TYPE OF INFRASTRUCTURES	REFERENCE	ORIGINICITY	TARGETED INDIVIDUALS	AIM / OBJECTIVES / HYPOTHESES	JUSTIFICATION	PARTICIPANTS	METHODOLOGY / SET UP	RESEARCH TOOLS	VARIABLES / INDICATORS STUDIED	ANALYSIS / INTERPRETATION	RESULTS	STATED LIMITS	CONCLUSION (THE BEST INFRASTRUCTURE/PRACTICE)	QUALITY
Pedestrian crossing	**Amosun**, S. L, Burgess, T., Groeneveldt, L. & Hodgson, T. (2007). Are elderly pedestrians allowed enough time at pedestrian crossings in Cape Town, South Africa? *Physiotherapy Theory and Practice* , 23(6): 325-332.	**Cape Town, South Africa**	**Elderly**	1) Determine the walking speed required to safely clear pedestrian crossings controlled by traffic lights close to selected homes for older persons in the Cape Metropole of Cape Town, South Africa. 2) Determine the maximal walking speed in unloaded and loaded conditions of residents in the selected homes. 3) Determine if there is a difference between the two conditions of unloaded and loaded walking. 4) Descriptively compare the required speeds to walk across the selected pedestrian crossings to actual walking speeds in unloaded and loaded conditions. 5) Assess the reported emotions of the residents and compare those individuals who walked slower than the recommended velocity of 1.2 m/s (unloaded condition) with those residents who walked faster.	Among older persons aged 65 years and over, the reports revealed that motor vehicle accidents involving pedestrians have been the highest causes of non-natural death from 2001 (19.6%) to 2004 (46.5%). The National Department of Transport of South Africa developed a road safety strategy titled ''The Road to Safety 2001 2005.'' This is a five year plan aimed at reducing road traffic accidents, fatalities, and injuries. The time allowed by the Traffic Department in Cape Town, South Africa, for pedestrians to cross a road at traffic light-controlled pedestrian crossings was based on a walking speed of 1.2 m/s, similar to the walking speed of 1.22 m/s recommended by the Department of Transportation in the United States of America. Paying attention to research reports that the walking speeds of elderly pedestrians were often slower for the time interval allowed at pedestrian crossings controlled by traffic lights in some countries, the elderly population in South Africa may be at risk when crossing the road.	n=447 living in 4 homes for older persons (chosen for their closeness to shopping malls). Mean age: 78,8 ± 7 years (65-93 years), 2 of them did not walk outside their home, 9 once a week, 4 twice a week, 4 more than twice a week, 17 once a day, 4 twice a day, 7 more than twice a day. Inclusion criteria: ≥ 65 years and ability to walk independently. Exclusion criteria: wheelchair users, existing neurological deficit, visual acuity score of 6/18 or lower on the Snellen Chart. The study was advertised through leaflets, posters, and information sessions with the residents. n=60 volunteers, n=13 excluded due to non-compliance and/or illness.The participants were interviewed to obtain information on age, current medical history and medication, and surgical history.	A questionnaire was administered by interview	Questionnaire: how often the participants walked outside of the homes, whether participants considered as adequate the time allowed to clear the road at pedestrian crossings and the emotions of the participants regarding their own safety when crossing the road.	Emotions regarding their own safety when crossing the road	Statistical analyses were performed by using Statistica software (StatSoft Inc., 2002). The first, second and fourth aims were accomplished through determination of the means and standard deviations. The third aim was accomplished through a t-test with a level of significance of p < 0.05. Finally, the fifth aim was accomplished through a chi-square test with the level of significance once again at p < 0.05.	22/31 participants who walked in unloaded conditions at or faster than the recommended speed of 1.2 m/s felt there was sufficient time to clear pedestrian crossings, but 16 of them were apprehensive while crossing. Participants who walked slower than the recommended speed of 1.2 m/s during the unloaded walking tests (n = 16) felt there was insufficient time to clear pedestrian crossings (100%) and were apprehensive (5/16), anxious (4/16), and fearful (5/16) while crossing. 6 participants in this group reported that these emotions inhibited them from walking outside of their residences when they wanted to. The relationship between the emotions experienced while crossing the road and the walking speeds of participants is significant (p < 0.05) (chi-square test).	The walking speeds were determined in a laboratory environment. If repeated on a typical road, the safety of the participants might be further compromised by the attention demands of walking. This would lead to difficulties with crossing while at the same time looking out for oncoming vehicles, other pedestrians, and any other potential hazards.	About 1/3 of participants walked slower than the recommended walking speed, but over 1/2 of participants who walked faster reported negative emotions while crossing the road.	43
							The body mass (kg) and stature (cm) were obtained for each participant to determine the body mass index (BMI).	The body mass was measured by using a digital scale, and stature was measured with a mounted tape measure.	Speed (Time) (crossing unloaded/loaded)		There was major inconsistency in the time allowed for crossing the road at the 40 traffic light-controlled pedestrian crossings nearest to the four selected homes for older persons. The mean required walking speed at the selected sites was 0.86 ± 0.32 m/s (range 0.38 - 1.77 m/s). At 4 of the pedestrian crossings, pedestrians would be expected to walk faster than the recommended speed of 1.2 m/s.		Though the measured pedestrian crossing intervals were inconsistent, enough time was allowed for elderly pedestrians at most of the selected pedestrian crossings.	
