Making Streets Better: The Joy of Kerbs

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Cover Photograph:
Flame Tree Path, Romford. 45° splay kerbs used on a cycle track/ fire path to be more forgiving to people cycling.

They say small is beautiful and we can't disagree when it comes to those small-scale interventions which can make it easier and safer for people walking and cycling. That is why we specialise in working to help make those changes to local streets which will enable human-powered transport;

- Assessment and design of pedestrian and cycle crossings,
- Side road entry treatments (from decent dropped kerbs to continuous footways),
- Filtered permeability schemes (close the road – open the street!),
- Walking and cycling audits,
- "Barrier bashing" – looking at alternatives to physical barriers,
- Cycle track design,
- Walking, wheeling and cycling friendly junctions,
- Experimental traffic orders, trialling and interim schemes,
- Led site visits to look at how street elements fit together,
- Small scale sustainable drainage (SuDS) design.

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A street in Pompeii with some seriously hefty kerbs on display. Credit: @lastnotlost

Stepping stones in Pompeii.
Credit: Jeremy Burge @jeremyburge

Making Streets Better:
The Joy of Kerbs

Kerbs were used in Roman Pompeii some 2,000 years ago to create footways raised from the city's trackways which were often covered in filth. There were even stepping stones in the trackways so the citizens didn't get their feet dirty. The Romans often used large stones as kerbs to provide lateral restraint to road surfacing and the technique was rediscovered by the engineers of the late eighteenth and early nineteenth centuries.

Today, kerbs are one of the most ubiquitous civil engineering element, yet we barely give them a moment's notice. They are available in a bewildering array of sizes, materials and configurations and so it is easy to get lost in trying to find the right kerb for the right job.

This guide gives you the essential background to kerbs, their use and versatility.

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Special thanks to Robert Weetman *@RobertWeetman* for his proof reading and comments.

1.0 Introduction

1.1 Overview

The discussion and interaction available in a face to face training environment cannot be replicated in print. However, this document complements City Infinity's training on how to use kerbs and provides background knowledge on how schemes can be designed and implemented with signposting to other sources for the reader to research.

1.2 Document status

This is just guidance which is a world away from standards and indeed legislation. Some guidance has a relatively short shelf-life because ideas move so quickly, but the basic principles and techniques around the use of kerbs are time-served and are easily applicable to many situations.

Kerbs being installed, providing the framework for a street retrofit.

1.3 Areas covered

This document is broken down into a series of easy to digest sections as follows;

- The basics,
- Kerb types
- Kerb materials
- Walking and cycling
- Installation
- Creative uses of kerbs

Floating bus stop, Mile End, London.
A myriad of different kerbs coming together to create protected space for cycling and an accessible bus stop.

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2.0 The Basics

2.1 Definitions

Where streets are concerned, there are a variety of terms used (often interchangeable) to describe certain features and so it's worth defining some. This guide will use the 'proper' terms throughout.

Carriageway

Generally the bit of a highway vehicles are used on (in the widest sense as people can walk and cycle

Channel

The area immediately next to a kerb line where water collects and then flows to gullies or other drainage features.

Cycle Track

A facility for cycling in or by the side of a highway which has a made up carriageway. Can be in the carriageway, but separated (sometimes referred to as protected) from traffic, on a footway (legally "converted" to a cycle track in England & Wales/ redetermined in Scotland) shared with pedestrians or segregated from pedestrians, or "grade separated" where the footway is at the highest level, then there is a kerb down to the cycle track and another kerb down to the carriageway.

Dropped Kerb

A section of kerb which is set lower than adjacent sections, often used at pedestrian crossing points and driveways. Dropped kerb units are normally low compared to ordinary kerbs rather than being full-height kerbs buried deeper.

External

As applied to radius (curved) kerbs and corner units, “external” refers to the situation where the face of the kerb is on the outside of the curve or corner.

Face

The kerb “face” is simply the front part of the kerb. Face is often used to describe how much of the kerb sticks up (see upstand).

Footway

A paved pedestrian facility provided in or by the side of a highway which has a made up carriageway.

Internal

As applied to radius (curved) kerbs and corner units, “internal” refers to the situation where the face of the kerb is on the inside of the curve or corner.

Length

The length of a kerb unit measure longitudinally. The standard UK kerb length is 914mm.

Parapet

A wall or barrier along the edge of a bridge which stops people or vehicles falling off the structure.

Pavement

From a highway engineer's point of view “pavement” refers to the structural aspect of a carriageway, footway, cycle track etc.

Upstand

Describes how much of the kerb sticks up about the adjacent surfacing. Often used interchangeably with “face”.

Wheel-grab

Usually applicable to people cycling, wheel-grab is where the cycle crosses a kerb line and an upstand “holds” the wheel to in front causing the rear wheel to slide along the kerb and potentially throwing the rider.

Width

The thickness of a kerb unit measured from its face (front) to back.

Kerb build-out to create crossing point within a line of parking bays.

2.2 What are kerbs for?

Kerbs can perform a variety of functions, many of them simultaneously. Their general engineering functions are as follows;

- Retain the edge of the top layers of a pavement,
- A demarcation between different areas or uses of a highway - the obvious here is a kerb between a carriageway and footway,
- To provide a check or channel for surface water management,
- To provide restraint to prevent vehicles leaving the carriageway.

However, kerbs have more subtle uses too, including;

- Pedestrian crossing points
- Wayfinding for visually impaired people,
- Making buses accessible,
- Creating protected cycle tracks

A very subtle use of a kerb – a footrest while waiting for the traffic signals to change!

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3.0 Kerb Types

3.1 Overview

There are a variety of kerb types available, some come as standard stock from suppliers and some have to be specially made or produced to order. This section looks at the some common types.

3.2 Standard Units

Materials will be covered in the next section, but most of the kerbs used in the UK will be precast concrete with characteristics conforming to the standard BS EN 1340.

Don't worry too much about the standard, it simply sets standard sizes, tolerances, quality and so on. The standard is European, but each country will have it's own regional variations.

In the UK, precast concrete kerbs will generally be 914mm long (3 feet) for straight units and with various cross-sections and profiles. Sizes are standardised to ensure compatibility, although as we will find out later, this has some limitations.

