Application of PERS to Evaluate Walkability in State of Qatar

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Abstract

Well-designed pedestrian facilities are essential to promote walking among residents. These facilities also act as safe space for use of cycling and other personal mobility vehicles. In 2018, Ministry of Transport developed a system to assess the pedestrian environment, called Pedestrian Environment Review System (PERS). The PERS system is intended to assess, in a consistent systematic way, the quality of the pedestrian environment. This paper applies the guidelines of this manual to assess the walkability in Doha City. A total of ten links and ten crossings were included in this study. On-street evaluation was completed for each selected element and relevant scores for each parameter was assigned. The links assessment demonstrated that, overall, there were some issues highlighted by the PERS Audit in the studied areas such as poor curb ramp design, placement of obstruction on the pavement, lack of tactile information, conflict between pedestrian and vehicles at side-entry intersections, unavailability of wayfinding materials, etc. The overall pedestrian environment in the wider area assessed was generally positive, adequately maintained and of an appropriate quality. The provision of poor-quality crossings was identified as a negative feature of the studied areas. The issues were related to the infrastructure itself. Recommendations are made based on findings to improve the walkability of pedestrian network in State of Qatar.

Keywords: PERS; Qatar; Walkability; Crossing; Road facilities

1 Introduction

Walking is an essential element of a conventional traffic system for communities. The walkability of road facilities captures the attention of transportation professionals in urban planning. Walking is widely recognised for its health promotion of individuals in terms of reducing chronic diseases and decreasing traffic congestions (Makhlouf et al., 2023). One of the key elements to stimulate the activity of walking is to provide walkable built environment. Specialists and scholars have studied the relationship between the walking environment and the prevalence of the walking activity in communities (LIANG et al., 2022). Several methods have been established to evaluate the walkability of street facilities such as Geographic Information System (GIS), surveys, deep learning, simulations and analysing data records (Li et al., 2023).

State of Qatar has introduced new system, known as Pedestrian Environment Review System (PERS), for assessing pedestrian facilities across the street network. This study was undertaken to determine the status of existing facilities by applying this new assessment system. This study describes detailed findings of the field audit conducted on ten links and ten crossings in Doha City. This audit was

undertaken as a part of the 2nd National Action Plan 2018–2022, Action No. 260: Analyzing local pedestrian behavior to update the guidelines of the design and control of pedestrian facilities. A link is defined as an infrastructure that connects two intersections. While crossings are the segments that allow pedestrian to pass/cross a road section. The audit allows for the identification and assessment of problems related to pedestrians in street facilities that lead to prioritizing resources allocation for rehabilitation efficiently and effectively. This audit was carried out in compliance with the Pedestrian Environment Review System developed by the Ministry of Transport and Communications guidelines (MOTC, 2018). The PERS Audit relies on a consistent systematic way to assess the quality of the pedestrian environment.

2 Methodology

PERS audit comprises of three main stages. First is the selection of study locations that is links and crossings. Second is the assessment based on predefined criterion. Finally, third stage is reporting the findings and presenting them for decision making and records.

2.1 Stage 1: Identification of Links and Crossings

The links and crossings were chosen in different zones/municipalities such as Al Markhiya, Al Gharaffa, Al Najma, etc. to assure the diversification of the locations with different built environments. The variation of suburb types was considered in which some locations were in residential, commercial, industrial, and diplomatic land uses. Moreover, these areas were free of roadworks to ensure a valid audit. The links that were selected for the assessment are summarised in Table 1 below. Furthermore, the identified crossings are shown in Figure 1.

Table 1: Links Name and Location

Link No.	Link Name	Location
1	Al Jassasiya St.	25.331308, 51.493410 to 25.331336, 51.485633
2	Bu Silla St.	25.345254, 51.446185 to 25.342906, 51.439620
3	Najma St.	25.239566, 51.547007 to 25.244890, 51.542866
4	Al Mansoura St.	25.270430, 51.543155 to 25.269530, 51.536206
5	Al Waab St.	25.255587, 51.440250 to 25.252200, 51.431266
6	Diplomatic St.	25.326298, 51.529497 to 25.330548, 51.529540
7	Marbella St.	25.367013, 51.549213 to 25.366615, 51.552624
8	Al Kahraba St.	25.288319, 51.525248 to 25.285469, 51.524755
9	Al Difaaf St.	25.282472, 51.502765 to 25.282427, 51.500949
10	Urwa bin Masoud St	25.305333, 51.485285 to 25.305328, 51.483689

