

**Applying International Best Practice:
Measuring and Improving the Performance
of Pedestrian Environments**

Ms. Ellie Gould, Senior Consultant, TRL

**Paper prepared for presentation
at the Giving the Edge to Pedestrians Session
of the 2011 Annual Conference of the
Transportation Association of Canada
Edmonton, Alberta**

Abstract

TRL, the UK's Transport Research Laboratory, has developed a method for quantifiably measuring the performance of pedestrian facilities. Although guidance exists in terms of the design for new facilities, historically there has been less effort in understanding how existing facilities perform in terms of pedestrian safety, accessibility and comfort.

The method, called PERS, divides pedestrian environments into separate components commonly found in the walking environment:

- Sections of footway
- Crossing points
- Public transit stops
- Interchanges between modes of transport
- Public spaces
- Walking routes.

For each component, a comprehensive set of data is collected and analyzed, based on detailed research undertaken by TRL over the past decade. The method is repeatable, results are comparable and it is used for highlighting individual and systemic performance issues.

Often it is more cost effective for agencies to repair and replace poorly performing elements rather than designing and installing facilities from scratch. The main strength of the PERS method is the ability to understand where investment needs to be targeted, both through the provision of low-cost, quick to remedy recommendations through to the need for longer term upgrades.

Developed with guidance from Transport for London, TRL has used the PERS method to audit over 150 miles of London's streets to date, resulting in measurable improvements for pedestrians across the UK's capital now and in the future, including planning for pedestrians at local, strategic and highly specialized levels.

Understanding that basic non-motorized user requirements are the same the world over, TRL has also undertaken specialized project work across Europe, Australasia and South Africa, with a variety of success stories and lessons learnt which are relevant for agency planners, engineers and active transportation practitioners.

This paper and its contents are Copyright Transport Research Laboratory May 2011. The views expressed are those of the author and not necessarily those of TAC.

Applying International Best Practice: Measuring and Improving the Performance of Pedestrian Environments

Ellie Gould, Senior Consultant, TRL

1. Introduction and Background

Walking is a desirable mode of transportation to encourage amongst many sectors of society around the world. No-one need pay for a walking trip and undertaking regular journeys on foot can improve the health of the individual pedestrian. Wider societal benefits can also be gained from increasing the modal share of this “slow mode”, for example through reducing the effect of traditional negative externalities associated with private motor vehicle use including air and noise pollution, climate change, congestion and accidents. Economic benefits can also be realized. It is necessary to ensure that as many people as possible are encouraged to make local journeys on foot through safe, accessible, inclusive and attractive walking environments.

Although there is much official guidance available to design and install new pedestrian facilities in developed nations around the world, traditionally there has been less emphasis placed on evaluating existing walking environments in a consistent and meaningful manner. With greater pressures being placed on local government budgets and an ever-increasing need to demonstrate value for money, there is a growing paradigm which favors upgrading existing pedestrian facilities.

TRL, the UK’s Transport Research Laboratory, developed an early methodology called PERS (an acronym for the **P**edestrian **E**nvironment **R**eview **S**ystem) for auditing elements of the pedestrian environment in 2001 in collaboration with the London Borough of Bromley. With the support of Transport for London in 2004 and 2009, the approach was expanded, with subsequent continued refinement which has created a mature on-street tool which can be applied to a range of walking environments both in the UK and internationally.

This paper sets out the principles of the PERS methodology, its application and its outputs. A series of mini case studies are also included to showcase how PERS can be used to justify and prioritize walking improvements in different types of pedestrian environments, demonstrating its use as a tool to influence the provision of best practice pedestrian facilities around the world.

2. PERS: The Pedestrian Environment Review System

The development of PERS aimed to provide a framework for considering the design of pedestrian environments, so that consistent and accurate judgments could be made whilst also trying to rate typically hard to quantify problems like perceptions. The tool was developed to promote the consideration of pedestrians in the street environment as well as ensuring that policy making and investment can be based on evidence and is highly defensible. It also allows the performance of different areas to be compared and contrasted.