							10 traffic light-controlled pedestrian crossings within 5-km radius of each of the selected homes were identified (measure of distance and time).	The distance of each pedestrian crossing was measured in meters from curb to curb with a measuring wheel. The time allowed to safely walk across each pedestrian crossing was measured in seconds using a digital stopwatch, from the appearance of the green walking signal to the appearance of the solid red non walking signal.		The mean maximal walking speeds (unloaded and loaded) of the 47 participants were 1,36±0,31 m/s (range: 0,73-2,03 m/s) and 1,36 ± 0,33 m/s (range: 0,58-2,12 m/s) respectively. Based on the mean walking speed required to walk across the selected 40 pedestrian crossings (0,86±0,32 m/s), only one participant (80-year-old female) walked at a slower walking speed (0.73 m/s unloaded; 0.58 m/s loaded).	Though the mean maximal walking speed of the participants was faster than both the recommended and the mean measured pedestrian crossing intervals, the outcome of this study indicated a discrepancy between the subjective emotions of the participants and the objective measurements of pedestrian clearance intervals and maximal walking speed.	The mean maximum walking speed of the participants was faster than that recommended at pedestrian crossings, and there was no significant difference when participants walked freely and when carrying a predetermined weight.	
							Assessing the walking speeds of the participants was conducted in a laboratory. The participants were instructed to walk as fast as possible (verbal encouragement). The measurements were repeated 3 times with the participants walking freely (unloaded) and 3 times with the participants loaded. In the loaded state, participants were required to carry a 2-kg load in the form of a dumbbell, which represented the predetermined weight of an average shopping bag. The weight was carried in the same hand (chosen by each participant), with the arm at the side for each test. The maximal time over the 12-m distance was determined for each participant, and the maximal walking speed (loaded and unloaded) was calculated.	The time taken to walk over a marked 12-m distance was measured by a photocell timing system.			On the basis of the recommended walking speed at pedestrian crossings (1.2 m/s), 16 participants (34.0%; 3 males, 13 females) walked slower during the unloaded and loaded walking tests. In addition, one female participant walked fast enough during the unloaded walk test (1.23 m/s) but was slower during the loaded walk test (1.14 m/s). The remaining 30 participants (63.8%) could walk (unloaded or loaded) at or faster than the recommended walking speed of 1.2 (m/s).			
	Barlow, J. M., Bentzen, B.L., & Bond, T. (2005). Blind pedestrian and the changing technology and geometry of signalized intersections: Safety, orientation, and independence. *Journal of Visual Impairment and Blindness.* 99 (10): 1-9.	**Portland (Oregon), Cambridge (Massachusetts), Charlotte (North Carolina), United States**	**Visually impaired**	Investigate the safety, orientation, and independence of pedestrians who are blind while crossing at complex, signalized intersections. Provide a descriptive analysis of broad measures of safety, orientation, and the need for assistance or intervention for safety in crossing, and implications for orientation and mobility (O&M) instruction.	Intersection geometry and signalization are designed to move vehicles as rapidly and efficiently as possible, but pay minimal attention to the movement of pedestrians (including the visually impaired). Intersections are wide, commonly more than four lanes, often with designated lanes for right-turning or left-turning. In addition, fluctuations in the flow and volume of traffic and the lack of vehicular lanes parallel to some crosswalks may contribute to disorientation, since the sounds of vehicles are used to determine the location of crosswalks, to establish a heading toward the opposite side of the street, and to travel straight across the street.	n = 16 for 8 or 9 crossings in the 3 cities (n total = 48 (30 men, 18 women) and 416 crossings, mean age: 46, 20-78 years old) using a guide dog or a long cane and were unfamiliar with the tested streets.	**Experimental design** **Charlotte and Portland:** Pedestrian signals to cross a major street were actuated (pushbutton to get a Walk signal and pedestrian timing). Pedestrian signals for minor streets were "on recall" (adequate time in every cycle to cross that street and no pushbuttons). **Cambridge:** Exclusive pedestrian phase to cross the major street at one intersection, and a leading pedestrian interval (LPI) for the other. **Other intersection complexities** included left- and right-turn arrows, split phasing (green signals provided for northbound traffic and southbound traffic at different times), signalized and unsignalized channelized (separated) right-turn lanes, offset intersections, skewed intersections, and median islands. Each participant travelled 2 routes at each of the 2 intersections (cross the street in front and the one beside, perpendicular and parallel). They could request assistance as they would have done to other fellow pedestrians in real life. One researcher communicated instructions for the experimental procedure, and the other one observed and timed the tasks.	