For radius kerbs (curved), lengths are shorter and designed to form a quarter of a circle with a whole number of units (to avoid having to cut kerbs) with the number of units required varying with the specified radius. 2, 3, 4, 6, 8 and 10 metre radii are the most commonly available. Larger curves of over 12 metres are formed using straight sections of kerb. One common problem is where designers do not specify radius kerbs to the nearest metre (e.g. 5.5m) and so road workers have to try and cut kerbs to fit. This is poor practice as the kerbs never quite butt up together properly. For very tight corners, some units are available in 0.6m and 1m radii.

When used to create junctions, radii less then 5m are generally used to help keep driver turning speeds low. Larger radii are used where there is a high proportion of large vehicles turning. Certainly in residential streets or places where the largest vehicle might be one or two refuse trucks a week, it is appropriate to keep radii tight and accept that the refuse truck driver will be able to cope rather than having car drivers turning at inappropriate speed.

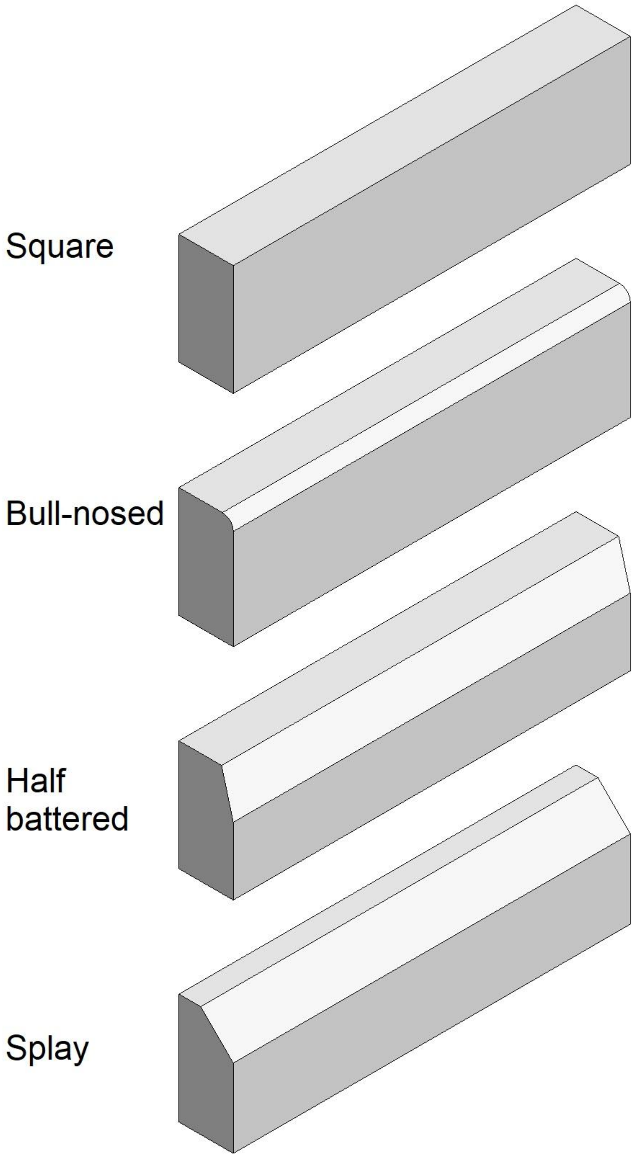
Standard kerbs tend to come in widths of 125mm or 150mm and depths of 150mm, 255mm and 305mm. We also have “edging” kerbs which are 50mm wide with a variety of depths, although 150mm is the most common.

Kerbs are available in a variety of materials and “non-standard” profiles, but there will be a common theme in terms of tolerances and quality.

3.3 Standard Profiles

The are 4 types of standard profile as follows;

- Square,
- Bull-nosed,
- Half-battered,
- Splay (or full-battered).



A general diagram of the standard UK kerb profiles.

Square kerbs are essentially square or rectangular in profile. Because of sharp corners, they can be susceptible to damage and so are sometimes manufactured with very slightly rounded edges.

Square kerb used at a bus stop.

Bull-nosed kerbs have one rounded edge which means damage is less likely. This profile if often seen where kerbs are dropped for driveways.

A bull-nosed "dropped" kerb commonly used at driveways and minor accesses. Note the pair of transition kerbs between the dropped and full-height kerbs.

Half-battered kerbs have the upper 100mm of the face angled back from the vertical at between 12.5° and 15° and are very commonly used. The half-battered profile provides a good level of containment of vehicles while being less likely to be damaged. They are also easier to lay asphalt up to than square or bull-nosed kerbs because the half-batter is less likely to be clipped by surfacing plant.

A half-battered kerb with most common dimensions to be found on the street.

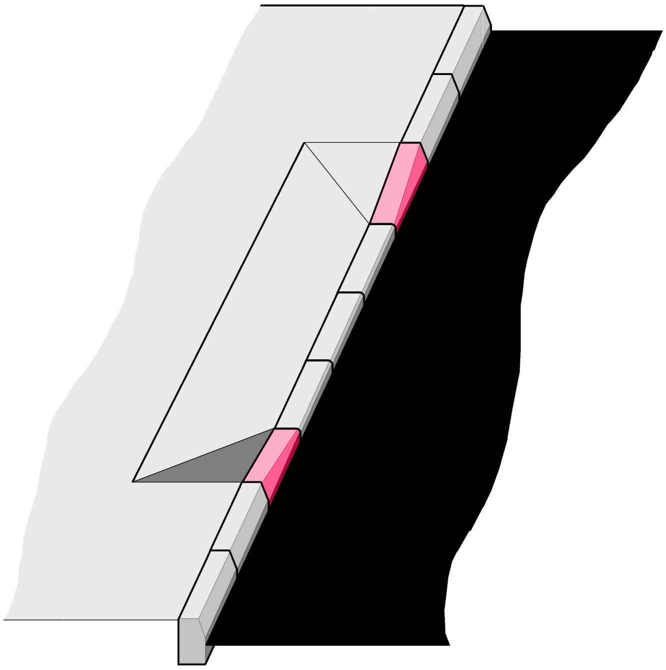
Splay kerbs have the upper 75mm angled back at 45°. Splay kerbs are sometimes called “countryside” kerbs after their extensive use on rural 'A' roads where their profile makes it easier for a broken down vehicle to be driven up onto the verge. They are also sometimes used on cycle tracks (more details in Section 3.9).

