

IWA policy statement on the operability of locks and moveable bridges

This is a Policy Statement by The Inland Waterways Association (IWA). It sets out desirable operational characteristics of locks and moveable bridges. IWA hopes that navigation authorities and restoration bodies will adopt it when locks or moveable bridges are to be repaired, reconstructed, replaced or newly built. It is intended for use on both existing and new waterways, as well as in the restoration of those that are currently derelict or abandoned.

IWA recognises that there may be conflicting considerations of heritage, safety, amenity and user-friendliness but will make navigation authorities and restoration bodies aware of the principles set out in this policy statement and encourage them to follow those principles as closely as is reasonably possible.

The heritage of our waterways should be an important consideration whenever works are undertaken to maintain, improve or restore structures such as locks and bridges. The diversity in design found on different waterways should be respected and followed, where possible, to maintain the individuality of each waterway. Nevertheless there are some issues, such as inadequate access across locks and lack of offside landing stages at moveable bridges operated from the offside, which should be considered on a case-by-case basis.

User operated devices are preferable to those which need supervision or attendance. Before installing any structure that is moveable, particularly if it is deemed to require supervision or attendance, consideration should be given not only to the initial cost but also to long-term costs of maintenance and manning. The convenience of users should also be a major consideration.

This Policy Statement should be read in conjunction with IWA's Policy Statements on other matters, such as the Policy Statement on Standards for the Construction, Restoration and Maintenance of Inland Waterways.

1. Locks

1.1 Dimensions

- a) The length, width, headroom and depth at the normal lower level of water in each lock should be sufficient to pass boats of the craft gauge of the waterway.
- b) Dimensions, particularly width and water depth, should normally exceed the minimum, so that water can be freely displaced as a boat enters and leaves.
- c) Allowance should also be made for fluctuations in pound levels, particularly on summit pounds.
- d) The craft gauge of the waterway should, where possible, be displayed at the entrance point to that waterway.

1.2 Boat Safety in locks

a) Sufficient bollards or hooks should be placed on the ground at the lock sides so that boats of varying length can be stopped using ropes, where necessary, and held as the lock is filled or emptied. Bollards are essential to enable a boat to be held while the engine is switched off when possible, reducing pollution to a minimum. Bollards should be designed to stop ropes slipping off them and should be maintained so as to be clearly visible.

b) In locks (other than narrow locks) exceeding 4 metres/13ft 6in rise, floating bollards, chains, rails, cables or ropes should be fixed down in recesses in the lock walls at intervals to suit varying boat lengths, so that craft can be held on their lines as the water level rises or falls. Recesses should be of sufficient width and depth to minimise any risk of hands or fingers becoming trapped.

c) Horizontal chains along lock walls should not be fitted, as there is a risk of boats becoming caught on them. Existing horizontal chains should be removed where possible to improve safety.

d) Mooring rings should not be used in place of bollards alongside lock chambers, as it is possible for ropes to jam if the free end becomes trapped underneath a ring as a boat falls.

1.3 Paddles

a) Top paddles, whether on the gates or in the ground, should be of sufficient size and suitable design to enable a lock to be filled quickly but safely and without undue turbulence and risk of flooding boats. Boaters should be warned by notice of any unusual risk inherent in operation.

b) Where paddles are fitted in gates above the lower water level in the lock, deflectors should be fitted to minimise the risk of water entering boats using the lock. Such deflectors should be designed to minimise the potential for blockage by leaves and other debris (for example, a single central board in front of [downstream of] the paddle opening is preferred to a grille comprising multiple elements).

c) Bottom paddles should be of sufficient size to enable a lock to be emptied quickly but without creating excessive turbulence and risking damage to boats waiting to enter.

d) All paddles should be maintained in operational condition.

e) New locks should be fitted with at least two top paddles and two bottom paddles, so that operability is maintained in the event of a paddle failure.

