Driving Surfaces for Mobility Vehicles

1 Scope

While the speed of mobility vehicles is relatively low; typically 4 to 8 mph, the small diameter wheels tend to accentuate any imperfections in the travel surface. Many of the problems experienced by motorcyclists and cyclists are the same only having a greater impact on the mobility vehicle. This guide examines some of the main problems encountered and proposes their solutions.

Mobility Vehicles include – manual wheelchairs, sport wheelchairs, powered wheelchairs, mobility scooters, pushchairs,

Other types include 3 and 4 wheeled foot and hand pedalled cycles, motorised tricycles and specially modified motor vehicles and motorcycles. These have similar characteristics and handling to other cycles and motor vehicles.

Note; from time to time a visual hazard may be noted as forming a hazard for people with both visual and hearing impairments. The inclusion of people with hearing impairment is due to the habit of people who are deaf or have low hearing facing their companions to lip read or use Sign language. The deaf person and their companion use visual and tactile clues for guidance.

Document History

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1.1 Index

2 Travel Surface

2.1 Safety

According to the good practice notes on preventing slips, trips and falls at work prepared by the HSE (1996), slips and trips can be prevented by:

Choosing suitable floor surfaces

Ensuring lighting levels are sufficient

Properly planning pedestrian and traffic routes to avoid overcrowding

Training maintenance workers to carry out necessary maintenance, including inspection, testing, adjustment and cleaning at regular intervals by using suitable methods for the surface being treated

Providing lighting so obstructions and potentially slippery areas can be seen, and maintaining lighting to keep levels safe

Checking floors for loose finishes, holes, cracks, worn rugs and mats, choosing finish carefully if it can become wet or dusty.

Removing obstructions and objects or erecting signs and barriers.

Best practice guidance in the form of Codes of Practice are available for the measurement of the properties of surfacing materials on roads, footways and cycle tracks to ensure that adequate safety standards can be met.

2.2 Fuel & Oil Spillage

Carelessness amongst vehicle drivers often results in contamination of the road surface and across walkways at garage entrances.

This can cause loss of steering control (slipping).

It causes other materials to stick to the wheels which being small are easily deflected due to materials built up on the steering wheels.

At crossings it contaminates the wheels of manual wheelchairs which is picked up on the rider's hands.

Spillage across entry ways are also a hazard for people with low vision and hearing (reflections, companion dog paws), and to people who use walking aids (crutches, walking sticks, walker frames) by increasing the potential for slips and falls.

Fuel Station operators should take action to control and remove any contamination across walkways.

2.3 Construction Sites

Often mud and other debris are tracked across walkways and carriageways by vehicles leaving a work site.

This deflects the small wheels, builds up in the small wheel arches, and is a hazard for pedestrians.

Site management should take action to remove any tracked mud and debris quickly.

2.4 Gritting & Salt

Roads need to be regularly swept to remove patches of grit etc. Often this accumulates in the centre of road junctions. Road sweepers should also take care not to create patches of grit over time by always missing the same part of the road.

The salt put on roads in winter can create the same problem though obviously this is better than ice. When roads are gritted care should be taken to spread the salt evenly.

2.4.1 Surface colours

Kerbs, road surface and walkway surface colour combinations should be selected to emphasise edges and purpose.

Using grey concrete for kerbs and gutters when combined with older tarmac tends to cause the surfaces to blend into each other. Kerbs and dividers should always provide contrast.

2.4.2 Surface dressings

Given that slipping is a major hazard to riders the problems caused by tar and surface dressing when the traffic itself is relied upon to complete the rolling process should be recognised. Loose chippings can build up on centre lines and apexes making cornering and overtaking unnecessarily hazardous to other vehicles leading to increased risk for riders.

Chippings and gravel which build up at the kerb side oft the carriageway are also a steering hazard, forcing riders to travel further out from the kerb.

This debris should be rolled into the surface and excess materials swept away.

2.4.3 Blown sand

Blown sand on walkways and carriageways can be a major obstacle for mobility vehicles and mobility aid users. It forms a barrier, tripping and slipping hazard. It deflects steering and traps wheels.

Highway maintenance near beaches and other places where there is blown sand should ensure that there are no significant build ups.

2.5 Overbanding

Overbanding refers to the use of bitumen to seal joints in the road surface, often following road works.

Bitumen causes mobility vehicle riders considerable problems particularly in wet conditions when its skid resistance is much lower than that of the surrounding black top.

The joints are often left proud of the surrounding blacktop causing bumps, and due to small wheel diameters can deflect the steering.

Often a low quality Bitumen is used which has a lower melting point which sticks to the wheels causing steering loss.

It is also considered to be expensive and can shine in the street lights if wet possibly appearing to a road user as a white line.

2.6 Water

Water Discharges (down pipes putting water across walkways) and water leaking onto the walkways or highway can be a serious problem particularly in the winter when it may freeze and turn to ice. Water leakage may also cause manhole covers and access plates to lift forming a tripping and steering hazard.

Algae growth and surface erosion (rutting and break up) can cause slip/trip hazards especially on inclines.

The responsibility for remedying this problem may in some cases be with the Water or Sewage Utility Operator.