ID	Legend	Intersection Name
1		Porto Arabia St. / Marbella St.
2		Diplomatic St. / Conference Centre St.
3		Al Mansoura St. / Al Khalidiya St.
4		Baaya I/C
5		Oqba Bin Nafie St. / Najma St.
6		Al Kahraba St. / Al Khail St.
7		Onaiza St. / Al Shabab St.
8		Najma I/C
9		Museum of Islamic Art I/C
10		Khalifa St. / Madinat Khalifa St

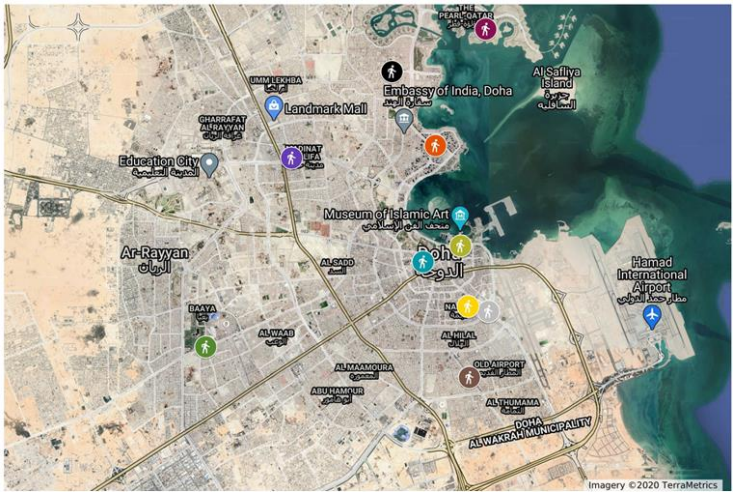

Fig. 1: Location Map of Crossings

2.2 Stage 2: On-street Evaluation

Once the abovementioned step has been completed, the on-street evaluation took place in late December 2020. For each review framework, manual entry of records through visual evaluation is reported in a review form on site. Each framework consists of several parameters where reviewer scores and comments on each parameter for each link and crossing. Each parameter is scored in a scale with a range from -3 to +3, where +3 represents the highest score and -3 represents the lowest. A parameter with a score of +3 reflects an excellent practice. Whereas 0 is an average score of the best and worst practices. While N is used when the parameter is considered irrelevant. The score reflects the level of service to the user ascribed by comments made to support each score and highlight key issues. The score is assigned based on the checklist factors identified for each parameter. The evaluation parameters for links and crossings are shown in Table 2.

Table 2: Links and Crossings Audit Parameters

Link Audit Parameters	Crossing Audit Parameters
Effective width	Crossing provision
Curb ramps / Dropped Kerbs	Deviation from desire line
Gradient	Performance
Obstructions	Crossing Capacity
Permeability	Delay
Legibility	Legibility
Lighting	Legibility for sensory impaired people
Tactile Information	Curb ramps / Dropped Kerbs
Colour contrast	Gradient
Personal security	Obstructions
Surface quality	Surface quality
User conflict	Maintenance
Quality of environment	-
Maintenance	-

A sample of assessment for link and crossing assessment form is included in Appendix A. The summary of link and crossing assessment for each site is provided in Appendix B.

3 Findings from Field Audit

3.1 Links

The effective width of the links, presence of obstructions, and road gradient are parameters used to rate the walkability of links. Most of the links had a sufficient effective width with obstructions in some cases, nevertheless. For example, lighting columns were installed in the middle of the sidewalk, which may cause issues for handicap users with wheelchairs. Some links perform very well in terms of effective width such as Al Kahraba St. in Msheireb Downtown Doha. Furthermore, most of the links scored 0 in gradient parameter since Qatar's land is almost flat. The presence of curb ramps at side-entries and intersections was considered in the evaluation for providing accessibility. Links are are classified into two categories, with curb ramps and without curb ramps. Links without curb ramps were also divided into two types, either complete absence of curb ramps or presence of speed humps instead of compensating the function of curb ramps while crossings in some cases. For links with curb ramps, some curb ramps were meeting the design requirements, while others did not meet the minimum requirements. Another accessibility parameter that was considered is the presence of tactile information for people suffering from visual impairment. All links lack tactile information except for

Al Kahraba St. in Msheireb Downtown Doha due to the recent development of these areas. Traffic volume/speed and pedestrian fences are factors used to rate the permeability parameter. Half of the links scores well in the permeability criteria due to the observed low traffic volume/speed without pedestrian barriers along the median. While other links perform poorly due to the parked vehicles along the links, wide links with high vehicle speeds, and/or high traffic volumes. User conflict is a parameter used to check if there is an adequate space provision for each road user. There is a conflict between pedestrians and vehicles at side-entry intersections and between pedestrians and cyclists on the sidewalk in most of the links, except for some parts of Al Waab, Najma, and Al Kahraba streets as there is a separation between different users eliminating conflicting movements. .