PERS is a holistic method used to identify deficiencies primarily in existing pedestrian environments, although it has the flexibility to be used as a tool during the design process. It consists of an on-street objective and quantitative assessment of various components of the street environment, broken down into six types of review:

- **Link review**
 - Sections of footway
 - Subways
 - Footbridges
- **Crossing review**
 - Signalized and unsignalized
 - Informal desire lines where the desire to cross in a particular location has not been met with formal infrastructure
- **Public transit waiting area review**
 - Bus stops
 - Tram stops
 - Taxi stand
- **Interchange Space review**
 - Spaces between different modes of public transport
 - E.g. rail station to adjacent bus terminal
- **Public Space review**
 - Parks
 - Plazas
 - Squares
 - Any other space used by pedestrians, whether formally provided or informally used
- **Walking route review**
 - Between an origin and destination
 - Usually between key trip attractors
 - E.g. railway station to town centre

Each of the six components listed above are divided into parameters that examine both the type and quality of the provided infrastructure as well as pedestrian behaviors and interactions observed during the assessment. Critically, this allows an assessment to be made in multiple dimensions.

In the example of a theoretical signalized crossing, the quality of the infrastructure itself may be suitable (well maintained, highly legible and well respected by motorists) but it may be considered inappropriate for the context of the junction (low operational speeds, low vehicular flows and with lengthy waits for the pedestrian phase, leading to pedestrians crossing the road without priority).

The parameters used within each component assessment are shown in Figure 1.

Figure 1: PERS Review Parameters by Component Type

Link	Crossing	Public Transit Waiting Area
Effective width	Crossing provision	Information to the waiting area
Dropped kerbs	Deviation from desire line	Infrastructure to the waiting area
Gradient	Performance	Boarding public transit
Obstructions	Capacity	Information at the waiting area
Permeability	Delay	Safety perceptions
Legibility	Legibility	Security measures
Lighting	Legibility for sensory impaired people	Lighting
Tactile information	Dropped kerbs	Quality of the environment
Colour contrast	Gradient	Maintenance and cleanliness
Personal security	Obstructions	Waiting area comfort
Surface quality	Surface quality	
User conflict	Maintenance	
Quality of the environment		
Maintenance		

Interchange Space	Public Space	Walking Route
Moving between modes	Moving in the space	Directness
Identifying where to go	Interpreting the space	Permeability
Personal safety	Personal safety	Road safety
Feeling comfortable	Feeling comfortable	Personal security
Quality of the environment	Sense of place	Legibility
Maintenance	Opportunity for activity	Rest points
		Quality of the environment

A trained PERS assessor will spend some time at each component before commencing the assessment so that adequate consideration can be given to typical pedestrian flows, behaviors and generally observe the context within which the component sits.

Once the formal audit is underway, the assessor will give each parameter a score on a 7 point scale (a whole score between -3 and +3) and will make a comment which justifies the score that has been given, including detailed commentary. In the case of a Link review, therefore, 14 scores will be collected, whereas 6 scores will be collected for the Interchange Space review.

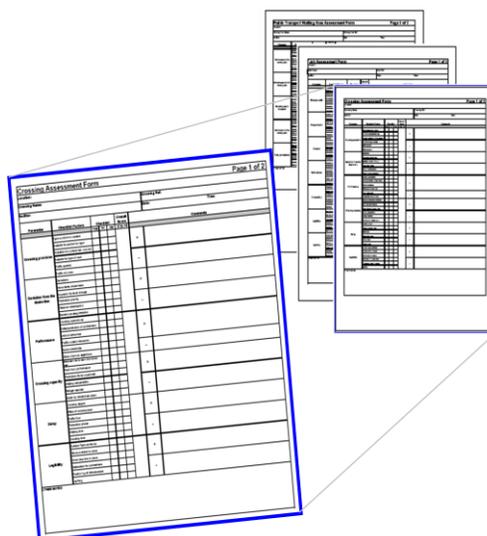
Figure 2: A PERS audit in progress



For each parameter shown above, there is a standard control sheet which is taken on site. A typical sheet is shown in Figure 3 and one sheet is completed per assessment. The sheet is partly comprised of a series of checks per parameter an auditor should make whilst developing an assessment. This helps with inter-auditor reliability and aims to ensure that all assessors (regardless of their formal job role) will fully consider the necessary points to make an assessment. For example, an engineer may have a natural tendency to focus only on the infrastructure elements, whereas the aim of a PERS audit is to provide a more holistic assessment and demands an appreciation of the qualitative aspects of good street design.