Road drains which become blocked or are too small for the flow in the area can cause. In winter this overflow can in effect become streams forming a barrier to mobility vehicles.

Ponding in walkways and at the edge of carriageways deflects steering and can affect the machine's electrics. In winter it can turn to ice.

Regular inspection for new freshets rising along side or in a path need to be made: inspection during and shortly after a rain storm can give early warning of potential new trouble spots.

2.7 Carriageways

2.7.1 Junctions

The single most likely site of a collision involving a road travelling mobility vehicle is at, or near, an urban road junction. Visibility, complexity and approach speeds are all significant. Roundabouts and other priority controlled junctions are more hazardous for mobility vehicles than signal controlled junctions. Lane markings and widths are significant especially at entrances and exits.

2.7.2 Lane widths

Although most mobility vehicles are able to maintain general traffic speeds in most situations mopeds are designed not to exceed 8 mph. Heavy traffic flows and high proportions of HGVs presents a hazard for all types of mobility vehicles. Attention to near-side lane width is important to ensure safe passing of and passing by mobility vehicles. Other considerations in near-side lane width are stationary vehicles, car doors opening and left turning vehicles.

2.7.3 Roundabouts

Large roundabouts often have high entry speeds and more than two lane approaches. The circulatory carriageway is wide which permits the traffic to travel relatively fast around the island. Circulating mobility vehicles are vulnerable to be struck by vehicles that fail to give way on entering the roundabout.

Alternate walkway/road crossings with flush dropped kerbs should be available on all roundabouts so that mobility vehicles and others who find kerbs a barrier can avoid becoming involved with fast moving and lane changing vehicles.

Grit build up can be a problem at roundabouts and should be cleared regularly.

2.7.4 Road markings

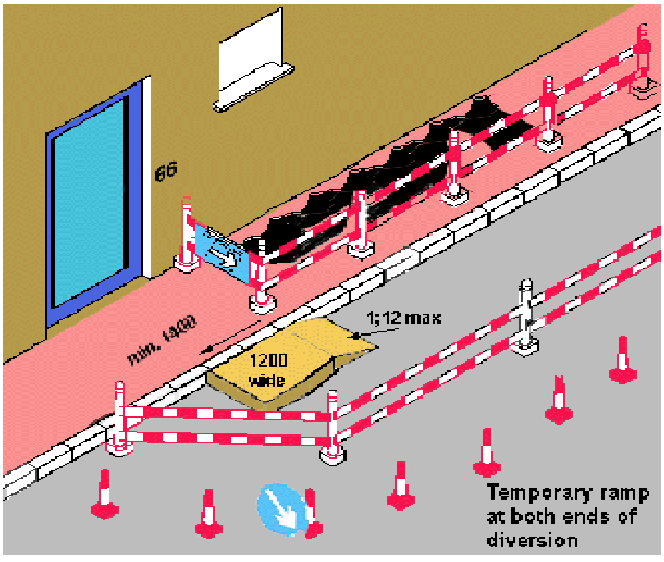
Where road markings are over painted the lines build up causing steering deflection. This causes mobility vehicle and cycle riders problems because the carriageway is uneven and can steer the rider out of line.

This matter is made worse as some white lines are smooth and offer little skid resistance particularly when wet.

2.7.5 Repairs

After road works the carriageway or on the walkways should be reinstated to the highest standard lips and hollows deflect steering. When services have been laid or dug up often it is repaired leaving a patch of sunken/uneven blacktop or walkways surface.

Those at the Highway Authority responsible for



checking the quality of reinstatement should make it clear from the outset that the standards expected will not be compromised.

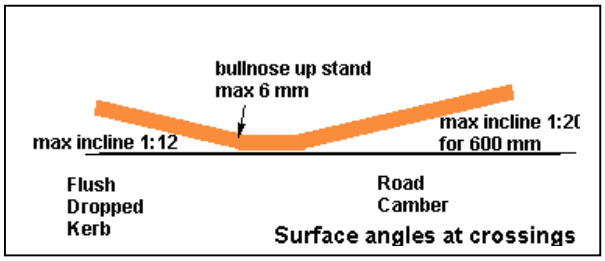
Resurfacing operations are essential to road and walkway maintenance, ribs, ridges and loose surfaces which exist during certain stages are unavoidable. Maintenance crews should ensure that adequate warning signage is provided at alternate viable routes.

Temporary traffic lights often involve laying a power cable across the carriageway. When this is not covered and not secured it effectively acts like a roller and can cause a mobility vehicle's front wheel to slide and deflect. Short steep bridging can cause the vehicle to bottom due the short wheel base and low ground clearance.

Where work is being carried out which obstructs the walkway or cycle track adequate diversion routes (ramped down to the road level) with barriers and signage must be provided. See 'New Roads and Streetworks Code of practice' from the Highways Agency for the minimum requirements.

2.7.6 Camber

Road cambers especially in inner lanes are often too steep for mobility vehicles to maintain a straight line of travel. This causes riders to move further into the lane increasing their vulnerability to other road users and slowing traffic movement.



Where cambers meet dropped kerbs high cambers can cause bottoming of the machine causing stalls. A steep angle may also cause deflection of wheelchair castor wheels or even tipping of the chair and rider.