In urban areas, splays are sometimes used at footway level loading bays to help drivers mount the kerb to access the loading area.

Splay kerb used between a footway and a cycle track on the A48, Port Talbot.

3.4 Transition Kerbs

If we need to change from one kerb profile to another (or between different sizes), then we require transition kerbs. For pre-cast concrete kerbs, transitions are available as stock items.



Here, left and right-handed transition kerbs (in pink) are being used between a full-height half-battered kerbs and a dropped bull-nosed kerbs.

Transition kerbs are “handed” with left and right-handed units determined by what one would see looking at the face of the kerb line.

3.5 Quadrants & Corners

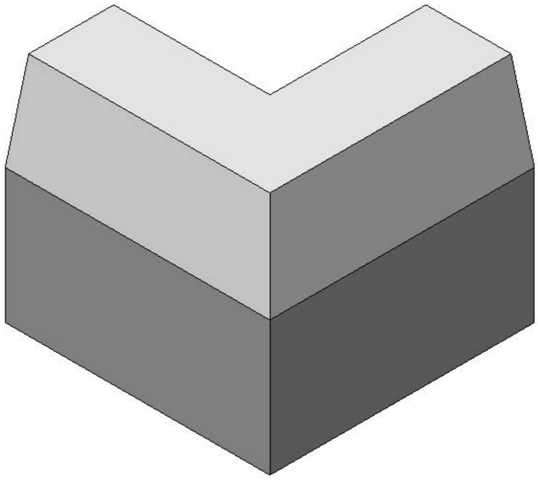
These are useful kerbs which again, for precast concrete, are held in stock. Quadrant kerbs are quarter circle units available with either 305mm and 455mm radii. On site, they are often called “cheeses” because of their passing resemblance to a piece of a wheel of cheese. They are available in half-battered, bull-nosed and 45° splay profiles as standard.

Quadrants are generally used to “round off” sharp corners on traffic islands, or to form dropped kerbs where we wish to maximise useable footway.

Quadrant kerbs being used on traffic approaches to pedestrian refuge and corner kerbs being used on pedestrian area.

A quadrant being used as a transition between half-battered kerb and a concrete ramped vehicle crossing.

Corner (or angle) units provide 90° internal or external changes of direction rather than than having to “mitre” a joint by cutting kerbs to fit.



Half-battered corner unit (external corner).

3.6 Containment Kerbs

These are used where there is a risk of vehicle over-run or collision with people or roadside features (especially from heavy goods vehicles). They are commonly used in ports, toll plazas or to protect weak bridge footways/ parapets. Sometimes they might be used at pedestrian refuges or at junctions for added protection such as where there's an industrial estate within a wider residential area and there is a risk of damage from HGVs.

At low speeds, the shape of the bottom of the kerb helps redirect errant vehicles, whereas at higher speeds, the upper part of the kerb contains the vehicle. Trade names include Tref (Brett) and Titan (Marshalls). Containment kerbs area available in a limited number of radii, quadrants and units to transition to standard kerbs.

Southwark Bridge, London. The start of a run of containment kerbs protecting the bridge parapet, but providing a cycle track too (containment kerbs behind the keep right sign).

St. Augustine Road, Leicester. Containment kerbs protecting bridge parapets.

3.7 Bus Stop Kerbs

A 21st century bus will have a low floor which essentially means no steps within the main part of its body. In addition, a modern bus will have a ramp which can be deployed to aid wheelchair users. Modern buses can also “kneel” which means that the suspension can be lowered to reduce the step height from the footway to bus. This is important for inclusive access, but rendered useless unless the bus stop environment is compatible.

In order to ensure the footway area at the stop is compatible with low floor buses, special kerb units can be used to provide a higher than normal kerb face, although increasingly, some buses can kneel so low that older high kerb units are actually too high.

Kerbs at the edge of the carriageway are often laid with a 100-125mm face, but this isn't always high enough for bus stop accessibility purposes.

Transport for London's *Accessible Bus Stop Design Guidance* [1] suggests a 140mm kerb face as being optimum, although there are other factors to consider. *Inclusive Mobility* [2] suggests 125-140mm. It is important to consult with the local bus operator or transport authority to ensure your design is compatible with local services.

“Kassel Kerb”, Cardiff

Some suppliers have developed special kerb units which transition from standard units to ones with a higher face for bus use. Some have a fixed upstand with a profile to contain bus tyres which prevents wheel damage and ensures bus drivers can pull right into the kerb.

Other systems consist of separate kerb and channel units which fit together in such a way as to permit a variable kerb face. The channel units are also textured to give the bus driver additional cues when pulling into the stop. These types of kerb system also tend to have textured top surfaces to provide grip and are wide to help visually impaired people distinguish them from standard kerbs.

Lewes Road, Brighton.

Half-battered kerbs laid with 140mm kerb face at a bus stop, London.

3.8 Kerbs and Drainage

Kerbs can act as a "water check"; that is surface water runs into the kerb line and the longitudinal gradient (or long fall) of the road, path etc. will mean water is then directed to a gully or other outfall.

Where the longitudinal gradient is very flat – perhaps shallower than 1 in 150, then channel kerb units (channel blocks) can be used to help accurately create falls. As usual, they are available in a variety of materials, but precast concrete is often used and the units will be a match for the standard kerb types. Channel blocks are also used to provide demarcation.

Precast concrete kerb and channel block.

Where water needs to be rigidly controlled, dished versions of channel blocks can be used (dished channels). They can be used where the long falls are flat, but they can also be used where they are steep and running water might erode adjacent verge areas. They generally come in shallow and deep versions.

It is not advisable to use channel blocks where people walk as they create a risk of people tripping or losing their footing. They are sometimes used at the back of footways where they slope away from the carriageway and so while still creating some risk to people walking, their position is generally just out of the location where people choose to walk.

Dished channel at rear of footway to stop water running onto private land behind.