Legibility can be defined as the clearness of wayfinding instructions reflected by signage, information boards, markings, etc. It was found that some links suffer from poor legibility due to lack of information, improper placement of signs, and/or absence of landmarks. Whereas several links showed convenient wayfinding features that assist pedestrians/walkers in their journey. Additionally, two problems in some links presented with regards to lighting, poor old yellow lights and absence of lights on the sides of the roads. This may affect the visual contrast of the pedestrian during the journey. All these factors play a major role in the personal security of the pedestrian. Furthermore, several links had CCTV units and security guards as well as appearing aesthetically. All these factors contribute to the personal safety and security.

The built environment quality of walking facilities varied from one link to another in this study. Multiple locations exhibited issues such as surface defect and/or wet surface associated with dirty presence of garbage. Moreover, another major problem was found that some walking facilities were left without paving. It was apparent from the visual evaluation that inadequate maintenance was done to some links. On the other hand, some links appeared to have perfect surface and environment quality condition. Consequently, it is clear from the abovementioned discussion that there are roads of high quality, medium quality, and others of poor quality.

3.2 Crossings

The crossings evaluation followed similar procedure that was used for assessment of the links.. The crossing provision refers to the suitable planning of crossings facilities of the pedestrian. This depends on many factors including location, pedestrian volume, road type, traffic speed, and pedestrian type. Crossing provision, deviation from desire line, performance, and crossing capacity determines the functional performance level of the crossing facility in terms of walkability. Most crossings appeared with high quality, serving pedestrians' desire lines, along with having adequate capacity and width at peak hours. These crossings manifested good visibility for pedestrians. However, some flaws were visible in some crossings. For instance, absence of a crossing facility, absence of refuge island, inadequate waiting area were found in some locations. These defect may cause difficulties to the pedestrian while crossing as well as impacting the personal comfort of the individual. In terms of delay, most of the crossings allows adequate time for pedestrians to cross. Nevertheless, the waiting time at some crossings was relatively long unlike the waiting time at crossings at Msheireb and the Pearl areas. Additionally, it was observed that there is a pedestrian phase in Msheireb that allows pedestrians on the four sides of the roads to cross during the complete stop of vehicles due to the red light. In the Pearl, there was no delay since the red light immediately flashes after pressing the push button of crossing.

Crossing legibility evaluation was done based on different conditions from the legibility of links. Legibility parameter for crossings encompasses the clearance of crossing markings, illumination of

the crossing area. It was found that some crossings suffer from poor legibility due to the low quality of lightning or markings or absence of crossing markings. Whereas several crossings showed well-lit crossings and clear crossing markings. Only one crossing had very good legibility for sensory impaired users due to the available audible information and tactile warnings provided. Another parameter to check the accessibility of the pedestrians is presence of curb ramps for people suffering from movement impairment. Most crossings have well-designed curb ramps. Though, few crossings did not have curb ramps or have curb ramps that may cause difficulties for handicap users with wheelchair due to its size and/or gradient. The built environment quality of crossing facilities varied from one crossing to another in this study. The crossings appeared to have perfect surface and environment quality condition overall. However, it was noted during the audit that the surfacing of the crossings contains cracks and poor reinstatements in some places which could cause a potential trip hazards to pedestrians. Multiple locations exhibited issues such as high mast light poles and traffic signal poles reducing the effective width of the crossings and obstructing pedestrians' movement. Moreover, another major problem was found that some push buttons at crossing facilities were not working. This indicates that adequate maintenance was needed at some crossings.

4 Conclusion

A total of 20 locations, with 10 links and 10 crossings, were evaluated. The links assessment demonstrates that overall, there were some significant issues highlighted by the PERS audit in the studied areas such as poor curb ramp design, placement of obstructing objects on the pavement, lack of tactile information, clear conflict between pedestrian and vehicles at side-entry intersections, and unavailability of wayfinding materials. The overall pedestrian environment was generally positive, adequately maintained and of an appropriate quality. Poor-quality crossings were identified in multiple locations of the studied areas. Most of the issues were related to the infrastructure of the crossings. For example, lack of audible information, tactile information, count down signals, rotating cones, insufficient crossing time for elderly pedestrian, inconsistency of curb ramp design, placement of permanent obstructions on the refuge islands, and the deficiency of push buttons.