2.7.7 Visibility at junctions and crossings

Walls, hoardings, plantings and fences/barriers at junctions need to permit riders to see approaching vehicles. They should be no higher than 1000 mm or if taller provide an unobstructed view (clear material).

Overhanging trees or hedgerows should be removed and set back to allow good vision for drivers of moving vehicles and mobility vehicle riders.

2.7.8 Pinch Points / Build-outs

Where pinch points or build-outs are used for traffic calming the cycle passage should be wide enough for mobility vehicle use, 1000

to 1100 mm wide to service larger machines. This improves safety for riders and reduces traffic obstruction.

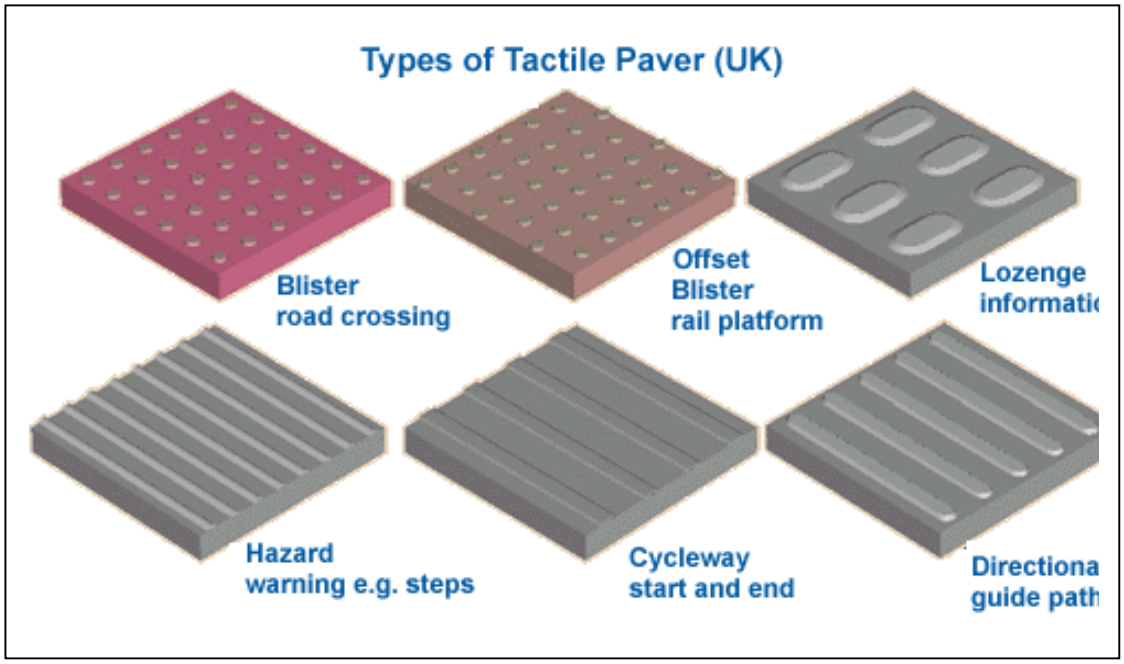
2.8 Walkway tactile paving

The following is a summary and does not provide all installation instructions. See our guide 'Tactile Paving and Warning Surfaces' for more details.

Pavers are 400 x 400 mm square tiles. Brick pavers are also available.

Blister pavers are red at 'controlled crossings' and buff/yellow at 'uncontrolled crossings'. If red pavers are set into red brick paved pedestrian areas they should have a contrasting border edging to highlight the location. The direction of the blisters must be inline with the dropped kerb on the opposite side of the carriageway as these indicate the direction the users should walk.

Offset blister pavers are used at the edge of heavy railway platforms, underground rail platforms and all off street light rail platforms as a warning of the edge. These can be any colour other than red but must provide a colour contrast with the surrounding surface.



The lozenge paver is used for on street light rail platforms. A single or pair of lozenge pavers are sometimes used to indicate where notices, tactile text or Braille signs are located. This is used to ensure that there is no confusion with kerbs and steps which have lower risers.

Way guidance pavers should be laid with the ribs in the direction of travel. They can be any colour except red and must form a strong contrast with the surrounding surface.

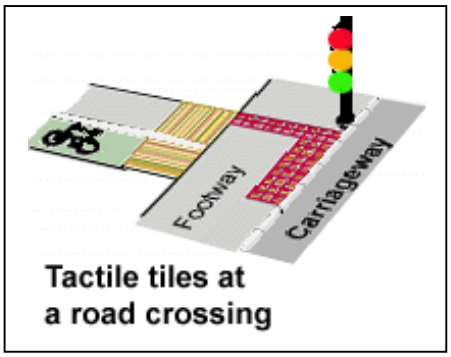
Hazard warning pavers are used at the top and bottom of outdoor staircases and step flights, to warn of rail level crossings. In some part of the UK they are also employed to indicate the door position of buses at bus stops.

The pavers shown in grey can be any colour except red, however, it is preferred if they contrast with the surface in which they are inset.

See Department for Transport "Guidance on the Use of Tactile Paving Surfaces" available on their website which informs constructors on the appropriate use of each type of tile and where each should be used. Using the incorrect paver confuses users and can lead to accidents.