Observation	Find and use pushbuttons Locate oneself in relation to the crosswalk at the beginning and at the end of the street crossing Travel path in relation to the crosswalk and crossing alignment Delay in beginning crossing after the onset of the walk interval or of parallel through traffic Right or wrong vehicular cue Pedestrian signal status at the beginning and at the end of crossing Vehicular signal status at the end of crossing Requests of assistance or the need for intervention for safety	**Descriptive data:** Compilation of the units of analysis and percentage on each observed variable	Participants looked for, found, and pushed the button on only 16.3% of the crossings in Portland and on none in Charlotte. ~75% of the crossings began with appropriate alignment, location or both; 50% ended outside the crosswalk. Several of the crossings were skewed or located somewhat away from the street corner. **Charlotte:** 43,5% complete crossings within the crosswalk. **Across the 3 cities:** 31,6% of the crossings that began outside the crosswalk and 25,0% of those that began poorly aligned ended within the crosswalk. 89% of the crossings that started within the crosswalk and were properly aligned ended within the crosswalk. Mean starting delay (3 cities): 6.4s. **Across the 3 cities:** 48,6% of the crossings started during the walk interval, and 26,9% of all independent crossings ended after the onset of the perpendicular traffic. **Portland and Charlotte:** 19,5% began crossing during the walk interval of the pedestrian-actuated crossings compared to 71,7% where the pedestrian phase was on recall. **Portland:** 24,6% began crossing during the walk interval of pedestrian-actuated crossings, and on 50,0% of these crossings, they failed to complete their crossings before the onset of perpendicular traffic. When the pedestrian phase was on recall, 82,1% started during the walk interval, and only 5,7% completed crossing after the onset of perpendicular traffic. **Charlotte:** Pedestrian-actuated crossings resulted in 11,4% of the crossings starting during the walk interval, with 37,8% of the crossings ending after the onset of perpendicular traffic, contrasted with 58,1% and 20,9%, respectively, of the crossings where the pedestrian phase was on recall. 80-90% of the choices to cross the street were made independently. **Requests for assistance:** 53% for starting location, 60% for alignment, and 73% for determining when to start crossing. Once the participants were in the street, interventions were much more common than requests, with only 7% of the assistance occurring as a result of the participants' requests.	Updated techniques for evaluating instructions, using pedestrian pushbuttons, aligning to cross, and determining the appropriate crossing time are needed.	Participants use pushbuttons only when they know they are there and where to find them. Proposed strategy: travel to the edge of the street; maintain alignment; assess street crossing and locate tactile clue for realignment; use systematic search patterns to determine if there is a pushbutton; and then return to the predetermined location and tactile cue. Participants were more successful in starting to cross within the crosswalk when they used the location of curb ramps to indicate the location of the crosswalk (lined for a cue for alignment). Most participants fail to push the buttons or, when they don't exist, they don't realize it is their turn to cross. Pedestrian phase on recall might be more effective for visually impaired individuals.	35
	Bennett, S., Kirby, R.L., & MacDonald, B. (2009). Wheelchair accessibility: Descriptive survey of curb ramps in an urban area. *Disability and Rehabilitation: Assistive Technology.*4(1): 17-23.	**Halifax, Nova Scotia, Canada**	**Mobility impaired (wheelchair dependent)**	Determine the extent to which curb ramps in an urban area of our city met a set of wheelchair accessibility guidelines.	At road intersections, existing guidelines suggest that there should be a means to ease the transition from the elevated sidewalk to the road for pedestrians and wheelchair users. Among the options available, the curb ramp is a common one. Most often in a curb ramp, the surface gradually slopes downward from the sidewalk to the gutter level. The curb ramp may be perpendicular, parallel or diagonal to the curb. Despite the widespread recognition of the importance of curb ramps and the availability of comprehensive guidelines regarding their design, we have observed a number of intersections in our city (and other cities we have visited) with a variety of design or maintenance problems that might present barriers to wheelchair users.	N/A	All data were collected from street intersections in an urban area that included university, hospital and residential buildings in Halifax, Nova Scotia. The borders of the area were defined as Coburg/Spring Garden Road, Tower Road, South Street and Oxford Street. Seventy-nine intersections were randomly selected within that area. Measured at the bottom of the slope between the 2 points where the curb ramp began to flare upwards towards the sidewalk level. If the ramp was on a curve, the measurement was taken along a straight line between the points at the edges of the ramp that were closest to the road. Measured parallel to the direction of travel, with an 18-cm-long inclinometer at the bottom of the curb ramp (just above the lip, if any) and 1 m further up. A mean of the 2 values was calculated. Measured with the inclinometer, directly in front of the gutter-ramp junction, on a line from the middle of the curb ramp to the middle of the road. A level square ruler was used for the measurement of any lip identified. The lip height was measured (in mm) from the gutter to the top of the lip at points 1/3 and 2/3 of the width of the curb ramp. The mean of these 2 values was determined and reported as the average lip height. Both roundabouts have university or city bus stops in close proximity and thus exhibit at least some heavy-vehicle activity. Although both roundabouts have sidewalks and marked pedestrian crossings, it needs to be recognized that the proximity of PS-RAL to a major university likely raises driver expectation of ongoing pedestrian activity. In both cases, blind study participants were asked to cross the road independently while accompanied by an orientation and mobility (O&M) specialist. Participants would cross the road when they felt comfortable that it was safe. The O&M specialist would intervene if necessary to avoid potential collisions. Trials in both projects were videotaped and were reviewed and extracted by the same analysts.	