Based on the results of the PERS audit, the following recommendations can be made:

- Removal/relocation of obstructions that reduces pedestrian space.
- Improve existing curb ramps at side roads to be flushed and aligned.
- Installing correct new curb ramps and tactile paving.
- Provide wayfinding materials such as finger posts or maps.
- Placement of crossings at signal junctions.
- Installing new traffic signals with adequate facilities such as push button, audible information, countdown, and rotating cones to facilitate normal and sensory impaired pedestrians' movement.
- Increase the pedestrian phase to provide sufficient time for elderly and mobility impaired pedestrians to cross safely.
- Installing pedestrian signs at a suitable distance before the crossing points.

It should be noted that the PERS is an advanced system, expecting very high standards of walkability infrastructure. The newly developed suburbs have higher scores while older suburbs have lower scores. Hence, significant improvements are expected to achieve these standards for the entire network of Doha City.

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Appendix A

3:30 9/7/2020

PERS [Software]

Link Assesment Form **Page 1 of 3**

Link Name: Al Jassasiya St.

Location: 25.381308, 51.493410 to 25.381336, 51.485633

Reviewers: M. E.

Parameter	Checklist Factors	Checklist +	Checklist +-	Checklist -	Score "-3 to +"	Comment Section	Comment Section
1.9 m 2.1 m Effective Width >5m	Width for pedestrian flow	✓			-1	• Some section are bigger than 5m	
	Wheelchair accessibility	✓					
	All sections acceptable width	✓					
	Separation from traffic	✓					
	Allowance for obstructions	✓					
	Pedestrian congestion			✓			
Dropped kerbs	Located on desire lines		✓		-3	Curb ramps are not provided but there are raised crossings at every side-entry intersection	
	Adequate capacity		✓				
	Level dropped/flush		✓				
	Gradient of drop		✓				
	Consistency		✓				
	Frequency of dropped kerbs		✓				
Gradient	Severity		✓		✓		
	Steps/ramps		✓				
	Rest points		✓				
	Undulations		✓				
	Appropriate handrails		✓				
	Presence of crossfalls		✓				
Obstrctions	Presence of obstructions	✓			0	lamp posts in middle of sidewalk	
	Location/alignment	✓					
	Overhead obstructions			✓			
	Tapering or transparent obstructions		✓				
	Tactile warnings			✓			
	Sight line reduction			✓			
Permeability	Frequency of crossing points			✓	+2		
	Parked cars/physical barriers			✓			
	Traffic flow			✓			
	Dropped kerbs			✓			
	Pedestrian barriers			✓			
	Sightlines	✓					
Legibility	Signage provision	✓			-1		
	Signage clarity	✓					
	Information boards			✓			
	Distances given on signs			✓			
	Sightlines	✓					
	Built form aids navigation			✓			

Link Assesment Form Page 2 of 3

Parameter	Checklist Factors	+	+-	-	Score "-3 to +	Comment Section	Comment Section
Lighting	Intensity/frequency	/			+3	but the light colour is yellow and it would be better if it is white	
	Definition/colour			/			
	Maintenance	/					
	Context suitability	/					
	After-Dark	/					
	Obstructions	/					
Tactile information	Evident		/		-3		
	Consistent/correct		/				
	Maintained		/				
	Appropriate Colour		/				
	Interruptions		/				
	Tapping Line		/				
Colour Contrast	Tonal contrast		/		/		
	Location		/				
	Assists navigation		/				
	Enhanced visibility of obstructions		/				
	Space identification		/				
	Made to specification		/				
Personal Security	Perceived/ sense of crime			/	+1		
	Activity on the street	/					
	Lighting	/					
	Police presence			/			
	CCTV			/			
	Visual appeal			/			
Surface Quality	Smoothness/trip hazards	/			0	one section only	has issues with Maintenance
	Surface friction	/					
	Slippery surfaces			/			
	UKPMS CVI hierarchy		/				
	Maintenance			/			
	Context suitability	/					
User Conflict	Conflicting movements			/	0	There is conflict at side-entry intersections and also with cyclists	
	User flows	/					
	Encroachment on pedestrian space	/					
	Segregation from cyclists		/				
	Bus queues an obstruction		/				
	Adequate space provision	/					
Quality of environment	Traffic/ noise			/	+2	no seating + no landscaping + low traffic volumes no noise	
	Aesthetics			/			
	Soft landscaping			/			
	Quality of materials	/					
	Quality of private frontages	/					
	Sense of place		/				