Use of brass stud type pavers should not be considered as these form a tripping/slip hazard for people using mobility aids such as crutches and walking sticks.

Corduroy pavers are used to mark restricted pedestrian and cycle ways should be ended with the appropriate tactile surfaces before joining to an ordinary footway. Restricted ways should end before the tactile area at a controlled road crossing.



Tactile tiles at a road crossing

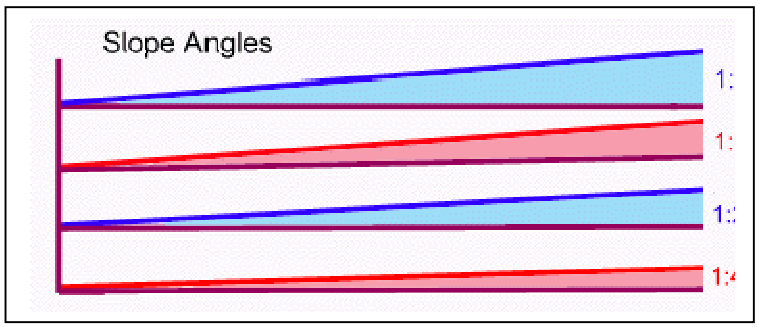
The ribs are inline with the direction of travel for the cycle way and transverse for footways. Buff, yellow or light grey are preferred colours. The corduroy paver should be used to indicate the start of ramped approaches to street platforms.

The information surface (not shown) should be non-bituminous and based on a neoprene rubber or similar elastomeric compound. It should be available in a variety of colours as the use of a contrasting colour and tone to the surrounding footway is recommended so as to assist partially sighted people. This has proved of little value and is rarely used today due to the probability of lifting and damage.

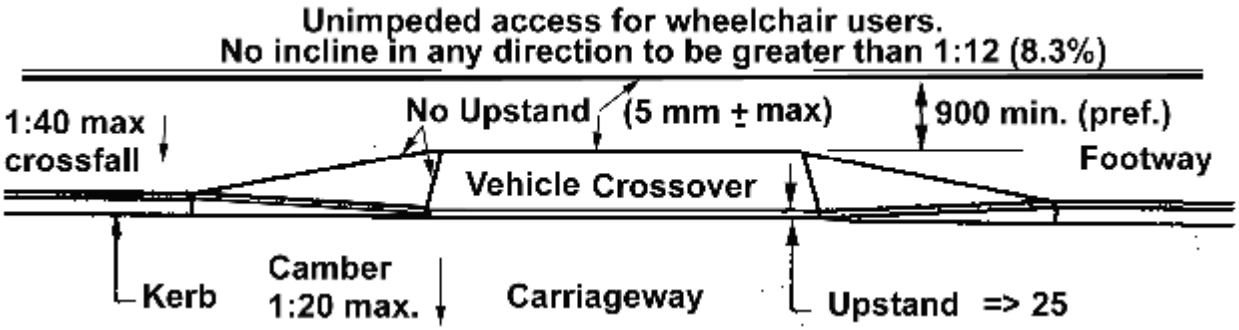
The New Roads and Street Works Act 1991 requires the replacement of the guidance surface when it is removed or disturbed in the course of opening the footway by the party disturbing the surface. Pavers should be inspected regularly to ensure that raised portions do not wear below 5.5 mm height below which they need replacement. It is essential that any reinstatement of the surface conforms to the advice in the Highways Tactile Paver Guidance.

2.9 Slopes, Hills and Inclines

Mobility vehicles are prone to tipping if they try to make a turn across an incline, generally the steepest incline on which they can handle a turn is 1:15 (6.7%, 6°).



Level spaces for mobility vehicle turning should be provided at road crossings and at intervals (30 metre max) along inclined routes. The level space should be at least 2800 x 2400 clear of obstructions and gate/door swings.



Care must be taken when installing pedestrian flush dropped kerbs and vehicle crossing dropped kerbs that no slope on inclines becomes greater than 1:12 (8.3%). Builders often forget that if they remove and replace one kerb stone and replace it with an angle cut kerb that this angel must be added or subtracted from the existing angle of the footway incline to maintain the correct slopes.

The 25 mm up-stand is used to differentiate these crossovers from dropped kerbs. The up-stand may also act a s a guidance edge on wider crossovers e.g. entries to car parks and industrial or commercial area entry ways.

2.10 Block Paving

Poorly installed and maintained block paving used on walkways and pedestrian areas causes puddling, deflects steering, is a tripping hazard.

Mobility vehicle steering is especially vulnerable to being deflected by bowling and mounding of surfaces.

Block paved areas should be regularly inspected and appropriate repair work carried out.

A common problem with block paved areas is when e.g. a utility company carries out sub-surface repairs and the base and sub-base

materials are improperly compacted when the surface is reinstated. It is not unusual to see utility company contractors removing piles of “excess” base material following excavation works.

2.11 Inspection chambers

The manhole covers are sometimes made of smooth metal which offers comparatively little skid resistance especially in wet and icy conditions.

The danger they pose is not helped when they are positioned in the centre of the carriageway or walkway especially if this is on a bend, or a roundabout’s circulatory carriageway/exit.