For each of the 79 evaluated intersections, the measurements of distance and slope were performed and each criterion was scored categorically (a score of 1 if the intersection met the criterion and 0 if it did not). Digital photographs were taken. Qualitative measurements were based on the consensus of two investigators (SB, MM).	Assessment of vehicle operations.	Presence of curb ramp (when the sidewalk sloped down gradually towards the road at the intersection) Alignment with crosswalk (wheelchair users should be able to move along a straight path from the sidewalk onto the road en route to the corresponding curb ramp on the other side). Diagonal and parallel curb ramps require the wheelchair user to alter his or her path to use the ramp. This is inconvenient for both the wheelchair user and for pedestrians who are taking a more direct route. Diagonal curb ramps can also be dangerous because, to approach the ramp-gutter transition at right angles, they may require the user to follow a path that takes them outside the crosswalk and potentially into the path of moving vehicles. Width of the curb ramp ≥ 915 mm (it needs to be wide enough to accommodate wheelchairs of different widths.) Slope of the curb ramp ≤ 4,8° (1:12) Gutter counter-slope ≤ 2,9° (1:20) Smooth transition from the curb ramp to the gutter (lip height ≤ 13 mm) (Smooth transitions reduce the difficulty of getting on or off the ramp and decrease the likelihood of a tip or gall when the casters meet and obstruction. However, commonly there is a small lip at the bottom of the slope that is intended to keep water in the gutter moving toward the drainage grate.) Surface free from irregularities (ones that would require a wheelchair user to change direction to avoid the irregularity or ones that would interrupt a wheelchair's forward movement) (Potholes, cracks, depressions or elevations within or at the junctions between segments can cause the wheelchair to tip over or cause the occupant to fall from the wheelchair.) Surface free from drainage grates (A drainage grate can cause tips and falls, either because the grate and surrounding surfaces are of uneven height or because a wheel can drop into an opening in the grate surface. Although the design and orientation of the openings can reduce the likelyhood of the latter, it is preferable that the drainage grate not be in the wheelchair's path.)	Descriptive statistics were calculated. Percent compliance was determined for each criterion and for a combination of all eight characteristics. The scores for each of the eight criteria were also summed to produce an overall score (0–8) for each curb ramp. Statistics related to Criteria 2–8 were only assessed for intersections where there was a curb ramp.	98.7% had curb ramps. 53.8% provided direct lines of travel from the sidewalks onto the crosswalks. 93.6% were ≥ 915 mm in width. The variability and range of values was large. 43.6% had ramp slopes ≤ 4.8° (1:12). 57.7% had gutter counter-slopes ≤ 2.9° (1:20). Some of the gutter slopes were negative values (i.e., the slope of the gutter was in the same direction as the slope of the curb ramp), which would not be expected to cause problems at the transition. 26.9% had smooth transitions (≤ 13 mm) from the curb ramps to the gutters. 85.9% were free from irregularities. 100% were free from drainage grates.	Although the criteria selected had excellent content an concurrent validity, the reliability and construct validity for the criteria are unknown. The guidelines on which they base their criteria were North American ones. These data must be generalized with caution in other parts of the world. The sample size was small. The area surveyed was selected for convenience. The results of this survey are specific to the area studied and caution must be used when generalizing the data to other areas within our city or to other cities. However, the boundaries contained a university, a large hospital complex and a rehabilitation center. Future studies should include comparisons among different zoning regions (e.g., residential, downtown core or rural) and should be carried out in other cities. The study was a cross-sectional one, which is a common study design for accessibility issues. They recognize that the accessibility of intersections varies over time (e.g., because of weather conditions or erosion). A subset of the existing guidelines was used, for practical reasons. The focus was on wheelchair accessibility. They recognize that intersection designers must also take into consideration other users (e.g., people with low vision, for whom texture, different colors and visual contrast can be helpful, or people who use ambulation aids), other objectives (e.g., traffic flow and water drainage) and cost considerations. The latter criterion might be considered a special case of the former. The two criteria might well be combined for future studies. A more comprehensive survey should include such elements as the dimensions of sidewalk approaches and landings above the curb ramp, the slope of flares on the sides of the curb ramps, the extent of cross-slope and the presence of detectable warnings for people with visual impairments.	