Combined kerb and drainage systems can also be used where gradients are flat or if connections to the local sewer system is difficult.

They are essentially hollow kerbs with holes in the face which allow water in. The water then runs within the kerb to an outfall. Where gradients are extremely flat, different units of varying invert depth are used to create flow

One-piece kerb and drainage system.

A combined kerb and drainage unit (cut down for sales demonstration). Produced from waste plastics and quarry dust, the units are lightweight, yet as strong as conventional products.

They are available in a range of profiles and radius units. They come as one or two piece systems, with the latter providing a lower channel element and upper kerb element. There is also a choice of high capacity units, dropped kerbs, bypass units and other useful elements.

Some systems provide sloped inverts (the bottom of the internal channel) with kerbs of varying overall heights which means that in internal gradients can be created in order to ensure water flows away more efficiently.

There are also side-offlet kerbs which are essentially kerbs with a hole in them which can direct flows straight into a ditch.

Two-piece, high capacity units.

Combined kerb and drainage systems will need access points at regular intervals in order for them to be cleaned and so special access units are provided. These access units can also then be piped to the surface water sewer or other drainage system.

Combined kerb & drainage system access unit.

Arterial gullies are also placed within the kerb line and they are useful for accommodating high flows of surface water and they are less likely to fail as they are not driven over. However, where installed in a footway edge, they can present a trip or slip hazard (when wet), so care should be exercised when specifying them.

Arterial gully.

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4.0 Walking & Cycling

4.1 Overview

People walking, cycling, using wheelchairs and using mobility scooters have particular requirements which are considered in this section.

4.2 Kerbs & Walking

Given an early purpose of kerbs was to help create raised walkways to keep people clear of the filth of the streets, it's no surprise that this function still exists. A kerb upstand also helps keeps traffic off footways and it provides a way of directing water away from where people are walking. In fact, kerbs are often of little consequence to people walking until the point at which they need to cross the road or perhaps a cycle track.

Most people will just get on with it, but we have some issues in how we enable everyone to pass. Some people find stepping up and down kerbs difficult or impossible, especially if they are using a wheelchair or a mobility scooter.

The solution is to either drop the footway down to the carriageway or cycle track or to bring the levels of the carriageway or cycle track up to those of the footway. Any kerb designed to be used as a crossing point must be laid flush for it to be fully accessible, although flush is taken not having a upstand higher than 6mm.

A flooded dropped kerb – not because of a poor dropped kerb installation, but a blocked surface water system.

The problem with having a flush kerb is that visually-impaired people cannot detect the change between the footway and the carriageway or cycle track. In order to assist, tactile paving is provided which provides a surface which can be detected. In addition as many visually-impaired people have some vision, the use of contrasting colour to that of the footway enables them to see the layout.

A poorly installed dropped kerb with a 25mm upstand. This could be high enough to stop a wheelchair or mobility scooter user being able to get out of the carriageway.

Tactile paving is a subject in its own right and we recommend that you read "Guidance on the use of tactile surfaces" [3] for the full details, although it is often tricky to get the details right.

Flush kerb at a crossing point.

Research commissioned by Guide Dogs For The Blind in 2009 saw University College London conclude that a 60mm kerb upstand should be detectable in terms of stepping up/ down from/ into the road [4].

The issue with this is the research is not exhaustive and the detectability of kerbs of a given upstand can be highly variable with colour contrast, lighting and materials. The best advice is to engage with users and advocates at the earliest stage.

In situations where the carriageway or cycle track is brought up to footway height, some care is needed to ensure that areas of low kerb (rather than flush with tactile paving) are not provided. This does create the potential for fiddly layouts.

Here, a cycle track is brought up to footway level for a zebra crossing onto a floating bus stop. The area between the red tactile paving and the ramp is flush with the cycle track and so additional "warning" tactile paving (grey) has been added. The layout has become rather fiddly.

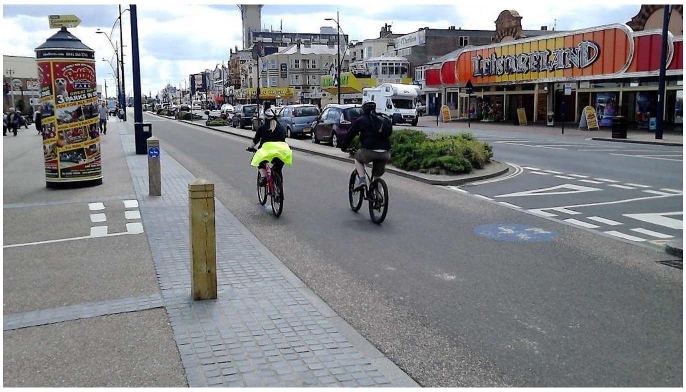
This is part of a raised junction where dropped kerbs are provided at 90° to each other. The kerb face is about 50mm and could be too low for some visually-impaired people to detect.

4.3 Kerbs & Cycling

On main roads or streets with even moderate volumes of motorised traffic, people cycling do not want to mix with motors [5]. Attitudinal surveys constantly report that people think that the roads are too dangerous for cycling and so changing roads and streets to provide protection is vital.

Kerbs play an important part in providing decent protection for people cycling, but detailing is important. It should be remembered that kerbs alone are not the whole solution, but they play a big part in separating people from traffic. Generally speaking, we can provide protection in four ways (often using a mix);

- At carriageway level,
- At footway level,
- At an intermediate level (stepped),
- Completely away from traffic.



Marine Parade, Great Yarmouth,
A low, square, granite kerb is used on both sides of this carriageway-level cycle track, so there is some risk of catching wheels. A wide “island” area provides space for other uses.

