



Precast Concrete Box Culverts

Guide to Site Practice



Ideal for a wide variety of civil engineering and construction applications



Standard Precast Guide to site practice

The proven strength and performance characteristics of precast concrete box culverts, together with their excellent service life, make them ideal for a wide variety of civil engineering and construction applications.

Box culvert sections can be manufactured in a variety of shapes and sizes, offering exceptional versatility in the uses to which they can be applied. In addition to the more common use for diverting water courses, box culverts have been used in an array of applications including balancing tanks, pedestrian subways, access shafts, service tunnels, sea outfalls, road crossings and many other situations where the whole life costing consideration requires strength, durability and economy to be of paramount importance.

Unlike other materials, such as steel, precast concrete box culverts do not require additional treatments to prolong their useful life or improve performance, their surfaces do not rust and the smooth internal finish of concrete ensures optimum flow of water through the box culvert.

Precast concrete box culverts fulfil the current design life requirements for buried structures. The ability to provide many years of service with the minimum of maintenance makes precast concrete box culverts the most cost-effective means of diverting water course, especially with the ever present risk of corrosive elements in the water or soil.

Whilst the methods and procedures for the installation of precast concrete box culverts are familiar to contractors, careful attention to detail will lead to safer working, a smoother flow of operations and a higher standard of finished culvert.

This guide provides a reliable checklist for anyone engaged in the installation of box culverts. It is published by the Box Culvert Association to encourage good practice in the use of precast box culverts.

TAKING DELIVERY

- The contractor is normally responsible for off-loading box culverts and should:
 - Agree with the supplier well in advance the place and approximate time of delivery.
 - Provide a hard access which can be used safely by standard delivery vehicles.
 - Provide a suitable crane of adequate capacity.
- Lifting methods differ between box culvert manufacturers. Holes for eye-bolts, threaded lifting sockets or projecting loops are commonly used but other methods may be employed. The contractor should:
 - Ascertain details of the lifting method used by the supplier.
 - Provide all handling equipment necessary to operate the lifting method on site.
 - Ensure that any non-standard attachment to the lifting point is supplied and that full instructions are given for its use.
- Where other methods, such as lifting forks, beams or slings are to be used the contractor should:
 - Consult the box culvert supplier to ensure that the proposed method is acceptable.
 - Protect the box culvert and particularly the joining surfaces from damage while lifting.
 - Ensure complete safety of operatives.
- Generally, box culverts are transported as laid, but for safety or economy, the box culverts may be transported on end. The contractor should:
 - Check with the supplier how the box culverts will be delivered.



- Where box culverts are delivered on end, establish a safe method of turning.
 - Provide any equipment necessary for the operation.
- The box culverts may be off-loaded into a storage area or they may be placed in line alongside the trench in which they are to be laid. In either situation:
 - Before offloading, check the box culverts for any damage which may have occurred in transit and report any defects promptly to the supplier.
 - Lower them carefully on to a firm level base away from the edge of the trench.
 - Move them by lifting and never by dragging.
 - In cold weather, protect open lifting sockets from freezing and bursting.

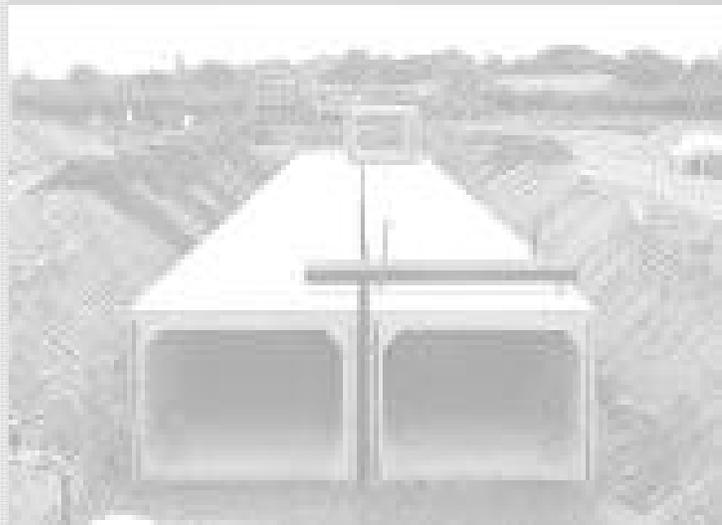
JOINTING MATERIAL

- The box culvert manufacturer may supply jointing material. If required, but not supplied by the box culvert manufacturer, the jointing material should be ordered in good time.
 - Establish the type of jointing material and whether any primer is necessary.
 - Measure the quantity required and allow for wastage.
 - Where seasonal grades are available, specify the grade required.
- The jointing material supplier should provide detailed recommendations for the use of the products.
 - Check the quantity and type of material on receipt.
 - Note any special requirements for storage.
 - Ensure full application instructions are followed by operatives.
- Damage to the profile of preformed jointing materials will impair efficiency.
 - Store cartons flat and protect from extremes of temperature.
 - Stack to a limited height to avoid crushing.
 - Prevent contamination from solvents.