In correctly constructed or damaged covers may also be proud of the blacktop or recessed or sunken causing deflections and tripping hazards. Manhole covers should not be more than 5 mm above or below the surrounding surface.

They may force riders into a hazardous line in order to avoid them possibly resulting in loss of control or collision. The blacktop surrounding manholes is prone to breaking up resulting in a pot hole.

2.12 Road Drains

These are often placed on the curve at road junctions where mobility vehicles need to keep close to the edge of the lane to avoid being side swiped by longer vehicles.

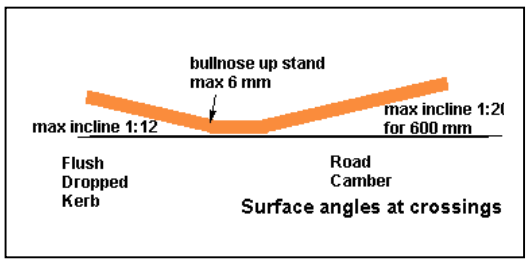
As mobility vehicles tend to keep close to the edge of the inside lane for their safety sunken or raised road drains are a particular hazard, deflecting steering, or if deep or high rise causing bottoming of the vehicle. Poorly installed drains therefore cause riders to travel further out in the lane increasing their hazard from faster vehicles and obstructing and slowing traffic movements.

Poorly cleaned road drains cause ponding and can cause high water flows along the kerb with consequent steering problems, mobility vehicles further out in the lane, and in winter icing.

Care in the siting of surface water drains and the width of drain slots needs to be taken. Poorly sited and wide drain slot can trap wheels diverting mobility vehicles and walking sticks causing a tripping hazard.

2.13 Dropped kerbs

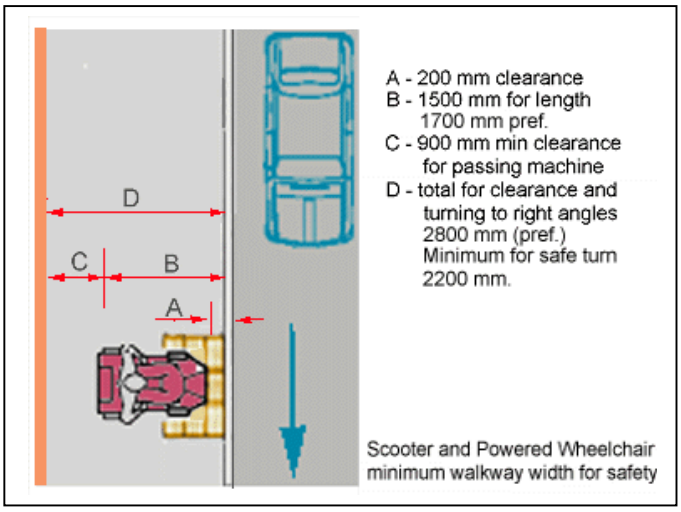
Poorly designed and installed dropped kerbs are a hazard to mobility vehicle riders and pedestrians alike.



High angle of incidence with road cambers causes puddling and can cause the machine to bottom and stall.

Steeply angled ramps across walkways deflect steering and mobility aids especially where there is insufficient level walkway width behind the ramp.

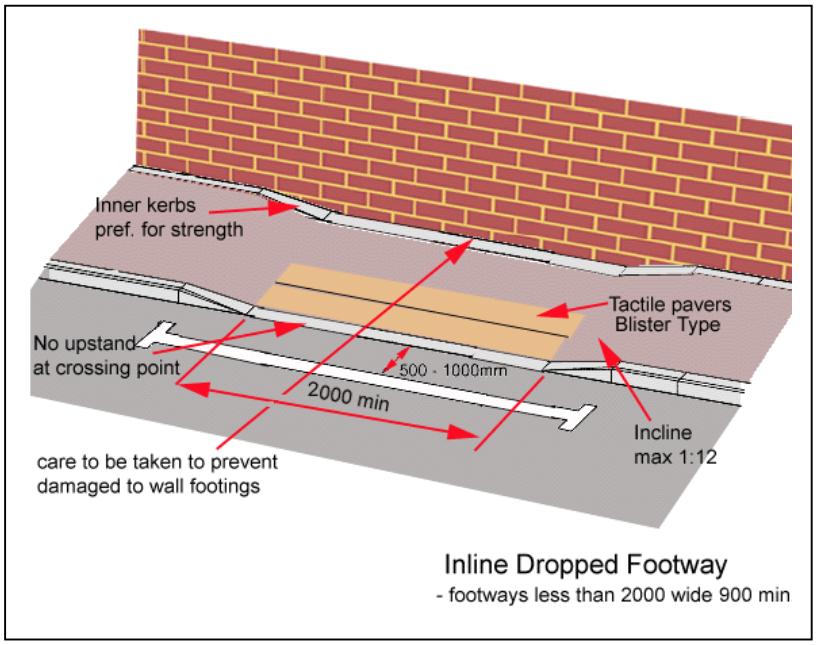
The upper flare on dropped kerbs installed on hills and inclines is often too steep as installers do not extend the ramp to decrease the ramping of the flare. On inclines the flare needs to be two or even three kerb stones long rather than the one common to flares on level areas. Similarly carelessness in installation does not take into account the need for longer flares when the kerb height is greater than normal.