General and detailed photographs are also taken by auditors and comprise a valuable part of the overall data collected on site. Past experience has shown the value of investing in a camera with geo-referencing technology.

Figure 3: On-street Assessment Sheets



All pedestrians, regardless of age and ability, require streets to be:

- Accessible;
- Permeable, and easy to move around;
- Easy to navigate and interpret;
- Safe from traffic and crime; and
- Clean and attractive to use.

Taking all these attributes into consideration, the environment is reviewed from the perspective of a vulnerable street user. This can include pedestrians who are less able to negotiate typical features of street environments, children who are less able to judge speed and distances accurately as well as pedestrians who may have temporary influences such as luggage or a stroller. We can also consider someone unfamiliar in a particular environment (e.g. a tourist) vulnerable, as they can benefit from additional assistance in terms of environmental legibility and wayfinding aids.

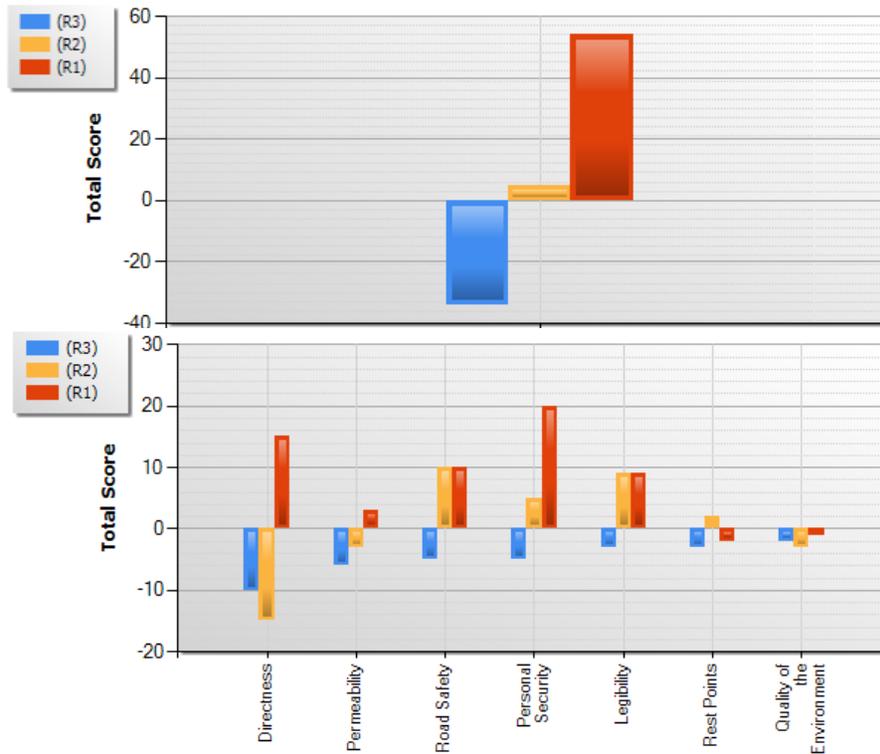
Once the on-street audit has been completed, entailing as few or as many individual assessments as necessary, the data collected by auditors is entered into the PERS software, which is incorporated as one module within the streetaudit product.

Figure 4: Splash Screen of streetaudit software, containing the PERS module



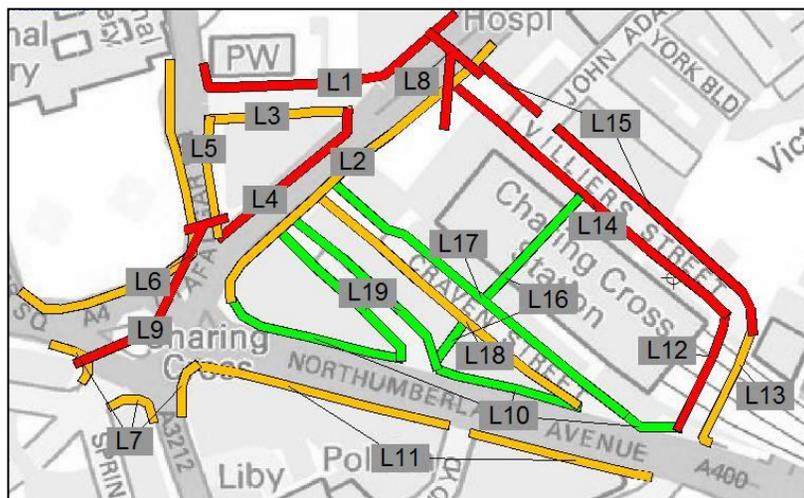
The software allows the data to be sorted, analyzed and output as graphs, tables and mapped components. The software uses RAG (Red, Amber and Green) ratings to show visual indications of performance, both in terms of individual parameters and total scores awarded to components. Examples of graph exports are shown in Figure 5, both showing total score results and parameter score results.

