Improved Crossing Facilities Design for the Elderly and Persons with Disabilities

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Introduction
Introduction

Effects of demographic change

⇒ conflict of aims especially at crossing facilities
Introduction

*Legal framework – accessibility of the physical environment*

- **UN Convention on the Rights of Persons with Disabilities (CRPD)**
  „Accessibility“
  „[…] to enable persons with disabilities to live independently and participate fully in all aspects of life“ and “[…] to ensure […] persons with disabilities access, on an equal basis with others, to the physical environment [and] to transportation, […]”
  (art. 9 „Accessibility“ para. 1 CPRD)

- **Equal Treatment for the Disabled Act (BGG)**
  Provide accessibility to ”[…] buildings or other facilities, public ways, squares and roads and public accessible transport facilities […]”
  (§ 8 para. 2 sentence 1 BGG)

- **Technical standards**
  - Directives for the Design of Urban Roads (RASt 06)
  - Guidelines for the Design of barrier-free Traffic Facilities (H BVA)
  - Several national standards (DIN)
Introduction

*Crossing facilities for all people – The German approach*

- differentiated kerb heights – „dual crossing“
- not applicable at any location (sewage guide, available space, costs,...)

Source: H BVA

“stop” indicators (SF)

on carriageway level

6 cm kerb

Source: H BVA

ground surface indicators
- to locate (AF)
- to determine the direction of the crossing (RF)

Photo/Figure: Boenke
Introduction

Crossing facilities for all people – The German approach

- 3 cm kerb – one kerb for all (uniform height)
- a compromise in Germany for several years
- problem: number of affected people (conflict of aims) rises

usable for wheelchairs etc.  palpable with the white cane
Introduction

Problem 1: The kerb

- in practice, a lot of different solutions to solve the conflict of aims
  - use of different kerb heights
  - use of different kerb designs
- no evaluation with participation of disabled people, no basis for standards
- unsatisfactory situation for all parties involved

Chamfered kerb (installation level 3 cm)
Rounded kerb (radius 2 cm, installation level 1 cm)
Rounded kerb (radius 5 cm, installation level 3 cm)
Ramped kerb

Photos (3): Boenke
Photo: Gme. Herrsching
Introduction

*Problem 2: Extensive use of ground surface indicators*

- installed to help blind and visually impaired people in orientation
- but:
  - extensive use at crossing facilities
  - endless variety of structures used
  - increasing complaints by users of wheelchairs: barrier
  - helping blind and visually impaired people in orientation???
Research project

Investigation methodology and findings
Investigation – Method and findings

*Aims of the study*

- Which kerb height/kerb design fulfils the requirements of the users best when building a kerb with a uniform height for all users?
  - best perceptibility for white cane users
  - best accessibility for wheelchairs and wheeled walkers
- which structures of tactile ground surface indicators:
  - show the best perceptibility for white cane users
  - are more accessible for wheelchairs and wheeled walkers (less vibrations)?

⇒ Looking for a design for all

⇒ project FE77.0500/2010 “Barrier-free crossing points on main roads - design of dropped kerbs and soil indicators in detail” funded by Federal Ministry of Transport and Digital Infrastructure, supervision by the Federal Highway Research Institute (BASt)
Investigation – Method and findings

*Investigation method – Participation*

- national and international literature study
- 1,384 interviews regarding experiences with the mobility of this group in street space
- **Comprehensive participation of people with disabilities**
  - National Centre of Competence for Accessibility
  - Representatives from the German Association for the Blind and Visually Impaired
  - the Social Association of Germany (physically handicapped)
- objective and subjective methods (measurements and survey with test subjects)
Investigation – Method and findings

*Kerbs – Installation height*

Test on installation height

- force to surmount the kerb raises with installation height
- small wheels have extreme difficulties ascending an edge 4 cm and above
- high failure (approx. 30%) when detecting kerbs (3 cm)
  - thus test subjects moved beyond (independent from kerb design)
  - observation was confirmed by the survey (interviews)

⇒ installation height of 3 cm has thus far proven to be suitable as design for all
Investigation – Method and findings

*Investigation method – Practical tests*

**Objective measurement**

- **vibrations (tactile reply) on the cane** when in contact with the different kerbs and surface indicators with this aid,
- **vibrations** on the handle **when rolling over** various kerbs and surface indicators with a wheeled walker,