Dropped kerbs should make a flush joint with the gutter surface. The 25 mm raised lip used on vehicle walkway crossings is a hazard for mobility vehicles and a tripping hazard for pedestrian crossings. (see sketch above)

The overall width of the walkway between the kerb and any rear obstruction at any dropped kerb should be 2200 mm (2400 mm pref. min.) to permit the vehicle to turn at right angles to the carriageway while waiting for a safe crossing time.

With footways less than 2000 mm wide designers should consider dropping the full width of the footway and make the drop slope in line with the route.



The correct tactile pavers should be used to indicate the crossing. These must only be used where there is a dropped kerb on both sides of the carriageway.

2.14 Crossings on steep inclines

See also Camber and Dropped Kerbs above.

A mobility vehicle travelling across a steep incline or hill is prone to steering deflection and loss of control. Crossings over inclined carriageways should be avoided or a level crossing area constructed.

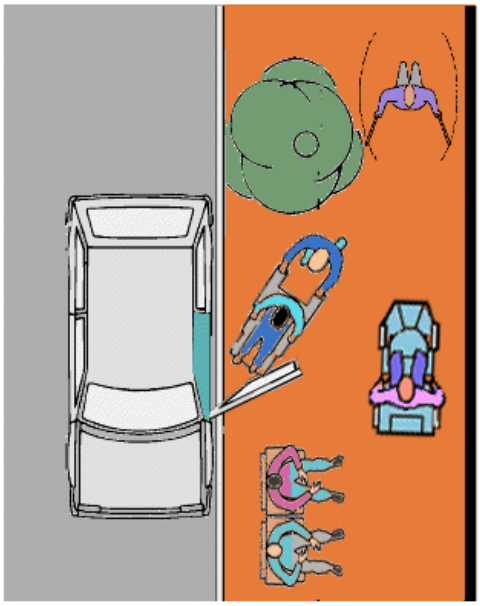
2.15 Walkway width

In general walkways should not be narrower than 1800 mm 2400 mm pref. (1200 mm minimum can be used for short distances to pass obstructions) to permit the safe passing of mobility vehicles, mobility aid users, people with baby buggies or carrying bulky items.

A level walkway width of at least 900 mm wide should be maintained at street furniture and for passing dropped kerb slopes. This should return to the 1800 mm min. width as soon as possible once past the obstruction.

Where there is a long stretch of existing narrow walkway (less than 1800) a notice/sign should warn riders before they enter that section. Many riders have difficulty turning their neck or twisting their back preventing them from reversing for any distance.

Mobility vehicles need to approach kerbs and dropped kerbs at 90° to prevent damage to their machine or the machine tipping when trying to go down a step at an angle. Where machines can be expected to make 90° turns walkway width should be 2200 mm minimum, with 2500 mm preferred to cater for larger machines.



There should be sufficient space for seated people's legs and for wheelchairs and carers to access cars without blocking foot traffic.

2.16 Walkway Crossfall

See also Dropped kerbs above.

The crossfall on a walkway should not be greater than 1:40 (2.5%) as any greater angle can cause mobility vehicle steering to deflect. Manual wheelchairs and wheeled walker frames are especially vulnerable as the free caster wheels tend to swing down the incline.

3 Obstructions

3.1 Street furniture

See also Visibility at Junctions and Walkway Width above.

The positioning of street furniture can be critical to safety of pedestrians and mobility vehicle riders.

Lamp posts, tree trunks and similar which encroach on the average width of the walkway should have visibility markings, contrasting/reflective bands 150 mm high, at 1000 and 14-1600 mm height above the walkway surface.

All street furnishings should provide visual contrasts and have no projecting parts which could cause tripping or hooking hazards.

3.2 Trees

Trees sited along walkways are often a hazard to mobility vehicle riders, mobility aid users and people with low vision and hearing. Root protrusions and mounding or rutting are all tripping and steering hazards.

Leaf fall, especially when wet cause slip hazards.

Low branches (below 2100 mm height) should be pruned back.

Trees should not obstruct street lighting and reduce visibility especially at highway crossing places.

3.2.1 Hedgerows

See also Visibility at Junctions above.

Over growth and leaf shedding are constant hazards which regular maintenance can control.

When cutting hedgerows maintenance crews should ensure that all debris are cleared away promptly.

Signage should be placed to warn pedestrians and mobility vehicle riders that the walkway ahead is closed and divert them at a safe crossing place.

3.2.2 Street Seating

When siting street seating remember that a seated person needs 450-600 mm minimum leg clearance to the passage of footway users.