Figure 5: Example Graphical Outputs showing Total Score (upper) and Parameter Score (lower) graph results for three Routes



The software package incorporates GIS (Geographical Information Systems) capability allowing users to upload any number of background layers such as topographic features, cartographic text, building lines and any other layers which may allow users to draw the location of audited components accurately and add an additional angle to the analysis. The program also enables the user to export GIS compatible layers of PERS results which can then be opened in MapInfo, ArcGIS or similar software programs.

Figure 6: Mapping Module within PERS software (showing RAG ratings)



This enables many authorities to share valuable walking quality data across teams, including those without the PERS software. For Transport for London, this means that PERS data can be incorporated within existing datasets and can be shared with colleagues in other teams which might overlap with providing for pedestrians, such as accessibility or planning teams.

More generally, GIS programs enable very powerful data layering and visualization to take place. PERS data can be therefore be exported and compared with data layers including crime statistics, location of pedestrian collisions and land use maps.

The software includes numerical factors which aim to provide relative weightings between parameters to reflect the relative importance of parameters. These weightings were devised based on comprehensive literature reviews which sought to detail the critical elements of making safe, accessible and attractive streets. Having a weighting system also ensures that a score of +2 is not automatically counteracted by a score of -2, as this would not enable a meaningful total score to be developed.

The default weightings which are automatically applied to a dataset can easily be changed to reflect the strategic policy making of a particular municipality or to reflect local conditions, although changes to weightings should be made with care.

3. From Operational Performance to the Development of Recommendations

Once the PERS audit has taken place, weightings have been applied to raw scores collected on-street and analysis has taken place, the PERS user should be able to identify the worst scoring components and systemic deficiencies occurring in the audit area (highlighted by consistent poor performance on a parameter level basis).

Understanding what best to do with this information is key to improving pedestrian environments, particularly where budgets do not allow for all improvements to be made and a commitment has already been made to collect the data. Often, small improvements which are relatively low cost and quick to implement can have a significant effect on the perceptions of pedestrians. For example, this can include cleaning litter from public spaces, removing graffiti from transit waiting areas or replacing bulbs to lamp columns. It would also cover putting in dropped curbs and tactile paving, either as repairs or as a complete installation. None of these measures require detailed planning procedures to be followed, can be carried out by a maintenance contractor with relative ease and can dramatically improve how pedestrians feel in the environment.

For these reasons, we term these improvements “quick win” recommendations.

The refinement to the PERS methodology which was carried out in 2009 included developing a standard list of quick win recommendations which could be applied to each component type.

These recommendations fall into two categories- physical improvements and environmental upgrades – and have previously comprised around three quarters of all recommendations made following London PERS audits. Whilst on-site, auditors can choose the quick-win recommendations which would benefit the walking environment, take a photograph of the problem requiring solution and would capture the location of this recommendation either through handheld GPS units or through a GPS-enabled camera as previously detailed. This particularly assists where multiple instances of the same problem (e.g. on one link) require remedy.

Once returning to the office, the software can be structured so that quick win recommendations can be logged, exact co-ordinates registered and a photograph of the problem uploaded. This is so that a work-list of maintenance (quick win) recommendations can be exported to Microsoft Office applications (e.g. Excel), with automatic population of input data, as seen in Figure 7. The work list includes prompts for authorization and sign-off, and fields are customizable.