Link Assesment Form

Maintenance	Cleanliness		✓	+2		
	Drainage		✓			
	Evidence of neglect		✓			
	Seasonal foliage		✓			
	Graffiti		✓			
	Landscaping		✓			
	Durability of materials		✓			

Comments:

* There are some defect sections with poor Quality and others with poor ——— effective width
* Lighting columns are at the middle of the sidewalk at some sections
* there is a big vertical curve

Quick Wins (Maintence Recommendations)

	Enhanced street cleaning along the link	✓	A board and goods on footway enforcement to reduce obstructions
	Remove litter and gum stains from the link		Enforce parking restrictions on footways
	Remove graffiti from infrastructure along the link		Remove redundant signage poles / lighting columns
	Remove fly-tipped refuse from link		Clear foliage and overhanging branches on footways and paths
	Clean lights and mirrors in subway	**Dropped kerbs and tactile paving**	
	Clear blocked drains/gutters to reduce ponding		Improve existing dropped kerbs at side roads to be flush & aligned
	Repair/replace broken fencing along the link		Install new dropped kerbs that are flush and aligned
	Repair malfunctioning street/subway lighting		Improve existing tactile paving at side roads - correct colour and layout
Surface Quality		✓	Install new tactile paving at side roads - correct colour and layout
✓	Resurface footway along sections with		Install new corduroy tactile paving at steps
✓	Resurface footway along sections with trip hazards		
	Install bound resin in small tree pits		

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PERS [Software]

Crossing Assesment Form **Page 1 of 3**

Crossing Name: Al Kahraba St. / Al Khail St.

Location: 25.285469, 51.524755

Reviewers: M.E

Parameter	Checklist Factors	Checklist +	Checklist +-	Checklist -	Score "-3 to +3"	Comment Section	Comment Section
Crossing Provision	Type suitable for context	✓			+3		
	Suitable for pedestrian type	✓					
	Suitable for pedestrian volume	✓					
	Suitable for type of road	✓					
	Traffic speeds			✓			
	Traffic volumes			✓			
Deviation from the desire line	Deviations			✓	+2		
	Serve likely desire lines	✓					
	At grade/ by level change			✓			
	Pedestrian priority	✓					
	Distance minimisation	✓					
	Barriers causing deviation			✓			
Performance	Crossing operational	✓			+3	* the time is enough for normal and relatively fast pedestrians * the location, visibilty, and quality of crossing markings is good * traffic volume is low	
	Safety/protection of pedestrians	✓					
	Vehicle behaviour	✓					
	Traffic control measures			✓			
	Space ownership		✓				
	Obstruction to sight lines			✓			
2- Crossing Capacity	Minimum dimension standards met	✓			+3	*waiting area and refuge island are provided sufficiently	
	Peak hour performance		✓				
	Pedestrian flows coped with		✓				
	Waiting areas/ widths	✓					
	Refuge capacity	✓					
	Width for wheelchair users	✓					
Delay	Crossing stages			✓	+3	When the button is pressed, all the four traffic lights will become red	
	Effect of crossing type		✓				
	Traffic flow	✓					
	Pedestrian phase	✓					
	Waiting time			✓			
	Crossing time	✓					
Legibility	Surface Type continuity	✓			+2	* Clearly marked crossing. * surface quality is good * well lit	
	Obvious where to cross	✓					
	Driver stop line in place	✓					
	Delineation for pedestrians	✓					
	Positioning of infrastructure	✓					
	Lighting	✓					