3.3 Work places

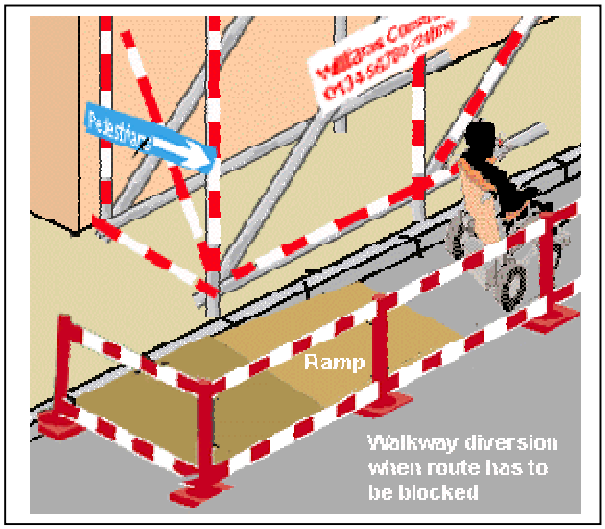
3.3.1 Scaffolds

Placing scaffolding over walkways is a fairly common practice and a hazard for mobility vehicle riders.

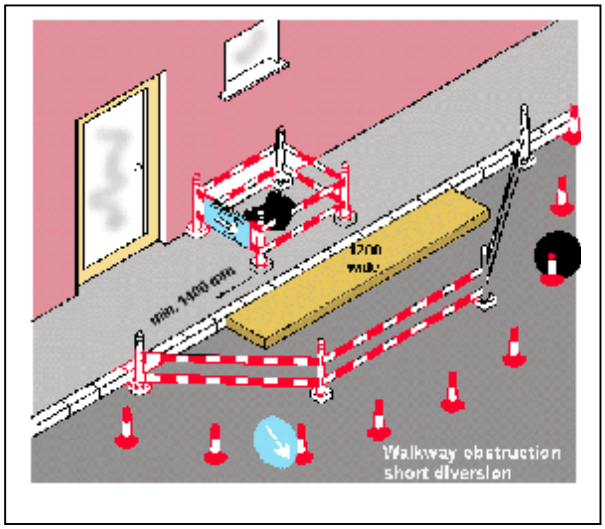
A minimum walkway width of

1200 mm, for short distances,

1800 mm min on longer, should be maintained below the scaffold.



Where the minimum's cannot be maintained a safe diversion should be provided either by using a temporary ramped bypass onto the carriageway, or by placing signs at the closest safe dropped kerb crossing before the obstruction.



3.3.2 Excavations

Excavations must be protected by barriers and route widths and diversions provided as for scaffolds.

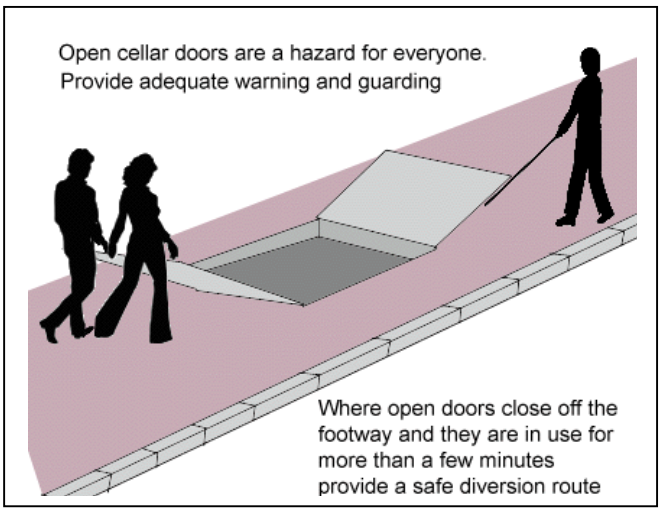
Debris must be kept clear of walkway and carriageway surfaces at all times.

Water/liquid discharges must be controlled and cleaned.

3.4 Other Obstructions

(See our guide Street Trading and Cafés for further information)

A-frame – and similar advertising boards are a hazard for mobility vehicles and pedestrians alike and should not be permitted in any walkway or footpath. These are a hazard to people with mobility and



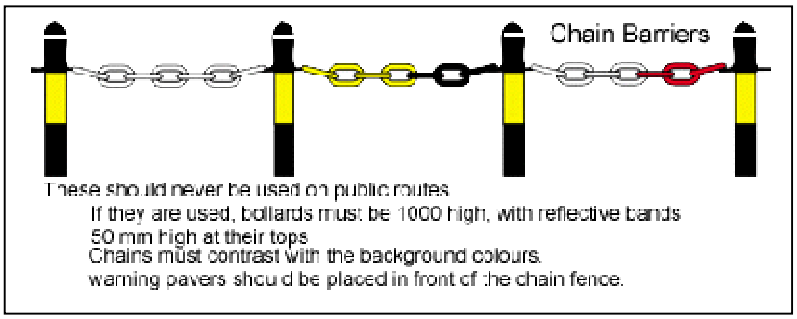
visual impairment and reduce the effective width of the footway.

Vehicle loading – when loading and unloading vehicles items should not be stacked/stored so that the walkways width is reduced forcing mobility vehicles and pedestrians into the carriageway.

Cellar Doors – open cellar doors can be lethal to mobility vehicles and pedestrians. Signage and barriers must be used to prevent people falling into the opening. Where the open door obstructs passage reducing footway width a safe temporary diversion should be provided and warning signs placed at the closest safe dropped kerb crossing place.
Opened doors folded back onto the footway surface must also be guarded as these form another tripping hazard. Some doors are flapped back so that they form a barrier at knee height. This practice is dangerous to everyone especially young children, people with visual and hearing impairments.