PREPARING THE TRENCH

- Keeping to the specified line and gradient, the trench should be excavated to a width

Box Culverts



equal to the box culvert width plus about 600mm for most conditions.

- Keep the width to a minimum to avoid unnecessary excavation, bedding material and backfill.
 - Follow the normal requirements for safety when working in trenches.
2. Full load bearing capacity of an installed box culvert line is achieved with uniform support at the base.
 - Carefully trim the formation to the required depth and gradient making allowance for the thickness of the bedding.
 - Excavate local hard or soft areas of the trench bottom which may cause uneven settlement and replace with well-compacted backfill selected to give uniform support.
 - Maintain a dry formation so far as possible by diverting water courses, pumping water from the trench or other means.
 - In clay soils, leave a protective layer of material in the trench bottom until just before the bedding is laid.

BEDDING

1. Bedding is intended to level out any remaining irregularities in the trench bottom and ensure uniform support under the full width and length of the box culvert.
 - Lay well-compacted selected granular material over the full width of the trench to a minimum depth of 200mm having first removed any protective layer.
 - Blind the surface with fine material to assist levelling.
2. Having achieved a flat, well prepared base, it should not be allowed to deteriorate.
 - Lay the bedding only a minimum distance ahead of the laying of box culverts.
 - Keep off the prepared base so far as practicable.
3. As an alternative to granular bedding, a concrete blinding layer is sometimes preferred to protect the formation or to allow faster laying of box culverts.
 - Lay a thin flat apron of unreinforced lean-mix concrete about 75mm thick on a trench bottom which has been well prepared to a uniform firmness.



APPLYING THE JOINTING MATERIAL

Joints may be left open in certain cases but a preformed strip compressed within the joint is commonly used. The strip should be applied to the box culvert just before it is laid in the trench.

- Where necessary, clean and prime the inner and sloping faces both spigot and socket and allow to dry.
- Place the strip in the internal corner of the socket or where otherwise directed.
- Cut mitred ends and join the strip at corners and do not bend the strip.
- Check all the joints in the strip to ensure that the strip is continuous.
- Always follow the recommendations of the manufacturer of the jointing material.

LAYING THE CULVERTS

A box culvert line is usually laid from the downstream end with sockets facing upstream to receive the next box culvert to be laid.

- Inspect the box culvert before laying to ensure that the jointing surfaces are clean and that no damage has occurred in handling and storage on site.
- Lower the box culvert carefully on to the prepared base aligning the spigot with the socket of the unit already laid.
- Prevent loose surface bedding material from entering the joint space during positioning of the unit by placing a hardboard strip beneath the base joint or by any other means.

- If any adjustment to level is necessary, remove the box culvert and adjust the surface level of the bedding.
- Do not use local packing to adjust the level.

MAKING THE JOINT

When a preformed strip is used, joints are closed by pulling against the box culverts previously laid.

- Anchor cables firmly at each end.
- Take on the crane the weight of the box culvert being jointed to reduce frictional resistance at the base of the box culverts.
- Allow for a load of approximately one tonnes per metre of strip to compress the strip.
- Apply heat, as recommended, to soften bitumen-based strip when the weather is very cold.
- Close the joint with cable pullers to the specified nominal gap.
- On completion, make good any holes used for lifting and laying.

To provide an internal seal or to improve hydraulic flow, joints in box culverts of sufficient size for access may be pointed internally. This can take the form of an elastomeric or bitumen-based sealant or even a sand cement mortar.

BACKFILLING

Backfilling should commence as soon as possible after the box culverts have been laid.

- Fill the trench to the level of the top of the box culvert working evenly on each side.
- Use selected backfill material well-compacted in layers not exceeding 200mm
- Do not use heavy vibratory equipment.
- Continue filling over the box culvert and compact in layers.
- Do not run heavy rollers or construction plant over the box culvert without protection.

Care must be taken since site traffic and construction equipment over shallow fill depths can impose loadings greater than those for which the finished box culvert has been designed. In such cases protective measures will be required.

Comprising the United Kingdom's leading manufacturers of precast concrete box culverts, the Box Culvert Association is actively involved in research and development programmes aimed at extending the application of box culverts and advancing installation techniques to speed construction and maximise efficiency.

The Association produces a number of publications to assist in correct specification and installation of precast concrete box culverts. These include:

- Guide to Site Practice
- Proven Strength and Performance
- Good Site Practice DVD available on our website

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