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Crossing Assesment Form

Parameter	Checklist Factors	Checklist +	Checklist +–	Checklist –	Score "-3 to +3"	Comment Section	Comment Section
Legibility for sensory impaired people	Button position	✓			+3	*all Buttons are working * The only signal with audible information * there is tactile information.	
	Audible information	✓					
	Rotating cones			✓			
	Tactile Information provided/intact	✓					
	Appropriate Tactile information	✓					
	Colour contrast		✓				
Dropped kerbs	Suitable locations	✓			+3		
	Capacity	✓					
	Level dropped/flush	✓					
	Gradient of drop		✓				
	Provision	✓					
	Profile	✓					
Gradient	Crossing at grade		✓		/		
	Crossfall evident		✓				
	Impedience to access		✓				
	Camber		✓				
	Severity of gradient on approach		✓				
	Severity of gradient on exit		✓				
Obstrctions	Obstructions on approach			✓	+3	* bollards can be considered as obstruction	
	Obstructions on crossing			✓			
	Location/alignment	✓					
	Overhead obstructions			✓			
	Opaque/tapering obstructions			✓			
	Tactile warnings	✓					
	Sight line reduction			✓			
	Permanent obstructions			✓			
Surface quality	Smoothness/trip hazards			✓	+3	overall quality is perfect surface is smooth and consistent	
	Context suitability	✓					
	Consistency	✓					
	Quality of reinstatements		✓				
	Drainage		✓				
	Slippery surfaces			✓			
Maintenance	Cleanliness	✓			+3		
	State of repair		✓				
	Littering			✓			
	Evidence of neglect			✓			
	Impact of seasonal foliage			✓			
	Graffiti/stickers/ chewing gum			✓			
	Evidence of debris			✓			

Crossing Assesment Form	Page 3 of 3

Comments:

Quick Wins (Maintence Recommendations)

	Cleaning and Repairs
	Remove litter and gum stains from the crossing
	Remove graffiti from infrastructure at the crossing
	Clear foliage and overhanging branches at crossing
	Clear blocked drains/gutters to reduce ponding

	Signals
	Repair rotating cone on crossing signals
	Replace control button at crossing signals
	Repair 'wait' illumniation bulb in control box
	Re-align the green man to be visible to pedestrians
	Repaire broken bulbs in the green/red man signal head

	Surface Quality
	Highlight crossing area and markings
	Resurface crossing at sections with ponding
	Resurface crossing on carriageway with trip hazards
	Resurface crossing waiting areas with trip hazards

	Dropped kerbs and tactile paving
	Improve existing dropped kerbs so that they are flushed and aligned
	Install new dropped kerbs that are flush and aligned
	improve existing tactile paving so that it has correct colour and layout
	install new tactile paving with correct colour and layout

Appendix B

Table 3: Scores for Links and Crossings Audit Parameters for Selected Sites

Link Audit Parameters										
	Link 1	**Link 2**	**Link 3**	**Link 4**	**Link 5**	**Link 6**	**Link 7**	**Link 8**	**Link 9**	**Link 10**
Effective width	-1	+1	+3	-3	0	0	-3	+2	0	+2
Dropped Kerbs	-3	-3	+2	-1	-3	+3	-3	-1	-2	-3
Gradient	N	N	N	N	N	N	N	N	N	N
Obstructions	0	+1	+3	-2	-1	-3	0	+2	0	+2
Permeability	+2	+1	-3	-2	-2	+1	-2	+3	+1	+2
Legibility	-1	0	-1	0	-1	-3	0	+3	0	0
Lighting	+3	N	N	N	+2	N	N	N	N	N
Tactile Information	-3	-3	-3	-3	-3	-3	-3	+2	-3	-3
Colour contrast	N	N	N	N	N	N	N	N	N	N
Personal security	+1	+1	+1	-2	+2	+2	+2	+3	+1	-1
Surface quality	0	+2	+3	-1	-1	-1	+3	+3	0	-3
User conflict	0	0	+2	0	0	0	+1	0	+3	-3
Quality of environment	+2	0	+3	-3	-1	0	+3	+3	-1	-1
Maintenance	+2	+2	+3	-1	-3	-1	+3	N	+1	-3
Crossing Audit Parameters										
	Site 1	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**	**Site 8**	**Site 9**	**Site 10**
Crossing provision	+3	+3	0	-1	-1	+3	+2	+3	+3	-3
Deviation from desire line	+3	+3	0	0	+2	+2	+3	+2	+2	+1
Performance	+3	+3	-1	0	+3	+3	+3	+3	+3	-3
Crossing Capacity	+1	-3	0	0	+2	+3	+3	+2	+2	-3
Delay	+3	+1	+2			+3	N	-1	-1	N
Legibility	+3	+2	0	0	+2	+2	+2	+2	+2	-3
Legibility for sensory impaired people	-3	-3	-3	-3	-3	+3	-3	-3	-3	-3
Curb ramps / Dropped Kerbs	+3	+3	-3	-1	+3	+3	+3	+2	+3	-3
Gradient	N	N	N	N	N	N	N	N	N	N
Obstructions	+3	+2	+2	0	+3	+3	+3	+1	+1	-3
Surface quality	+3	+2	+2	-1	+3	+3	+3	+2	+2	-2
Maintenance	+3	+3	-2	-1	+3	+3	+3	+1	+3	-2

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