Street Trading & Cafés – these should be properly bounded by barriers and should not reduce the walkway width below 1800 mm (wider in busy areas), (see our guide "Street Traders & Cafés")

Chain & Rope Barriers – these should never be used inline with the direction of travel. They are difficult for many people to see and identify. They form a ripping hazard to almost everyone in low light conditions.



Bus stops & Taxi Ranks – when placed on walkways the minimum width should be 1800mm for the walkway (1200 mm min.), plus a minimum of 900 mm width for standing people if people are seated 1000 mm pref.

Cobbles – cobbled walkway surfaces should not be used where mobility vehicles have passage as they deflect steering and can cause injury; from bumping, to people with neck and back impairments.

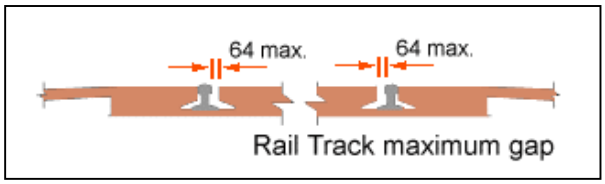
Gates – all gates need to be placed on level sites, have latches which can be reached and operated by riders and people with visual and manipulative impairments, have sufficient safe, clear space outside the gate swing.

Rotating Doors and Turnstiles - these are unusable by mobility vehicles and alternate routes must be provided.

4 Countryside

See our guide to Mobility in the Country series of guides.

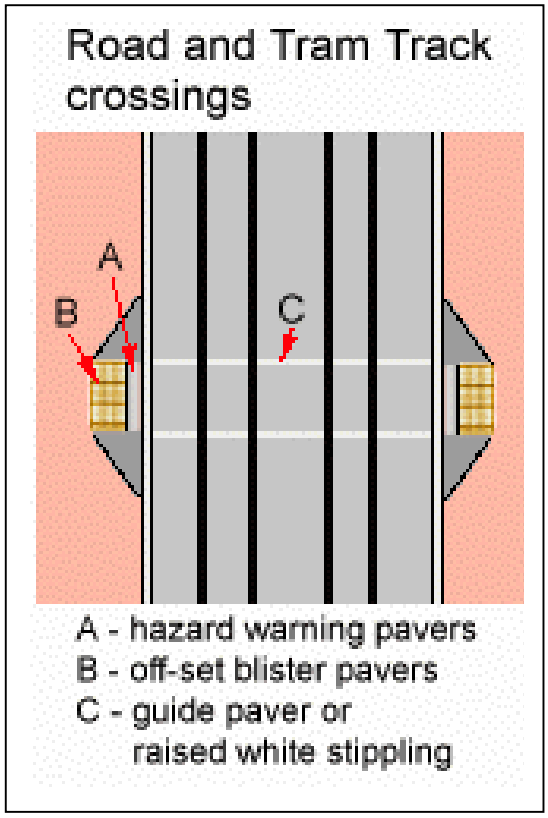
5 Railway and Trams



Railway crossings

Light and standard gauge track crossings are detailed in the railways guidance documents. Some factors which affect accessibility are

the slope of the ramp at the end of platforms, this is often too steep and lacks level platforms, the width of crossings are the surface of the crossing, which is often timber, which is slippery when wet, crossing widths are sometimes very narrow, there is a lack of edge definition on the crossing.



Track/surface gaps are often too wide.

Tram and Tracked Bus crossings – the track surface should not be proud of, or below the road surface level by more than 5 mm where possible. Wheel Gaps between the track and road/walkway surface should be kept as narrow as possible 64 mm wide max all track crossings should be made as close to 90° as possible to prevent wheel trapping.

The road surface at the crossing should be level, with minimal camber. A level area/platform at track top height should be available on either side of the track. This should be set back so that waiting riders and their vehicles are clear of the train/tram.

Tracks running inset into roads can be a problem for cyclists and mobility vehicle riders, regular crossing places should be provided.

Note: automatic/unmanned trams should only be used on segregated (enclosed) tracks.
In 2004 the HSE is developing new safer (?) crossing control systems.

Railway and Tram Tracks – tracks running along a road will tend to trap the wheels of mobility vehicles. Where these tracks are run along carriageways etc., sufficient space should be available on the kerb side of the route for the mobility vehicle and the side of the tram/train. Care must be exercised when designing left and right turns that the vehicle body does not trap the mobility vehicle against kerbs or other obstructions. Escape dropped kerbs should be provided to allow mobility vehicles to avoid these corners/junctions.

6 Appendix – Turning Circles

ISO 7176-5

Turning circles spin –

Manual wheelchair (standard) 1500 x 2000

Class A powered (indoor) 1500 x 2000

Class B powered (indoor/outdoor) 1500 x 2000

Class C powered (outdoor) 1800 x 2000

Turning circles drive –

Manual wheelchair 1650 recommended circle 2000

Class A powered 1780 recommended circle 2000

Class B powered 1795 recommended circle 2300

Class C powered 2700 recommended circle 2800

Spinning reverse 180 turn –

Manual, class A + B 1400 min.

Class C 1740 (not all can make this manoeuvre)