1.4 Paddle gear

a) Paddle gearing should be:

- of a ratio which enables operation by boat crews without undue difficulty;
- provided with low friction slides and paddles as standard;
- designed without unnecessarily low gearing;
- designed and maintained so that, when paddles are raised, they remain open until lowered;
- designed so that paddles can be closed quickly in response to emergency conditions;
- designed and maintained to minimise the risk of injury to operators;

b) In the case of gate paddles, vertical paddle links between winding gear and paddles themselves should be provided with guide straps, so that the links cannot be forced sideways and bent by careless boaters

c) On paddles operated by a removable windlass, spindles should be maintained to fit a standard windlass for that waterway.

d) Where it is consistent with the use of traditional equipment appropriate to the waterway, paddle gear should be mounted so as to accommodate a long throw (400mm/16in as opposed to the 250mm/10in or 300mm/12in commonly used) windlass, because from time to time all types of paddle gear can be difficult to operate.

e) Manually operated hydraulic paddles should not normally be fitted, as they can be unreliable, are slow to use and can delay a response to an emergency situation. Where these have been retrospectively fitted, consideration should be given to returning to traditional paddle gear as originally installed.

f) Traditional paddle gear, appropriate to each existing or restored waterway, including types not operated by a windlass, should be used in preference to other types. In those few instances where traditional paddle gear is not user friendly, discrete modifications should be made where practicable to remedy this. If this is not practicable, sufficient examples should be retained, in use where safe, to serve both as a living record and as an illustration of historic design. These should be protected by listed status (a good example is Wolverley Court Lock on the Staffs & Worcs Canal).

g) On waterways where gate paddles were fitted to supplement ground paddles, these should be retained or reinstated as and when top gates are replaced. At locks where queues develop regularly during busy periods, the addition of gate paddles, if not previously fitted, should be considered as a means of increasing boat traffic capacity.

h) To avoid wear and/or slipping of the windlass, spindles on new and restored locks should be to standard cross section dimensions.

i) Paddle pawls should not be installed in such a way as to prevent prompt dropping of the paddle gear in the case of an emergency. Paddle pawl stops should not be fitted if this

prevents the use of two hands to wind the paddle down and any that have been fitted retrospectively should be removed.

1.5 Access around locks

a) Where practicable, access should be provided to enable operators to cross both at the head and at the tail of every lock, either by the provision of handrails of a suitable height mounted on the gates, with footboards where necessary, and/or by a fixed bridge. This is not just a matter of convenience but is also necessary to hasten remedial action in cases of emergency. Footboards should be positioned as far as practicable so as not to interfere with navigation under all water conditions.

b) Where they are used for access across locks, all footboards, tops of balance beams and metal- or wooden-decked footbridges should have non-slip surfaces.

c) Where practicable and on all new locks, foot boards at lock tails should be fixed so as not to project into lock,

d) Lock tail bridges should be positioned wherever practicable so that access to them is not obstructed by balance beams.

e) Where possible the distance between the balance beam and steep drops or structures should allow easy safe access around the beam.

f) Where locks were fitted with provision for a towrope to be passed through a lock tail bridge, this provision should where practicable be retained or reinstated. Where new locks are built on an existing waterway, such provision should where practicable be included, if it was a feature of the waterway.

g) Steps should be provided at the tail of a lock for the easy dis/embarkation of crew. Where practicable, steps should be provided on both sides of broad locks and retained when previously provided at narrow locks.

1.6 Ladders and Steps

a) Ladders should:

- be positioned approximately one third of the way along each side of a lock, diagonally opposite each other. This should ensure that they are positioned clear of the waterfall zone (where water may overtop the gates), of the gate opening recesses and of top gate balance beams;
- be positioned so as not to interfere with use of bollards;
- extend sufficiently far below water level to enable a foothold to be gained easily by a person in the water;
- be recessed into the lock walls and have enough space at the rear to enable the users feet to be properly placed onto the rungs;

- have handrails extended sufficiently far above the lock copings to enable a person to leave the lock-side upright and without crawling.

1.7 Cills

- a) Cills should be designed to diminish the risk of boats being caught on them as a lock empties or fills.
- b) Positions of cills should be clearly marked on the lockside.