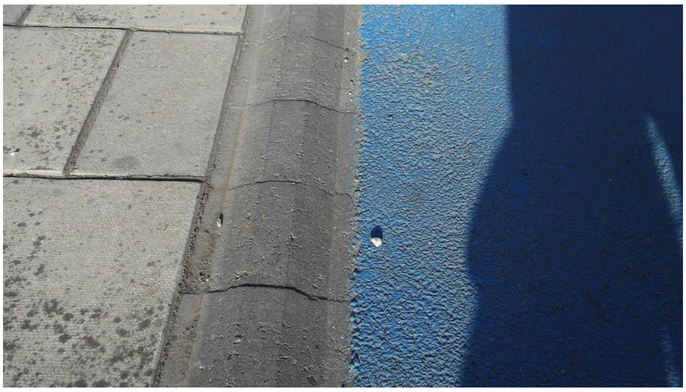
At carriageway level, we are concerned with building “islands” between people cycling and general traffic lanes. It is often the case that the cycle space is taken from an existing carriageway. The islands might be relatively narrow, but when wide they are available for bus stops, pedestrian crossing points, loading bays and planting.

As a general principle, having a low “forgiving” kerb next to footways reducing the risk of riders catching their wheels or pedals and it allows the full width of the cycle track to be utilised. Forgiving kerbs are gently sloped to allow people to make full use of the cycle track width as if they do clip the kerb, they won't be thrown off their cycle.

Vauxhall Bridge, London.
One-piece units dividing traffic lane from cycle track. Traffic-facing profile is vertical, cycle-facing profile is 45°, although a small vertical upstand remains, to it could grab wheels.

Cycle tracks provided at footway level could be provided where space is taken away from people walking (which is often less desirable), where the designer is trying to simplify the levels or perhaps on bridges where there is limited depth to excavate.

A13, Beckton, London.



The footway and cycle track are at the same level and so a demarcation kerb and tactile paving will be needed. The demarcation kerb is 200mm square with a raised ridge of 25mm.

At the intermediate level (or grade separated), we are providing a cycle track lower than the footway, but higher than the carriageway. This is often (but not always) where a cycle track is built by taking part or all of the carriageway.

Newarke Street, Leicester.
A traffic lane has been repurposed as a 2-way stepped cycle track. Half-battered kerbs face traffic and are laid on their side to give a slope of about 22°, they give a forgiving profile to people cycling.

Hills Road, Cambridge.
A low bull-nosed kerb is provided to the left of this cycle track which could catch a wheel. To the traffic side, a sloping "Cambridge" kerb is provided to allow occasional overrun by emergency vehicles. The slope is about 22°.

With cycling infrastructure away from traffic, there are plenty of different kerb types in use. Perhaps we can think of them as small roads in the construction sense. If the routes are provided for people walking as well, then a stepped track can help provide clear space.

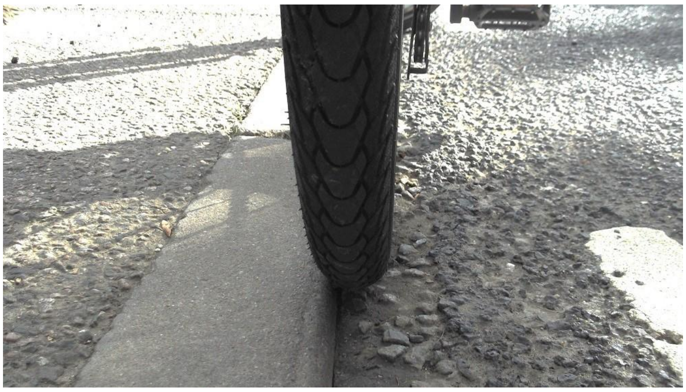
Bolina Road, South Bermondsey, London
Footway and cycle track link laid with a level surface which is less helpful to visually-impaired people.

Chaucer Drive, South Bermondsey.
Full height half-battered kerbs used on both sides of this link, so there is a risk of pedal strike.

In addition, forgiving kerbs assist people using non-standard or adapted cycles to join or leave the cycle track in comfort and safety. This is especially important to people who use cycles as mobility aids. For more information, Wheels for Wellbeing cover the subject in detail in "*A Guide to Inclusive Cycling*" [6]

It is suggested in the "*London Cycling Design Standards"* [7] that a maximum kerb height of 50mm is useful to prevent pedals being caught on kerbs. We discuss this in some more detail in Section 8.3.

Kerbs can also be a hindrance and even a danger to people cycling. The principal issue is where a cycle route transitions from a carriageway to a cycle track. The ideal position is that people cycling shouldn't have to cross a kerb. If they do, then kerbs should be provided across the line of travel because the closer to parallel with the line of travel one gets, the more chance there is that someone will slip in wet or icy weather. Any upstand running parallel to the line of travel risks "grabbing" wheels and throwing the rider off.



A kerb upstand will "grab" the wheels and throw the rider off their cycle.

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5.0 Kerb Materials

5.1 Overview

Kerb materials are numerous and in bygone times, they were reflective of what was available locally. Historic places tend to have natural stone kerbs which are testament to their long service lives. Modern kerbs tend to be concrete and while very versatile, they never provide the romance of a well-worn granite kerb.

A cast iron kerb in Bristol, reflective of historic manufacturing in the city.

5.2 Concrete

Concrete kerbs have become popular because the material can be moulded into almost limitless shapes and profiles.

Some manufacturers will manufacture bespoke profiles (with a minimum production run) if they can be fitted into an existing standard mould, which is essentially a steel box with formers inside. The moulds are placed into a hydraulic press which compacts the kerbs to a point where they can be tipped from the mould fully formed and self-supporting for curing.

Also available are concrete products made with recycled stone (waste from natural stone processing) which can give a look closer to natural stone than plain concrete, although the quality can be variable. These kerbs are often referred to as “conservation” kerbs and they are available in a variety of colours and profiles.

Conservation type kerb with dark granite flecks.

5.3 Natural Stone

Natural stone is available in an almost endless range of colours and textures. Before the invention of mass-produced concrete, natural stone tended to be the material of choice. The most hard-wearing kerbs will be materials such as granite and basalt, although softer materials such as sandstone have been used.

The shaping and finishing of natural stone kerbs used to be a labour-intensive process involving splitting large pieces of stone into rough kerb-sized units with finishing using hand-tools. Modern manufacturing involves precision sawing and a variety of mechanical and other processes to provide texture.

Old granite kerbs.

Modern processing also allows for kerbs with standard radii to be produced as well as bespoke profiles (including matching historical shapes), although there will be a lead-in time and potentially minimum orders. Damage to bespoke units in use can also be an issue for replacement (although hard stone products are extremely durable).