**Subjective evaluation**

- perceptibility and accessibility of different kerbs and structures of surface indicators rated by **test subjects with a disability** who use an aid for mobility,
- perceptibility and accessibility of different kerbs and surface indicators rated by **test subjects** of a comparison group (people **without disability**) who use an aid for mobility.
Kerbs – Installation height and kerb design

<table>
<thead>
<tr>
<th>Kerb</th>
<th>Principle</th>
<th>Kerb</th>
<th>Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 Rounded kerb (r = 1.5 cm)</td>
<td><img src="image1" alt="Diagram" /></td>
<td>B4 Chamfered kerb (3 cm/3 cm, 45 degrees)</td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>B2 Rounded kerb (r = 2.0 cm)</td>
<td><img src="image3" alt="Diagram" /></td>
<td>B5 Sinusoidal kerb</td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>B3 Rounded kerb (r = 5.0 cm)</td>
<td><img src="image5" alt="Diagram" /></td>
<td>B6 Ramp</td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Investigation – Method and findings

*Kerbs – Edge design*

- shows the conflict of aims: e.g. wheeled walkers and blind people rating vice versa
- round kerb edges are better to access with rolling aids
- angular kerb edges are more perceptible with the white cane

⇒ a rounded kerb with an edge with a radius of 2 cm has to be proven the best solution as design for all
Investigation – Method and findings

Ground surface indicators – Ridged plates

- Ridged plates, right-angled bars („stop field“)
  - poor ratings from users of rolling aids, if increasing distance between bars
  - rated with good „stop function“ by white cane users (independent from distance between bars)

- ridged plate with longitudinal bars (functionality „guiding“)
  - high functionality to guide white cane users
  - accessible without any difficulties for users of rolling aids
Investigation – Method and findings

*Ground surface indicators – Choice of items*

**Truncated cones/knobs**

<table>
<thead>
<tr>
<th>32 truncated cones diagonally, diameter 33 mm</th>
<th>50 truncated cones, diagonally</th>
<th>32 knobs, diagonally</th>
<th>36 truncated cones, orthogonally</th>
<th>36 knobs, orthogonally</th>
</tr>
</thead>
</table>
Investigation – Method and findings

Ground surface indicators – Truncated cones/knobs (1)

- Knobs
  - decreasing performance (perceptibility) as size of knobs or number of knobs decreases
  - good accessibility for users of rolling aids
- truncated cones (large diameter)
  - very good accessibility for users of rolling aids
  - perceptibility with the white cane rated „not so good“ in some cases
  - very good perceptibility when stepping on the cones (feet/shoes)

⇒ safety/functionality for location strip is given
Investigation – Method and findings

*Ground surface indicators – Truncated cones/knobs (2)*

- **Truncated cones**
  - very good perceptibility, independent from their arrangement (diagonally, orthogonally)
  - small diameter: whitecane users complaining tactile feedback as “too heavy” and “unpleasant” in some cases
  - small diameter: accessibility by users of rolling aids criticised (“sharp blow”)

- **Truncated cones/knobs, orthogonally arrangement**
  - problems to distinguish between truncated cones/ knobs and ridged plates
Recommendations
Recommendations

**Kerbs**

- a rounded kerb with a radius of 2 cm fulfills the needs of all users best (Design for all)
- when building a crossing facility with an uniform height of the kerb an installation height of 3 cm was proven to be the best height for all users
- at main roads kerbs with an installation height of 3 cm should be secured by tactile ground surface indicators to prevent stepping over (difficult orientation via acoustics)

⇒ radius of 2 cm should be new standard, because fulfils functional requirements of all users best
Recommendations

*Ground surface indicators*

- **ridges with small distance of bars*** fulfil the requirements of white cane users and users with rolling aids better than wide ridges

- **truncated cones with bigger diameters*** are better accessible and at the same time perceptible enough for white cane users to point to crossing facilities

- **cones** should **only be arranged diagonally** rather than orthogonally to be sure not to be mixed up with ridged plates

* within the framework of valid (German) specifications
Recommendations

Further recommendations

- continuous mobility training for safe and improved use of mobility aids
- mobility aids should be improved to improve mobility
- use of pre-fabricated parts to avoid lowering of kerbs (installation height above carriageway level)
- ramps could be an improved design for all-solution at crossing facilities (tests showed some good approaches for good accessibility and perceptibility; but only one layout tested)

⇒ further research necessary
Thank you! Any questions?

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