The mean (+SD) overall score was 5,6 (+/- 1,1). Only 2 (2,6%) of the intersections met all eight criteria. However, 61% of the intersections scored more than 6 of a possible 8 and the mean score was 5,6. For most wheelchair users, even a curb ramp with some problems is preferable to managing a curb (usually 15 cm high in our city) without a ramp. This was often because the curb ramp was of the diagonal type, with two sidewalks sharing the access to the same curb ramp. Even with very wide diagonal curb ramps that wrapped around a corner, a wheelchair user would need to change direction to approach the ramp–gutter transition squarely. The question of roundabout accessibility is complex and cannot be reduced to a simple relationship to traffic volumes. Although a low volume site may have the appearance of being usable, a higher-volume site may result in lower delay if combined with a greater rate of yielding. The greater the countenslope of the gutter, the more abrupt the transition is from the curb to the gutter or vice versa. Even a 13 mm lip can interrupt the forward movement of a wheelchair and cause a tip or fall. Concerns about the flow of water in the gutter are legitimate ones; the collection of water, ice and debris at the bottom of a curb ramp can present accessibility barriers and danger for wheelchair users and pedestrians alike. However, there are design options (e.g., the use of drainage grates on both sides of the curb ramp) that can minimize this constraint.	34
	Bollard, E. & Fleming, H. (2013). A study to investigate the walking speed of elderly adults with relation to pedestrian crossings. *Physiotherapy Theory and Practice.* 29 (2): 142-149.	**Kilkenny, Ireland**	**Mobility impaired and elderly**	Investigate the walking speed of elderly Irish adults and to establish if it allows the safe clearance of pedestrian crossings (consideration of the acceleration phase or the subsequent steady-state speed).	In 2007, 81 pedestrians were killed and 884 were injured on Irish roads. […] The fatal casualty rate of pedestrians is highest among both males and females over the age of 75 years (data dating from 2004-2006). "Traffic Management Guidelines" recommend that the green pedestrian aspect time is fixed at 6s and that the amber pedestrian aspect varies with the width of the road, allowing a second for each 1.2m of road width that pedestrian's cross.	n = 52 community-dwelling adults aged ≥65 years without unstable neurological conditions (recruited from 4 day care centers). Average age: 79,5 years. 28 with no walking aid device, 19 using a walking stick, 2 using 2 walking sticks and 3 using a rollator Zimmer frame.	**Quantitative cross-sectional design.** **Experimental conditions:** outdoors in 2 day care centers and indoors in the 2 others due to poor weather. **Surface:** on a level surface (no step down, gradual surface) with markings at 1m intervals. **Instructions:** walk alone at a normal and comfortable speed (with mobility aid if normally used). 20 pedestrian crossings were identified within a 1km radius of the day care centers.	**10-m walk test:** digital spilt-timer stop watch. The stop watch was spilt at 2.5m, as according to Lindemann et al. (2008) older people take at least 2,5m to achieve steady-state walking. Trundle wheel to measure the distance of each crossing curb-to-curb and a digital split-timer stop watch to time the interval of the green and the amber light signals.	Time Speed (Time) Distance from curb-to-curb	**Descriptive analysis:** describe data concerning the participants and the characteristics of the pedestrian crossings (mean, standard deviation, minimum, and maximum).	**Mean acceleration in the 2,5m:** 0,20 ± 0,15m/s2 (range 0,01-0,67 m/s-2). **Mean steady-state walking speed:** 0,82 ± 0,27 m/s (range 0,28 - 1,41 m/s). 49 participants (94,2%) had a steady-state walking speed of less than 1.2 m/s. Considering distance and time allotted, 6/20 crossings (30%) would not have provided enough time for the participants to safely cross the road. If these participants had inadvertently started crossing at the appearance of the amber light signal (entering the crossing without a need for initial acceleration) considering the average distance of the pedestrian crossings (9,29m) and allowing a time of 7,27s (mean time of the amber light signal), 50/52 participants (96,2%) would not have had enough time.	1) The sample size and the geographic area were quite small, 2) Participants walked on a level surface, with no obstacles or distractions. 3) Participants were walking at a normal and comfortable walking speed, it cannot be determined if they would have been able to clear the pedestrian crossings, given the timeframe, at a maximum safe walking speed. 4) An assessment of balance, muscle performance, and strength could contribute to the findings of this kind of studies. 5) The results cannot be generalized to all elderly community-dwelling adults as it focused on day care center attendees.	The steady-walking speed considered by the "Traffic Management Guidelines" of 1,2m/s is too high for much of the participants. An average steady-walking speed to consider should be around 0,8-0,9 m/s. It is important to take into consideration acceleration in the first 2,5m and the steady-state walking speed in the remaining distance individualized to each pedestrian crossing.	45