Machined and textured granite transition and ramp kerb.

Natural stone can be produced and imported from all over the world and so thought will need to be given about the environmental and social/ ethical considerations. Environmental factors should also consider the whole-life costs as a properly installed granite kerb could last for centuries!

Wide granite kerbs with low upstand (about 50mm) remain in perfect condition while the carriageway surface fails next to it!

5.4 Plastic and Composite

Kerbs are heavy for those installing them and they can create dust when cut (see Section 5.5). In some cases, we may wish to trial a layout and do not want to excavate to install traditional kerbs.

There are many products in the market which are made from recycled plastic or composite materials which might be helpful for a particular situation.

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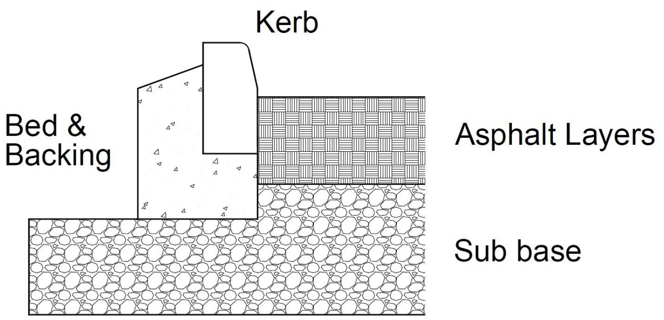
6.0 Installation

6.1 Overview

This section provides the basics on how kerbs should be installed. For those interested in more detail, we recommend "*Roadwork: Theory & Practice, 5th Edition*" [8] which has a whole chapter on setting out and installing kerbs and paved areas. We will concentrate on some key construction and design issues.

6.2 Basic Installation

Providing a decent foundation to support a kerb line is absolutely key. Unless kerbs are properly supported, then they will move and create maintenance issues and problems in use.



The basic components of a well-supported kerb.

The diagram shows a well-supported kerb in what is known as "flexible construction", that is granular materials in the lower layers and asphalt in the upper layers. This is as opposed to "rigid construction" - concrete.

The sub base layers are crushed stone or recycled materials (concrete and brick mainly) which meet a certain specification, depending on the design of the road "pavement" (the name for the structural layers of a highway). The sub base acts to transfer load from the upper layers into the ground below (which will often be weaker).

When we are laying kerbs, the sub base needs to extend beyond the outermost kerb line to provide proper support, otherwise they will sink.

The kerbs are laid on a bed of concrete, mixed to a specific recipe which doesn't need to be too strong, but it must be stiff enough to hold the kerbs without moving as the concrete cures (often called "kerb mix" concrete on site). The bed will allow the kerb line to be lined and levelled as required by the design.

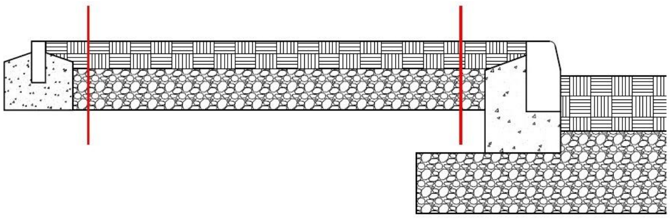
New kerb lines being installed. Note that they are laid on a concrete bed which is in turn supported by a structural layer which extents beyond the kerb line to provide proper support.

The kerb backing is there to support the kerb line laterally. If at all possible, bed and backing should be laid in the same operation to provide really strong support.

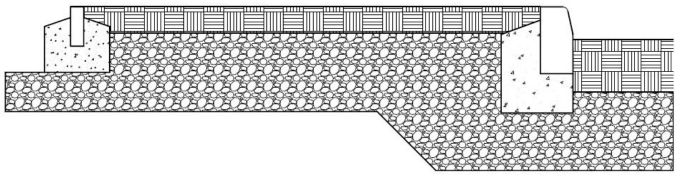
An issue which is often seen on site is that kerb mix concrete is often left in piles waiting to be used and so it is important to ensure deliveries are timed to allow the concrete to be used in good time. On large sites, static concrete plants can be used and for small loads, batching vehicles are available which can produce concrete to order.

6.3 Retrofits

Retrofit schemes often have problems where the carriageway is being widened, or perhaps a new footway or cycle track is being added. Unless the sub base layers are fully extended to support the new kerbs and construction, there will be movement and failure characterised by longitudinal cracking in the new work.



This diagram shows a footway being added behind an existing kerb line at the edge of the carriageway. It is unfortunately common for the addition to involve excavating just enough for the new work which means no support for the new kerb line (an edging in this case) and the sub base for the new work doesn't meet the existing. The red lines show where crack will eventually come through.



This diagram shows the correct approach. The existing sub base has essentially been extended to ensure it is contiguous with the existing and the new kerb is properly supported.

The other type of retrofit scheme could be where a carriageway is narrowed to provide space for new/ wider footways or even cycle tracks. If the existing carriageway is known to have been well constructed, then it is entirely possible to cut a trench within which we can install a new kerb line.

A rock-wheel or trenching machine cutting a tench for a new kerb line.

New edge of carriageway kerb laid in the trench with forgiving cycle track kerb laid (right hand side). The cycle track kerb is supported with bed and backing laid on sub base which is contiguous with the existing construction. The large hammer is called a "maul" and is used for tamping kerbs into place.

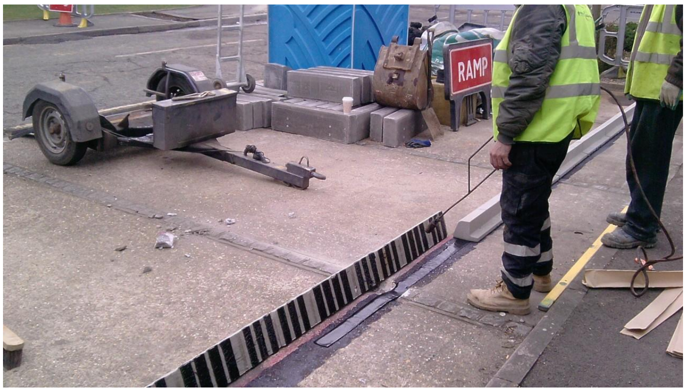
A retrofit scheme should be designed with the same care and attention as one would for a "complete" scheme. In the long-term it is a false economy constructing a scheme which doesn't properly consider and support its kerb lines.