1.8 Lock Gates

- a) All lock gates should be designed for ease and safety of operation.
- b) Lock gates should be designed to minimise the risk of boats being caught on them as a lock empties or fills, or as a boat enters or leaves the lock.
- c) Single or mitred hinged gates will be the norm but other types, such as guillotine, radial or flap or sliding caisson gates may sometimes be suitable. If a guillotine gate is installed, consideration should be given to the fitting of separate paddles and power operation if feasible.

1.9 Balance Beams

- a) The outer ends of balance beams should be set at approximately the buttock height of an adult of average build.
- b) Balance beams should be fitted with handholds.
- c) Where the ends of full-length balance beams would be fouled by bridges or other structures, they should either be cranked, hinged or the gates operated through mechanical or electrically powered devices.
- d) Balance beams should not overhang the side of a lock, or other vertical or steep drop when the gate is open or being opened, and the ends should be located immediately outside the foothold quadrants.
- e) Balance beams should be designed and maintained to facilitate ease of opening.

1.10 Foothold Quadrants

- a) Footholds are an important facility to initiate the opening and closure of manually operated hinged gates with balance beams. The first three footholds for opening a gate should be provided to suit the position of an average adult's feet when pressing back on the end of a balance beam to open a gate. They should be spaced not more than 150mm apart. Intermediate footholds are optional but may be spaced up to 400mm apart.

b) A foothold is also required to initiate the closure of each hinged gate from the fully open position.

1.11 Water Control

a) Water level control became more sophisticated as the waterway system developed and various methods of water conservation were installed on some canals. Methods of control include the use of bywashes, back-pumping, lock gates as weirs, side ponds or "airhole" weirs. Some of these structures are no longer the most effective form of water control but there may be a case for retaining them on heritage grounds.

b) Where locks were equipped with side ponds and where a water conservation benefit can be identified, they should be reinstated. This also applies where duplicated locks are interconnected by a paddle for the same purpose.

c) Where side ponds are reinstated and made usable, they should be available for user operation. Clear operating instructions should be provided.

1.12 Bywashes

a) Bywashes should:

- normally be provided at all canal locks;
- preferably be on the non-towing path side so as not to interfere with the location of landing stages above or below the lock;
- be of sufficient size to prevent water from flowing over the gates during normal conditions;
- have weirs of sufficient length to prevent boats being drawn to them under normal conditions;
- have fendering where not submerged.

b) Where, exceptionally, bywash intakes are on the towing path side, they should be protected by grills.

c) The tail race from a bywash should be designed to minimise the effect of discharged water on a boat's steerage.

d) Air holes provided to relieve pressure in ground paddle culverts should be located away from the operating position.

e) Also sometimes known as "air holes", are bywashes which discharge into and not below a lock. These do not always function satisfactorily because at times of high flow, it may be difficult to achieve a level when emptying a lock. Bypassing such "air holes" with adequate conventional bywashes resolves this problem. If such "air holes" are retained for heritage or other reasons, they can fulfil a useful water saving function in association with a conventional bywash by holding water in locks at the upper pound level if there is no

requirement to leave them empty. On river navigations the weirs and control structures in the river itself will usually render a bywash unnecessary.

f) Navigation authorities, concerned about flooding of adjacent property, sometimes require canal locks to be left empty at all times even by boats ascending and even when there is a shortage of water. IWA will campaign to have such locks properly repaired and brought back to an acceptable and safe standard. Note that this is a different situation from river navigations, where locks may be required to be left empty for flood management purposes.

1.13 Working Space

a) Sufficient working space should be provided on both sides of a lock to minimise the risk of lock operators falling in, 2 metres/6ft 6 in should be sufficient but with, in addition, at least 0.5 m/1ft 6in working space at the end of a balance beam in any position (See 1.10 above).

b) Operational land should not be sacrificed when lockside properties and/or land are disposed of.

c) The working surface at the lockside should be level and of material suitable to allow safe operation of the lock throughout the year. Materials used should be consistent with those used in the canal's original construction.

d) Working space should be maintained as clear of obstructions as is possible, including excessive vegetation. The temptation to clutter lock sides with non-functional, cosmetic features should be resisted.

e) It may be necessary in some places to provide railings to separate working space from spectator areas. (See also 1.15 below.)

f) Working spaces and walking routes between them should be kept clear of obstructions and undergrowth.

