossing. The crossing is controlled and normally used when high volumes of vehicular traffic clash with high levels of pedestrians. These kind of crossings need space to implement. Guidance tactiles are used on both footways as well as in the central island to guide visually impaired pedestrians from the one crossing point to the next.



Layout of a staggered pedestrian crossing.

- **Page 22 and 23** give a few layouts and applications of tactiles to midblock level crossings. The medians in these scenarios will receive some TGSI warning blocks to communicate a break in the first road crossing. It gives the visually impaired person an opportunity to recoup and make the second crossing when safe to do so. It is important to note that zebra crossings are controlled crossings, hence the guidance tail.
- **Page 24 to 26** show layouts and construction detail of mid-block raised pedestrian crossings and standard raised tables in the road infrastructure. The design of raised tables and midblock crossings depend on traffic circumstances.



Yield controlled raised mid-block pedestrian crossing.

5. FURTHER DEVELOPMENT REQUIRED

As mentioned before, the NDoT is also in the process of updating their Guidelines on Pedestrian and Cycle Facilities and would like to include the detailed work on pedestrian crossings developed by GIBB in the National standards and guidelines. The NDoT have rolled-out the book of drawings throughout South Africa as the standard to follow.

However, further research and development on the application of TGSIs in SA is required in terms of the following:

1. Finalisation of the detail drawings.
2. Simplification of some complex terms used in the notes of drawings.
3. Further discussions and workshops with relevant stakeholders and interested and affected parties, government departments and disability alliances and committees.
4. Further development of the layout of the document and scenarios of crossings.
6. Further research and inclusion of detail on colour and luminance contrast between the TGSIs and the surrounding footway surface
7. Skid resistance of TGSIs.
8. Wet and dry weather conditions impact on luminance and slip resistance.
9. Sight distances and the location of vehicle stop lines on intersections.
10. Geometric design of the intersection and Storm water drainage.
11. Reduction of ponding on pedestrian crossings.
12. Investigating the use of Intelligent Transport Systems (ITS) for signalling and pushbuttons as well as audible signalling, location of signals and buttons around an intersection and at midblock crossings etc.
13. The application of a white thermoplastic strip on the 300mm Buffer.
14. Development of a guidance document for the book of standard drawings.
15. Inclusion of terminology and definitions.
16. Further explanation on controlled, un-controlled and rural intersection treatment.
17. More clarity on the extent of guidance tactiles towards intersections and crossing points.
18. Illumination of pedestrian crossings.
19. The inclusion of shared pedestrian and cycle crossings and treatment.

The effective and successful use of the tactile paving surface depends on visual impaired pedestrians understanding the different meanings assigned to the different tactiles and layouts. It is important that visual impaired people be made aware of the presence of the facilities in their area.

6. CONCLUSION

Although NMT is recognised as a valuable component of transportation systems, it has historically not been included in traditional transport planning, with walkways and cycle paths generally implemented as afterthoughts, and sometimes not at all. There was also little infrastructure to accommodate the needs of the physically challenged (the elderly, people in wheelchairs, the blind, deaf and young children) and this is now being addressed by applying the principles of universal access in all transport projects.

Due to lacking, contradicting and outdated information that resulted in confusion in the engineering industry, with regards to the application of tactile pedestrian crossings in South Africa, GIBB developed the standard book of drawings with the City of Tshwane, "**Standard Construction Detail and Design Standards for Intersection Pedestrian Crossings affected by the Bus Rapid Transit Infrastructure**". The document incorporates international best practice, and consultation with the National Department of Transport, South African Bureau of Standards (SABS), Universal Access Consultants and some Disability Alliance groups including South African National Council for the Blind (SANCB).

South Africa needed one updated document that was in line with international best practices and standards on the application of TGSI's. South Africa needed a document that is applicable to local conditions, sustainable, but at the same time universal.

The urgency of finalising the set of Standard Drawings and accompanying guidelines is necessary to standardise the application of TGSI in South Africa, as many intersections and pedestrian crossovers are currently being designed and built according to different people's interpretations.

The standard book of drawings, however originating from CoT, is not officially adopted by Tshwane yet. They are however using it on major projects. The NDOT is promoting it throughout South Africa and busy incorporating the layouts into their new NMT guidelines. The City of Johannesburg (CoJ) has incorporated it into their "Complete Streets Guideline".

The quicker the provinces and municipalities adopt and apply the same standards, the better for South Africa and the quicker universal access can be achieved through consistency and uniformity in application. Further development can be done in the next few months or years. At least everybody is moving in the same direction and not as per the current phenomenon where cities, municipalities and provinces are implementing TGSI's differently. This results in the concept of universal access being ruined for the whole of South Africa.

Imagine being a visually impaired person trying to move about in South Africa today.

REFERENCES

A list of references can be provided by the author upon request.