Other retrofit methods involve bolting or sticking new kerb lines to existing (normally carriageway) surfaces to reallocate road space. These systems can be used to create traffic islands, cycle tracks, wider footways and other features. Care should be taken that the manufacturer's installation instructions are followed to ensure the product is durable in service.

Cost savings can be gained from not needing to excavate and the speed of installation, but in highly trafficked places, they may not be as long-lived as traditional construction

.An Orca, a proprietary recycled unit which can provide "light segregation" for cycle lanes. The unit has a half-battered face to general traffic and a forgiving profile to people cycling.

Line of Orcas. Ruckholt Road, Waltham Forest.



This system provides a half-battered kerb profile on a "cut down" unit which is adhered to the existing surface using heat-activated adhesive. In this case, a parking bay is being shortened to widen the footway without excavating the concrete carriageway.

6.4 Tips & Tricks

One issue which can often be seen is where kerbs have been "butted up" too closely and the surface of the kerbs has spalled (thin pieces of concrete broken away). The rule of thumb is to leave 2-3mm between each kerb (a trowel width) and this allows a little movement which can come from thermal change and sometimes heavy vehicle over-run.

Parking or bus laybys are often created in such a way as to leave sharp corners. On the entry/ exit to the layby, these can damage vehicle tyres and within the layby, sweeping is made more difficult. In order to deal with this, careful use of internal and external radius kerbs is needed.

The "double swept" kerb design of this parking layby means there are no sharp edges to catch tyres on on and the gentle curves help with sweeping – especially by machine.

Kerbs are often used in laybys (along the line of travel) and as part of road humps (across the line of travel) to retain surfacing materials (often block paving). Unless the bed and backing is well-designed and constructed, failure is likely Failure is also a risk where heavy vehicles are continually running along/ across kerbs and so are generally best avoided unless significant work is undertaken to restrain them.

Kerb failure at the edge of a bus layby. As well as presenting a danger to road users, the block paving is no longer properly retained and so it will move and also fail.

6.5 Health & Safety

There's a saying that goes "*health will hurt you over time and safety will hurt you now*" and this is sadly very pertinent to people involved in kerb laying.

The health hazards with kerb laying stem from the repetition of installing kerbs. Individual units are not only heavy, the bodily movements associated with the process can lead to permanent musculoskeletal damage [9]. This can be mitigated with power-assisted installation (with kerb lifters mounted to site excavators), safer systems of lifting and regular medical screening. In some situations, smaller kerb units or lightweight kerbs might be a choice.

In addition, cutting of kerbs creates dust and unless managed and suppressed, exposure to this dust can lead to silicosis [10] which harms the lungs. Over time, the health impacts are severe.

The safety aspects involve the hazards of working near traffic, buried utility services and construction plant, all of which need to be mitigated by good site planning and operations.

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7.0 Creative Uses Of Kerbs

7.1 Overview

This guide has so far concentrated on many conventional uses for kerbs, but is we think a little more laterally, there are other benefits to be accrued.

7.2 Sustainable Drainage Systems

Increasingly, we are looking to our streets to manage surface water with the increasing risk of intense rainfall as a result of climate change. We can use kerbs to help direct surface water into temporary storage and infiltration areas.

Sustainable Drainage Systems (SuDS) seek to reduce the amount of surface water entering drainage systems, provide water treatment, slow the flow of water into drainage systems and encourage water to soak into the ground.

A simple inlet from the carriageway into a planted storage/ infiltration area. A gap in the kerb run is finished with quadrant kerbs and a flush kerb between. The granite cubes slow the speed of the water as it enters the feature.

Talgarth Road, Hammersmith, London.
Kerb inlets being used to divert surface water into a planted storage area.

A small corner in a parking area with another gap in the kerb line to provide an inlet for surface water to enter.

Goldhawk Road, Shepherds Bush, London.
Kerb-inlets being used to channel water into a tree pit which is part of a cellular detention system with overflow to the sewer.

7.3 Vehicle Access Control

Kerbs can be used to prevent or discourage access or overrun by vehicles. We saw containment kerbs in Section 3.6, but we can be a little more subtle.

The kerb of the right of this footway has been installed to discourage people driving from the car park to the road. Much tidier than a line of bollards.

7.4 Continuous Treatments

For a long time in the UK, we have built junctions which suggest that drivers have priority. Where walking is concerned, this is despite Highway Code advice giving priority to people already crossing a side road.

Continuous footways and cycle tracks provide and reinforce the priority of people walking and cycling over side streets (often referred to as “visual priority” or “design priority”). Although this could have been covered earlier, it is a subject worthy of mention on its own.

High Street, Walton-on-the-Naze.
A wide kerb is used to help continue the footway across the side street. In this case, the kerb generally has a face of 25mm which drops to flush across the junctions. Note the tactile paving to assist visually-impaired people to recognise they are crossing an area used by traffic.

Lea Bridge Road, Waltham Forest.

Magee Street, Kennington.
Continuous footway and cycle track.
The kerb between the cycle track and the carriageway is dropped for vehicle access which is less comfortable for cycling across.

The last few years has seen suppliers introduce Dutch style “inritbanden” units to the UK, which are roughly translated at “entrance blocks”.

It's an apt description as the Dutch use them as transitions from main streets into side streets where drivers need to cross footways and cycle tracks to move between the two classes of street.

To provide the best level of service to people walking and cycling, we want to be able to keep footways and cycle tracks at a constant level through junctions. This is achievable with traditional UK kerbs, but the result can be fiddly and hard to construct and so we often end up with dropped kerbs in the cycle track.

The other (important) advantage of inritbanden is the fact that drivers have to negotiate the change in level and in doing so, they have to do it far more slowly than a junction where the layout suggests they have priority.

Middenweg, Amsterdam, Netherlands.
Inritbanden (dark grey) providing a ramp up to a paved verge, then cycle track and then footway.