1.14 Lock Walls

It is important that lock walls, whether in masonry, brickwork or other materials, are maintained so that:

- ledges and gaps do not develop on which boats can be caught whilst a lock is filling or emptying;
- voids do not develop that retain and then discharge water onto boats as the lock empties; and that are likely to develop into structural faults.

1.15 Railings

- a) Traditionally railings have only been provided at lock sides in exceptional circumstances. Where large numbers of the general public frequently assemble at locks, railings may be desirable but they should be clear of the working space (as defined above).
- b) Where railings are erected at locks, ample space should be allowed for lock operators to walk between the railings and the end of a balance beam when the gates are in either the closed or partly closed position.
- c) Railings and gates must not inhibit access for rescuers in an emergency.
- d) Railings should not be placed where they could inhibit lock or moveable bridge operators stepping on or off boats. Fixed bridges often offer the only opportunity for crew to disembark safely and railings should not be placed between the canal and towing path under such bridges.

1.16 Drop Locks

Drop locks may have to be considered at a canal crossing with inadequate headroom where a moveable bridge is deemed impracticable. However, health and safety considerations have led to their being deemed unsuitable for user operation, thereby increasing operational costs, and they should not be put in unless all other more practicable options, including user-operated devices such as a dropped pound, have been ruled out. Unless water can be pumped back into the adjoining pound(s), drop locks are likely to waste water.

1.17 Staircase Locks

- a) Staircase locks form interesting features on canals but, even if properly used, can be wasteful of water. New staircases should be avoided where alternative options are feasible, unless there is ample water supply, or space for side ponds, and the navigation authority allows user operation.
- b) Clear operating instructions should be provided at all staircase locks.

2. Moveable Bridges

2.1 General

- a) All user operated moveable bridges should be capable of being operated easily by a single handed boater. Moorings need to be provided both above and below the bridge on the side from which the bridge is operated.
- b) Powered operation may be necessary at major road crossings or other places where the size of the structure makes manual operation difficult or slow.

c) Some moveable bridges are normally left open to the waterway. Local agreements should be sought whereby this practice can be extended.

2.2 Safety and Security

a) Moveable bridges may need to be secured against vandalism or improper use (see also 3.3 below).

b) Provision should be made for all moveable bridges, and particularly lift bridges, to be secured when open to navigation. It is not satisfactory to have to rely on the bridge operator to hold it open whilst the boat goes through.

c) Where road barriers and warning lights are required, they should be interlocked with the bridge mechanism to prevent misuse by motorists or others.

d) Buffers should absorb excess energy but not cause the bridge to rebound.

e) Bascule bridges should tilt as nearly as practicable to the vertical, so as to give maximum clearance to boats, within the constraints of maintaining the waterway heritage.

f) Clear operating instructions should be provided at all moveable bridges where the method of operation is not obvious.

2.3 Operating Points

a) A landing stage is required on both sides of any moveable bridge, on the side of the waterway from which the bridge is operated. These should be well signposted, have sufficient depth of water and adequate bollards.

b) Where closing chains have been provided at some manually operated bridges they should be maintained or reinstated where necessary.

c) An extension lever should be provided, where necessary, at manual push-open type swing bridges to render them operable without undue difficulty.

d) Suitable footholds or paved quadrants should be provided at manual push-open type swing bridges.

e) Moveable bridges operated by a windlass should be geared to enable operation by boat crews without undue difficulty.

f) Operating mechanisms of moveable bridges have suitable drains to avoid accumulation of water and debris that may interfere with operation.