Figure 7: Work list report detailing “quick win” recommendations

Pedestrian improvements Work List (PERS3)									
Specific Maintenance Recommendations									
Survey Site Name	Unique Facility ID	Type of facility	Date	Time	Facility location	Recommendation	Geographic co-ordinates (OSGB36)	Photograph of problem	Rec Type
2012 Excel	L6	Link	16/07/2009	10:25	Western side of Silvertown Way	Remove redundant signage poles / lighting columns	Easting: 539583.3 Northing: 181217.8		Physical
2012 Excel	L6	Link	16/07/2009	10:25	Western side of Silvertown Way	Install new tactile paving at side/access roads - correct colour and layout	Easting: 539555.8 Northing: 181276.5		Physical
2012 Excel	L7	Link	16/07/2009	09:45	Eastern side of Silvertown Way - Wouldham Rd	Remove graffiti from infrastructure along the link	Easting: 539602.2 Northing: 181201.5		Environmental

For problems which require the development of a longer term solution, often there is a need to engage a whole multi-disciplinary team to ensure that proposed solutions are fit for purpose.

4. Application of PERS for London

TRL have undertaken several phases of PERS audits for Transport for London, and have covered over 30% of Transport for London’s Road Network (TLRN). This equates to around 150 miles of audits across a variety of distinctive areas which London has to offer including local town centers, arterial roadways, residential areas and around tourist attractions.

Many of the PERS audits have been used to develop a business case for public realm improvements. The following mini case examples show a variety of PERS applications and its flexibility as a tool.

Local PERS audit case study: Blackfriars Road

Blackfriars Road is an arterial roadway in central London. Included in the area is access to an underground station, Transport for London's headquarter offices and tourists accessing local attractions including London's South Bank and River Thames.

A full PERS study was conducted, collecting data for each component and each parameter within any given component. In brief, the PERS study identified:

- Blackfriars Road is a traffic dominated environment with poor permeability
- Many obstructions on footways reduce the effective width
- Poor quality footway surfaces create trip hazards
- Many crossings over Blackfriars Road lack signals, correctly dropped curbs and tactile paving
- Dangerous informal crossing movements by pedestrians are common
- Pedestrians are often delayed by barriers and signals
- There is a need for improved lighting at some waiting areas



Figure 8: photographs taken during audit

Figure 8 shows two photographs collected on site which illustrate commonly observed problems, including a crossing point lacking dropped curbs and tactile paving to one side, and a transit waiting area which has been poorly lit despite its location under a dark bridge.

The next photographs show images taken in 2009 during a local PERS audit in Willesden, north London. The accompanying report delivered higher and lower cost alternative solutions to resolve the problems found during the audit, alongside a priority rating for implementation. Also included are photographs taken the following year, after selected schemes had been installed.

Figure 9 shows a very long zebra crossing with a central refuge to separate the crossing into two stages, although the location of the refuge was not at the midpoint of the crossing. The turning circle at the crossing allowed vehicles to turn into the intersecting roadway at high speed, thus exposing pedestrians to risk particularly on the longer stage of the crossing. The legibility of the crossing had also faded over time, and bollards had suffered from vehicular strikes.

Figure 9: Crossing point audited in 2009



Figure 10 shows the changes made to the same crossing point including footway build outs which have reduced the distance to cross, relocation of the refuge to divide the crossing into two equal stages and tighter corner radii which force vehicles to slow both on approach and exit. The carriageway has been raised to the height of the footway to create a “raised table” design facility which also serves to slow vehicles and improve the visibility of crossing pedestrians. Dramatic improvements have also been made to the legibility of the crossing.