The layout of junctions using inritbanden is also designed to promote tight turns and where possible, provide a buffer area between the carriageway and the cycle track. In addition, the side streets are generally low traffic with no through routes for motors. It is therefore important to consider traffic at the network level.

Inritbanden allow the level transition to be installed as a kerb line. The units are available in different sizes with varying ramp gradients.

Slightly steeper Inritbanden viewed from the side street. Note the special transition units on either side.

The first contemporary units to be used in the UK were on the Coundon Cycleway in Coventry with “entrance kerbs” supplied by Charcon (part of Aggregate Industries. The units are generally based on the Dutch units tweaked to fit with standard UK kerbs.

Coundon Road, Coventry.
Entrance kerbs slowing drivers as they turn.

The units are available in 750mm or 500mm deep variations with narrower versions are being developed for limited space situations.

Transition unit as supplied by Charcon.

Other suppliers have been thinking about developing their own versions, but Hardscape have been working with a Dutch partner to bring a wide variety of Dutch units (including entrance kerbs) to the UK as standard stock.

7.5 Stepped Cycle Tracks

We covered half-battered kerbs laid on their backs and Cambridge kerbs which have a slope of about 22° in Section 3.9 and 45° splay kerbs in Section 3.3. Both can be used as “forgiving” where the footway is “stepped up” above the cycle track, although the 45° splay kerbs are a little too steep.

Singel, Deventer.
30° *splay kerbs between cycle track and footway.*

The Dutch often use “rijwielpadbanden”, or cycle track kerbs which come in a variety of profiles and which generally have a maximum slope of 30° and a maximum upstand of 50mm (although there is variation).

Closer view. Note the textured finish to the surface of the kerb which will help reduce slip risk.

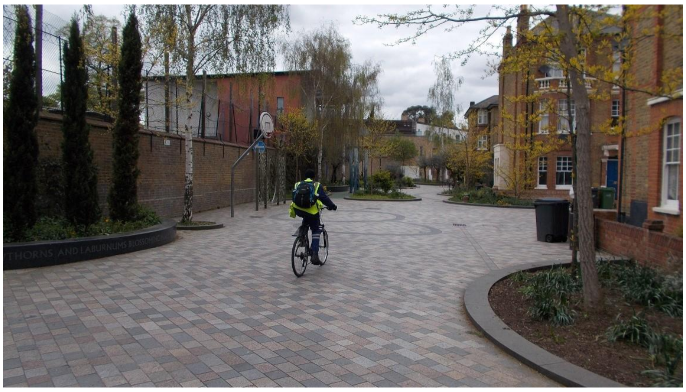
Hollyfast Road, Coventry.
30° kerb between the footway and cycle track.

The idea has now made it to the UK with Aggregate Industries supplying its 30° Bristol unit which like the Dutch uses a 50mm upstand.

7.6 Traffic Calming

Kerbs are integral to traffic calming schemes, used for traffic islands, build outs, pedestrian refuges and the like. Their use doesn't have to follow rigid conventions and perhaps some of the most effective schemes are where the kerbs disappear into the background.

Bridge Avenue, Upminster.
Kerbed planting beds within a 20mph Zone.



Van Gough Walk, Lambeth.
Bespoke kerb units creating planting beds for a low speed limited vehicle access street.

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References

[1] http://content.tfl.gov.uk/bus-stop-design-guidance.pdf

[2] https://www.gov.uk/government/publications/inclusive-mobility-making-transport-accessible-for-passengers-and-pedestrians

[3] https://www.gov.uk/government/publications/inclusive-mobility-using-tactile-paving-surfaces

[4] https://www.ucl.ac.uk/civil-environmental-geomatic-engineering/sites/civil-environmental-geomatic-engineering/files/steps_project_for_guide_dogs_association.pdf

[5] https://www.cycling-embassy.org.uk/wiki/barriers-cycling

[6] https://wheelsforwellbeing.org.uk/campaigning/publications-and-research/

[7] http://content.tfl.gov.uk/lcds-chapter3-streetsandspaces.pdf

[8] Roadwork: Theory and Practice, 5th Edition, Kendrick et al.

[9] http://www.hse.gov.uk/msd/index.htm

[10] http://www.hse.gov.uk/lung-disease/silicosis.htm

Resources

AJ McCormack & Son “The Paving Expert”
http://www.pavingexpert.com/home.htm

Suppliers

This list is not exhaustive and does not come with any particular recommendation or endorsement. Other suppliers are available.

Brett Paving – Kassel Bus Boarding Kerb
https://www.brettlandscaping.co.uk/professional/product/kassel-kerb/

Marshalls – Variable Bus Stop Kerb
https://www.marshalls.co.uk/commercial/kerb/products/marshalls-variable-height-bus-stop-concrete-kerb-system-webfa036060

Bomax – Scan Kerb (stick-down)
http://www.bomax.co.uk/scan-kerb/

Aggregate Industries – Cambridge Kerb
https://www.aggregate.com/products-and-services/commercial-landscaping/kerbs/cycle-kerb

Aggregate Industries – Entrance Kerb
https://www.aggregate.com/products-and-services/commercial-landscaping/kerbs/dutch-kerb

Aggregate Industries – Bristol Kerb
https://www.aggregate.com/charcon-rides-ahead-kerb-bristol-citys-cycle-scheme

Natural Stone Kerbs
http://www.cedstone.co.uk/kerb-edging

Combined Kerb and Drainage
https://www.pdsenviro.com/products/envirodeck/

Light Segregation
http://www.rediweldtraffic.co.uk/products/cycle-lane-products/orca-cycle-lane-product/

Marshalls – Standard Kerbs
https://www.marshalls.co.uk/commercial/product/british-standard-kerb

Green Blue Urban – Storm Water
https://greenblue.com/gb/product-category/stormwater-management/

Marshalls – Kerb & Drainage Systems
https://www.marshalls.co.uk/commercial/water-management

ACO – Kerb & Drainage Systems
https://www.aco.co.uk/products/kerbdrain

Durey Castings – Arterial Gullies
http://www.dureycastings.co.uk/shop/e-large-arterial-kerb-drainage-82.html

Hardscape – Dutch Kerbs
https://hardscape.co.uk/select/?fwp_category=active-travel-kerbs

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