	Hoxie, R. E. & Rubenstein, L. Z. (1994). Are older pedestrians allowed enough time to cross intersections safely? *Journal of the American Geriatrics Society* , 42(3), 241-244.	**Los Angeles, California, United States**	**Elderly**	To characterize and describe the pedestrian traffic flow at a busy urban intersection and to determine the percentage of older pedestrians at risk for injury because of reduced walking speeds.	Currently, pedestrian clearance intervals at intersections are calculated based on the normal walking speed of 1,22 m/s described in the standard manual for city traffic engineers. This norm approximates average walking speed described in the literature. However, these average walking speeds were determined by studying healthy older pedestrians who had no mobility problems. When adjustment is made for exposure, older pedestrians are more likely to be injured by motor vehicles than younger pedestrians. Over 7 000 pedestrians are killed in the U.S. each year, with the highest death rate occurring in older persons, especially those who live in urban environments.	n = 1229 pedestrians who legally started to cross the intersection by placing one foot in contact with the street while the "walk" display was shown during the 19,5 h of the survey were included in the study. This included 592 (48%) older adults (≥65 years old) and 637 (52%) younger individuals (<65 years old). 43 of the older pedestrians (7%) used an assistive device. n = 73. 139 of the 159 older pedestrians who were unable to cross the street in the allotted time. 73 (53%) were willing to participate in the study and answer the questions. Their mean stated age was 77,3 years. Only 2 persons were discovered to be under age 65 years (63 and 64). n = 200. 100 older and 100 younger individuals	**Location:** Intersection of Third Street and Halifax Avenue (area with a high concentration of older residents and pedestrians, a large number of senior apartments and board and care homes, and several senior citizen centers and clinics). The intersection is 21,85 m wide from curb to curb and has handicap ramps at each corner. Pedestrians have a maximum of 27 s from the beginning of the "walk" indication on the pedestrian traffic signal and a minimum of 17 s from the last display of the "walk" indication to cross before opposing vehicles receive a green light. Thus, they are required to walk at a minimum rate of 0,81 m/s if they start at the very beginning of the "walk" indication, but as fast as 1,29 m/s if they start at the last legally acceptable time to do so. **Observational study** where the activities of all pedestrians crossing the intersection between 11:30 and 18:00 on three separate days were documented. Subjects who were unable to cross the intersection in the allotted time were immediately approached by one of two available interviewers and asked if they would answer a few survey questions concerning the safety of the intersection. The researchers returned to the same intersection during the same time of the day and in similar weather conditions similar to the original survey and measured the actual walking speed.	Data were recorded by one observer who was standing on the sidewalk of the intersection. All pedestrians who legally started to cross by placing one foot in contact with the street while the "walk" display was shown were entered into the study. The observer counted and classified all such pedestrians before they entered the intersection by sex, apparent age group, noted wither they used an assistive device, and determined whether they were able to reach the opposite curb before opposing vehicles received a green light. Survey: 1) Do you believe you are in danger when you cross the intersection? 2) How often do you cross this intersection? 3) Do you realize that you didn't get to the sidewalk before the light changed? 4) Have you fallen during the past year? 5) What is your actual age? Stopwatch	Speed (time) Experience of danger; Use of intersection; Comprehension of their inability to cross in the allotted time; Number of falls Speed (time)	Percentages of the observations Percentages of the answers to the questions Student's T-test	27% were unable to reach the opposite curb before the light changed to allow cross traffic to enter the intersection. 23% were stranded by at least a full traffic lane away from the safety of the curb when the light turned green on the oncoming traffic. 54 (74%) considered themselves to be "in danger" when they crossed an intersection. 46 (63%) stated that they cross the street at least daily. 43 (59%) were aware they did not get to the opposite sidewalk before the light changed. 18 (25%) said they had fallen in the past year. The mean walking speed for younger pedestrians was 1,27±0,17 (range: 1,04-1,68) and for older pedestrians it was 0,86±0,17 (range: 0,41-1,29), 96% of the older pedestrians walked more slowly than the 1,22 m/s traffic manual guideline. 100% of the younger and 77% of the older pedestrians in the group were able to cross the street in the allotted time.	The duration of the study was short. Observing a 6,5-hour period for three separate days may not give an adequately representative picture, even though these were the hours of peak traffic by older pedestrians. The observations were limited to one intersection, which may not adequately reflect the situation at other intersections. The definition of age was an observational guess. Only 53% of persons approached were willing to answer the questions, and they may not have fully represented the older crossing population. They did not interview those pedestrians who were able to cross in the allotted time.	27% of older pedestrians were unable to cross in the legally acceptable time. 23% of older pedestrians were stranded by at least a full lane. While the average walking speed of our older subjects appears to be sufficient to allow most of them to cross this intersection, if they begin crossing at the earliest display of the "walk" light, it is inadequate to allow a large proportion to cross in the allotted time if they begin crossing a few seconds later, even though the "walk" light is still displayed and they are legally allowed to begin crossing. Timing of the pedestrian signal should be adjusted to allow pedestrians more time to cross. Many older people in the community seem to have lost some of their inability to walk in an adequate rate to cross this and other intersections in the allotted time.	40