Figure 10: Crossing point revisited in 2010, following improvements

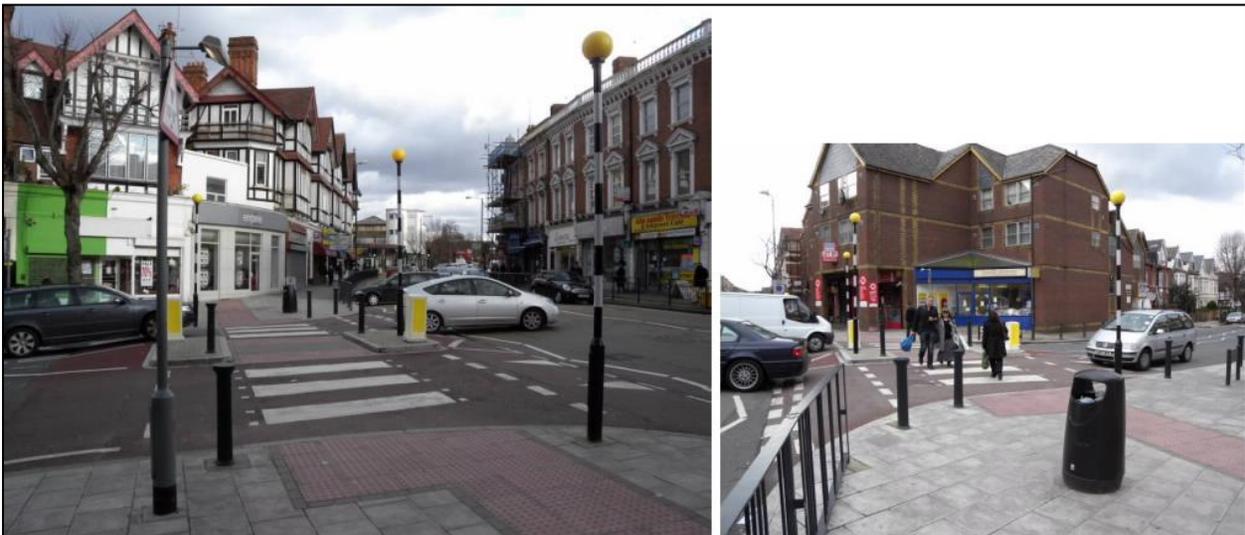


Figure 11 shows a section of footway in the same area in 2009, and illustrates a relatively narrow footway with reduced effective width owing to the presence of temporary footway obstructions from local businesses. The surface quality along the footway was poor at the time of the audit, with frequent trip hazards noted. Demand for the parking was noted as low.

Figure 12 shows the improvements captured immediately after construction work had reallocated a section of roadway, providing more space to the pedestrian realm. Inset parking bays periodically located ensured that parking capacity was neither lost nor wasted. The surface quality following the work shows a visible upgrade. Figure 12 shows there is only so much engineered solutions can do, however, with narrowing of the width from the seemingly thoughtless location of a business sign which has neither been aligned to the front nor rear of the footway.



Figure 11 (left): Link audited in 2009

Figure 12 (right): Link revisited in 2010

Strategic PERS audit case study: Pedestrian Interchange at Railway Stations

Strategic PERS audits were undertaken by the TRL team at the 8 biggest railway stations in central London. These railway stations serve both short and long distance journeys from all four corners of the UK and can be considered as some of the major gateways to the capital. The PERS methodology was combined with that of a complementary tool called Community Street Audit (CSA) undertaken by pedestrian charity Living Streets. The CSA methodology involved engagement with key stakeholders around the stations along key walking routes.

Analysis was conducted separately but indicative results from the earlier PERS audits highlighted areas of particular priority and focus for the later CSAs.

Further PERS audits have recently been conducted (2011) in the Netherlands, addressing key walking routes from rail stations to local town centers.

- **Australia (2010)**

- A large pedestrian and cyclist environment upgrade project in Hoddle Street, Melbourne used PERS and CERS (Cycling Environment Review System, TRL's "sister" methodology for cycling environments). This study was part of the Victorian [State] Transport Plan, where AU\$5M is being invested to improve the modal choice of Australians wishing to access inner Melbourne, the Central Business District (CBD) and onward roadway connections including the freeway. It was imperative that the improved efficiency gains for private motor vehicles were tempered with improved levels of accessibility and safety for pedestrians, cyclists and public transport users, and PERS and CERS were collectively used to address these challenges.

- **South Africa (2010)**

- PERS was used as part of The City of Johannesburg plans to develop a Bus Rapid Transit (BRT) system within the existing fabric of a developed area. The design follows TOD (Transit Oriented Development) principles, introducing commercial land uses in and around existing train stations, improving current infrastructure and creating new links to the BRT system. The project context involved a high proportion of residents lacking private transport use, meaning that public transit is heavily relied upon. Improvements to public transit infrastructure are also being teamed with increasing employment opportunities in local areas.

6. Non-Motorized User Needs: The Same the World Over?

The use of PERS for diverse applications outside the UK has told us much about walking needs around the world. In addition to the selection of projects discussed previously, the principles of PERS have also been applied to workshop sessions to explore improving levels of walkability with the Government of Dubai, where there are serious constraints on the distance and length of time pedestrians can walk owing to the oppressive climate.