3. General

3.1 User Friendliness

- a) Locks should, wherever possible, be designed for unassisted user operation. Unnecessary assistance or supervision diminishes the pleasures of self reliance enjoyed by boaters and introduces additional expense whether or not that cost is borne directly by the boater, although IWA supports provision of lock keepers at tidal locks and locations where there is a traffic supervision role. Nevertheless assistance is appreciated by some boaters in specific circumstances and locations and should continue to be available for those who want it.
- b) All locks and moveable bridges should be designed, commissioned and maintained to be capable of operation by the 'average person'. Excessive force, agility or dexterity should not be necessary. Operation of locks and moveable bridges should be designed where possible to 'fail safe', by restraining or safely dispersing kinetic energy in structures and mechanisms so that injury is minimized where reasonably practicable.
- c) On non-tidal waterways, all locks and bridges should be available 24 hours a day and should be user-operable outside working hours, including use of powered operation where this is fitted.
- d) The navigation authority should maintain an operating regime that minimises delay, is relatively fast in operation and, as far as possible, avoids the need for a booking system.
- e) Clear operating instructions should be displayed at non-standard or unusual features, such as staircase locks, mechanised locks and bridges.
- f) Where traffic light style signals are used at locks and moveable bridges on non-tidal waterways, the signals shown should follow a consistent system throughout the network.
- g) Navigation authorities should plan for portage points at locks and (where appropriate) moveable bridges, to enable small craft users to avoid locks and to bypass moveable bridges.

3.2 Powered Operation

- a) Where locks or moveable bridges are powered or remotely operated, the operating instructions should be as simple and unambiguous as possible and clearly displayed. Partially powered operation with manual control of some functions, such as road barriers in quieter locations, may be appropriate.
- b) The mechanism should be programmed so that, after use of the emergency "STOP" button, operation can be resumed or reversed with either the "Open" or "Close" button. For reasons of safety or convenience it is essential that an operation can be immediately reversed.
- c) While timed devices are appropriate for limiting the rate at which locks fill or empty, systems should allow the user to limit the maximum rate of filling or emptying. Automatic

opening sequences over which the user has no further control once initiated should not be used.

d) Up to date emergency contact numbers should be clearly displayed for use in emergency or in the case of a failure.

e) Wherever practicable, powered devices should be fitted with manual override/backup to allow emergency operation in the case of power or mechanical failure, preferably without the need for attendance by navigation staff.

f) Where Navigation Authorities utilise outside contractors to carry out maintenance and emergency repairs to powered assets, it is essential that they have an efficient call out system operative at all opening times.

3.3 Lock and Bridge Security

a) It is recognised that in some locations locks and moveable bridges need to be protected against vandalism and misuse. Locking mechanisms should only be installed where there is a proven need. If justified, locking devices should be designed to be as user-friendly as possible. For instance, spring bolts can be released with one hand using a key and can be locked again without a key. The arrangements are less satisfactory when both hands are needed. If a key is required suitable notices should be placed in advance of structures advising of the type required.

b) In an emergency it may be necessary to lower or open paddles quickly. Systems where paddles have to be locked in the open position before the key can be withdrawn (in order to operate a further paddle) are not compatible with safety.

c) Navigation authorities should seek a common standard key to limit the number needed by users.

3.4 Landing Stages

a) Landing stages are usually designated sections of the towpath but may need to be specially constructed or formed by pontoons.

b) Landing stages should be provided at all locks and moveable bridges and should:

- be built without overhangs or projections that might damage or trap vessels;
- be sufficient to accommodate at least one boat of craft gauge;
- be provided with bollards or cleats, of adequate size for the vessels using the navigation, spaced so as to accommodate varying lengths of craft;
- have direct and easy access to the lock or bridge;
- have adequate depth of water for the craft gauge;
- normally be placed at the towing path edge or on pontoons but be on the off-side where required to suit bridge operation;

- be sited where boats will not be unduly affected by flows to or from bywashes and turbulence from emptying locks;
- be provided with timber, plastic or other fendering to protect boat hulls;
- be provided if feasible at all tidal locations with adequate depth of water at all times. Failing this refuge moorings should be provided nearby

c) On commercial waterways separate landing stages should be provided for use by commercial and leisure craft respectively. These should be clearly signed.

d) Activities which interfere with navigational uses should be prohibited at landing stages.

3.5 Novel Solutions

Novel solutions may be suitable for new waterways and may sometimes be appropriate for established or restored waterways. Such solutions should take account of principles set out in this document, particularly attendance, water supply and lifetime cost.

Version History

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