	Schroeder, B. J., Rouphail, N. M., & Hughes, R. G. (2010). Working concept of accessibility: Performance measures for usability of crosswalks by pedestrians with vision impairments. *Transportation Research Record.* 2140 (2009), 103-110.	**Charlotte and Raleigh, North Carolina, United States**	**Visually impaired**	To develop measures to describe the decision of the safest moment to cross for blind pedestrians. It is about identifying crossing opportunities in a conflicting traffic stream. It is important to propose metrics that can be used to compare the crossing ability across sites before and after a crossing treatment is installed or even from one pedestrian to another. **Hypothesis:** both site geometry and conflicting traffic volumes contribute to the accessibility of a site but that ultimately driver and pedestrian behavior may play the most crucial role in rendering a site accessible to and usable by pedestrians who are blind.	Although roundabouts in the United States are still not as common as they are in other countries, more than 1,400 were known to be in operation at the time of this research. One of the primary challenges in conducting research on the accessibility of roundabout pedestrian crossings is assessing the crossing performance in quantifiable and reproducible terms. The crossing task can be categorized into four distinct components: 1. Locating the crosswalk, 2. Aligning to cross, 3. Deciding when it is safe to cross, 4. Maintaining alignment during crossing. Complex intersections, including roundabouts, present some unique challenges for pedestrians with vision impairments. The traffic control strategy at a roundabout entry leg is typically a yield sign, and many drivers are able to enter the circle without the requirement to come to a full stop. Similarly, traffic exiting the roundabout is free-flowing, resulting in largely uninterrupted traffic flow at the exit portion of the crosswalk. Roundabout crosswalks are typically not signalized and the task of identifying crossing opportunities is thus unassisted. Depending on the geometric design of the roundabout and the location of the crosswalk, vehicle speeds may be relatively high and the auditory interpretation is complicated because vehicles are moving on a circular path. The continuous flow of traffic circulating the roundabout can create a difficult auditory environment and the listening task is complicated by elevated levels of ambient noise.	**DAV-CLT:** n=10 blind participants **PS-RAL:** n=12 blind participants	**Observation:** 2 roundabouts studied under the NCHRP Project 3-78 and the National Institutes of Health-National Eye Institute research project. **The first single-lane roundabout** is at the intersection of 9th Street and Davidson Avenue in Charlotte, North Carolina (Site DAV-CLT). The DAV-CLT roundabout has an inscribed diameter of approximately 42.7 m and an approach speed limit of 40 km/h. It is located in a mostly residential neighborhood just northeast of uptown Charlotte. The crossing distance for each lane is 4.9 m, corresponding to a crossing time of 4.6 s at a walking speed of 1.1 m/s. Each subject completed 3 trials at the northern and 3 trials at the southern crosswalk, resulting in a total of 12 entry- and 12 exit-lane crossings. The crossing task at an unsignalized pedestrian crosswalk is assessed in terms of 4 accessibility criteria: 1. Crossing opportunity: sufficient crossing opportunities (yields or crossable gaps); 2. Opportunity utilization by the pedestrian; 3. Delay: crossing opportunity taken within a reasonable time; 4. Safety: crossing interaction without a significant degree of risk. **The second single-lane roundabout** is at the intersection of Pullen Road and Stinson Drive in Raleigh, North Carolina (Site PS-RAL). The PS-RAL site has a smaller inscribed diameter of 26.8 m and a similar approach speed limit of 40 km/h. The roundabout is located close to the main campus of North Carolina State University and thus experiences frequent pedestrian activity from students walking to and from class. The crossing distance is 4.0 m, indicating a theoretical crossing time of 3.7 s. Each subject completed 8 full trials at one crosswalk, resulting in 16 entry- and 16 exit-lane crossings. Both roundabouts have university or city bus stops in close proximity and thus exhibit at least some heavy-vehicle activity. Although both roundabouts have sidewalks and marked pedestrian crossings, it needs to be recognized that the proximity of PS-RAL to a major university likely raises driver expectation of ongoing pedestrian activity. In both cases, blind study participants were asked to cross the road independently while accompanied by an orientation and mobility (O&M) specialist. Participants would cross the road when they felt comfortable that it was safe. The O&M specialist would intervene if necessary to avoid potential collisions. Trials in both projects were videotaped and were reviewed and extracted by the same analysts.	Assessment of vehicle operations.	P(Yield) = probability of yielding, defined as the ratio of the number of conflicting vehicles that have yielded to all vehicles encountered during the observation period while a pedestrian is waiting to cross. P(GO|Yield) = probability of "Go" given a yield, defined as the ratio of yields that resulted in a pedestrian crossing, or "Go" decision, to all yields encountered during the observation period. P(Crossable Gap) = probability of a crossable gap, defined as the ratio of the number of time-based vehicle gaps that exceeded the crossable-gap time to all gaps encountered during the trials. The crossable-gap size is calculated by dividing the crossing distance by an assumed crossing speed of 3.5 ft/s and adding a 2-s safety buffer. P(GO|Crossable Gap) = probability of "Go" given a crossable gap, defined as the ratio of crossable gaps that resulted in a "Go" decision to all crossable gaps encountered during the observation period. Observed delay = time elapsed from the pedestrian arrival at the crosswalk until the crossing is initiated, in seconds. Delay>Min = delay beyond first opportunity, defined as the difference between the observed delay and the delay assuming the pedestrian had crossed at the first crossing opportunity. P(Risky Crossing) = proportion of actual crossings that are considered risky.	