Although the PERS tool was initially developed with London and UK standards in mind, the wider research conducted as part of its conception allowed international best practice to be considered and reinforced by the tool, and as such the PERS tool and its principles have relevant application to planners, policy makers and practitioners throughout walking environments across the urbanized world.

Whilst pedestrians in many locations around the world have very specific requirements in terms of climate, culture and policy context, TRL's use of the PERS tool internationally has highlighted the following shared best practice requirements for four different components of the pedestrian environment:

- **Links**
 - Footways should be provided
 - Footway dimensions based on mobility of the most vulnerable pedestrians
 - Lighting should illuminate footway
 - Pedestrians should be able to cross frequently and safely
 - Legibility aided by color contrast
 - Can have specialist infrastructure for particular needs

- **Crossings**
 - Crossings should provide the safest route to cross
 - Crossing designs should be internationally recognized
 - Traffic, where possible, should be stopped to allow pedestrian priority
 - Pedestrians should not have to walk far to reach a crossing facility
 - The location of crossings should consider all pedestrian types, needs and desire lines

- **Public Transit Waiting Areas**
 - Should be easily seen from footways
 - Key desire lines to and from bus stops should be met with crossing facilities
 - Adequate capacity should be provided around the bus stop to minimize user conflict
 - All pedestrians should board in safety
 - Driver training should include understanding pedestrian types and safety
 - Shade and/ or shelter should be provided
 - Real Time Information and specialized sources of information should be provided

- **Interchanges between modes of transport**
 - Mode hubs should be in close proximity
 - Pedestrians should not walk further than absolutely necessary
 - Signing systems should be introduced
 - Pedestrians should be offered safe crossing options
 - The interchange between public transport modes should be ideally quickest and easiest to encourage its use

When these principles are not followed, almost regardless of the country or culture, the following have either been witnessed or anecdotally reported:

- Pedestrians may not use provided facilities;
- Pedestrians may behave "illegally";
- Pedestrians may cross red signals;
- Pedestrians may follow the pedestrian desire line, regardless of infrastructure and physical barriers; and
- Pedestrians may walk in the carriageway placing themselves at risk of a vehicle strike.

These behaviors can result in any combination of conflict, casualties, exclusion and ultimately a decline in the modal share of non-motorized modes. Where these trends require addressing, PERS is one tool which can be used to understand how to improve the pedestrian environment right from the most basic of needs– thereby providing metrics which can start to reverse these challenges.

7. Conclusions

This paper has sought to introduce the Pedestrian Environment Review System (PERS) method to showcase how it can be used to better understand walking environments and to identify and prioritize improvements. In doing so, it has highlighted a diverse range of project applications both in the UK and internationally to demonstrate its strength and flexibility as a tool for planners and practitioners alike.

Walking is an important mode of transport – and with clear links to creating healthy, happy and sustainable places we all need to ensure there is adequate investment in the critical infrastructure which supports walking as a viable mode of transport. Not only do our streets need to be safe, accessible and supportive of street activity, they need to link other modes of transportation effectively so that incremental changes can be made to the way we choose to use our streets for the better.

With reducing budgets available to do this, authorities need robust and defensible methods to prioritize investments in walking, seek lower cost solutions to problems and deliver clear value for money to citizens. The PERS method is one such evolving tool which has demonstrable success in achieving these aims, and will continue to be refined and applied to help create world-class walking environments.

References / Further Information

Legible London	http://www.tfl.gov.uk/microsites/legible-london/
Living Streets	http://www.livingstreets.org.uk/
Transport for London	http://www.tfl.gov.uk/
Transport Research Laboratory	http://www.trl.co.uk/

List of Figures

Figure 1	PERS Review Parameters by Component Type
Figure 2	A PERS audit in progress
Figure 3	On-street assessment sheets
Figure 4	Splash Screen of streetaudit software, containing the PERS module
Figure 5	Example graphical outputs showing total score (upper) and parameter score (lower) graph results for three routes
Figure 6	Mapping module within PERS software (showing RAG ratings)
Figure 7	Work list report detailing “quick win” recommendations
Figure 8	Photographs taken during audit
Figure 9	Crossing point audited in 2009
Figure 10	Crossing point revisited in 2010, following improvements
Figure 11	Linked audited in 2009
Figure 12	Link revisited in 2010
Figure 13	Monolith sign at Bond Street (London, UK).