Data at both roundabouts were gathered by the same observers and by applying an identical data collection protocol.	There is higher yielding rates at the PS-RAL roundabout, which may be related to the proximity to a major college campus. Both sites further exhibit a range of yielding percentages. For participants at PS-RAL, the yielding rate varied from 9.4% to 70% (mean 37.2%) with a smaller range evident at DAV-CLT (0% to 33.3%, mean 11.3%). A lower overall yield utilization rate is evident at DAV-CLT (67.4%) than at PS-RAL (85.4%). Both sites suggest a slightly higher yield utilization rate at the exit leg. By combining yielding and yield utilization rates, it can be stated that the PS-RAL site exhibits a higher likelihood of crossing in a yield than DAV-CLT. The minimum crossable gaps for DAV-CLT and PS-RAL are approximately 7.0 and 6.0 s, respectively. To allow for a direct comparison across sites, the results for PS-RAL are shown for minimum gap thresholds of 6.0 as well as 7.0 s. DAV.CLT (61.5%) has a slightly higher overall rate of gaps greater than the crossable gap than PS-RAL does (51.8% for the 6-s gap). The difference in gap availability is of course greater if the threshold for "crossable" is increased to 7.0 s at PS-RAL. There are gap utilization rates for DAV-CLT of approximately 60%. At PS-RAL the gap utilization rate is higher for the exit leg than the entry leg with 63.6% and 52% utilization, respectively. When the crossable-gap definition is increased to 7.0 s, the utilization rate increases, as expected. Observed delay experienced by the blind pedestrians reveals significantly lower delays at PS-RAL. The lower delay is likely attributable to greater P(Yield) and greater P(GO|Yield) at this site. Pedestrians at PS-RAL experienced less "unnecessary delay" compared with DAV-CLT. The intervention rates at PS-RAL are clearly higher than those at DAV-CLT, especially the exit-lane crossing, which is risky at an intervention rate of 5.8%. However, with repeated crossings, even the 1.0% intervention rate at DAV-CLT could result in a high likelihood of a risky decision over time.	A crisp definition of accessibility for single-lane roundabouts remains elusive, and more data at varying geometries and volume levels are needed before final conclusions can be drawn. Although the analysis framework represents a tool to quantify crossing performance, it is recognized here that it will not be usable directly by the U.S. Access Board or engineering agencies, since it does not be crosswalk usability to specific geometric configurations or traffic conditions. In other words, crosswalk usability is not defined in terms of metrics that are available to agencies faced with making decisions about roundabout construction or about pedestrian treatments to be installed at roundabouts.	With more frequent occurrence of yields and similar crossable-gap frequency, the PS-RAL site appears to be more accessible than DAV-CLT. Especially in light of similar yield and gap utilization statistics, it appears as if a crossing is more likely at PS-RAL. From a safety perspective, these estimates suggest that the PS-RAL site is riskier to cross and thus less accessible from that perspective. The overall observed intervention rate of 6% was a clear indication of the risky nature of the studied two-lane roundabout crossing. It is unclear what factors contribute to the higher rate of interventions, but it is likely a combination of background noise, auditory confusion, travel skills, and ultimately higher traffic volumes. The analysis showed that one site is more usable from a delay perspective, whereas the other is more usable because of safety. It can be argued that personal safety outweighs delay, especially if actual crossings are infrequent. At the same time, there is some limit to how much delay is acceptable even if a crossing is attempted only rarely.	32
See also "Descriptive/ Comprehensive"	**Duncan-Jones**, B. (2001). Modern road crossing designs and visually impaired people. *Municipal Engineer.* 145 (2): 185-													

TYPE OF INFRASTRUCTURES	REFERENCE	ORIGIN/CITY	TARGETED INDIVIDUALS	AIM / OBJECTIVES / HYPOTHESES	JUSTIFICATION	PARTICIPANTS	METHODOLOGY / SET UP	RESEARCH TOOLS	VARIABLES / INDICATORS STUDIED	ANALYSIS / INTERPRETATION	RESULTS	STATED LIMITS	CONCLUSION (THE BEST INFRASTRUCTURE/PRACTICE)	QUALITY
	190.													
See also "Descriptive Comprehensive"	**Laakso**, M., Sarjakoski, T., & Sarjakoski, L. T. (2011). Improving accessibility information in pedestrian maps and databases. *Cartographica* . 46(2), 101-108.													
See also "Descriptive Comprehensive"	**Nodin**, Y. (2006). Faciliter la ville aux personnes à mobilité réduite. *Le Moniteur*. 16 juin 2006: 62-64.													
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Se also "Sidewalk"	**Stahl**, A., Newman, E., Dahlin-Ivanoff, S., Almén, M, & Iwarsson, S. (2010) Detection or warning surfaces in pedestrian environment: the importance for blind people of kerbs, depth and structure of tactile surface. *Disability and Rehabilitation*.32 (6): 469-482.													
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See also "Street-Comprehensive"	**Walker**, J.M., Horton, S.A., Wright, J.M., Chan, S.W., & Conway, L.R. (1987). Walking velocities of older pedestrians at controlled crossings. *Topics in Geriatric Rehabilitation*. 3(1), 65-70.													