

# Hynds Box Culvert System

Technical Guide D8.1

Hynds precast concrete box culvert units simplify the construction process, providing a fast and cost-effective solution that is often more economical than the in-situ construction option.



12.22 | DRAINAGE | D8.1 BOX CULVERT SYSTEM

## Applications

Stock underpass for rural highway crossings

Pedestrian tunnels

Stormwater culverts

Vertical chambers

## Product Attributes

Large range of strengths and opening sizes

Optional precast wingwalls and headwalls available to match

Various joint sealing options available

Lower fill covers possible, above the precast unit

## Quality

ISO 9001:2008 Quality Management Standard

## Approvals/Standards

Purpose designed for various load configurations up to HN-HO-72

NZS 3101, Concrete Structures Standard

NZS3109, Concrete Construction

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PIPE SYSTEMS

Hynds precast concrete box culvert units simplify the construction process, providing a fast and cost-effective solution that is often more economical than the in-situ construction option.

### Product Attributes

- Customisable for special conditions or shapes
- Longer life and smoother surface compared to steel culverts
- Simplifies preparation of site plans for council approval

### Design Options

- Stormwater Culverts: Opening width and height is determined by the hydraulic requirements of the specific site. Hydraulic calculations can be performed by referring to the CPAA "Hydraulics of Precast Concrete Conduits Manual".
- Pedestrian Tunnels: Opening size is to be determined by the tunnel space desired. For Pedestrian Tunnels, this is usually dependant on the NZ Building Code.
- Recommendations for herd sizes:
  - For a herd size of 450 – 650 head of cattle, a 2 m x 2 m\* box culvert should be the minimum size opening selected.
  - For a herd size of 650 head of cattle or more, the recommended minimum size of the box culvert should be a 3 m x 2 m\* structure.

**\*Please note:** The recommendations above are based on the assumption that the underpass is not too close to buildings on either side. Sizes are span x depth.

**Vertical Chambers:** Hynds box culvert units may also be used to form vertical chambers.

### Wingwall Options

Hynds supply wingwall panels with fixing holes, brackets and dressing sets so that the panels can be fixed to the box culvert. These panels have reinforcing starter bars protruding at the bottom of the panel. The bars are fixed to the base reinforcing mat, and the base is then poured in-situ on site by the contractor.

### Headwall Options

Hynds will supply the end units of the conduit structure with suitable headwalls as part of the box culvert unit if requested.

**TABLE 1** Standard box Sizes & Weights(tonne)

Height (mm)	Width (mm)	1200	1500	2000	2500	3000	3500	4000
	Thickness (mm)	200	175	200	200	200	225	250
<b>900</b>		4.3	-	-	-	-	-	-
<b>1000</b>		-	4.6	5.9	6.7	7.6	9.4	10.4
<b>1500</b>		-	5.2	6.7	7.6	8.4	10.3	11.3
<b>2000</b>		-	-	7.5	8.3	9.1	11.1	12.2
<b>2500</b>		-	-	-	9.1	9.9	12.0	13.1
<b>3000</b>		-	-	-	-	10.8	12.9	13.9
<b>3500</b>		-	-	-	-	-	Larger sizes made to order	
<b>4000</b>		-	-	-	-	-		

Alternate sizes are available on request – Standard unit length is 1550 mm

Weights are approximate for a Standard middle culvert unit (excludes headwalls)

### Culvert Dimensions

- Hynds Box Culvert Systems are made to order.
- A variety of opening sizes are available to suit most farm types and stock quantities.
- Box culverts dimensions can be customised for specific site conditions. (e.g. matching existing box culverts.)

**Note:** Preferred sizes are detailed in Table 1.

### Culvert Strength

- Culvert strength is dependent on earth loads, highway loads and cover to the finished culvert.
- Hynds Technical Services Department will design the precast concrete box culverts to suit the specified highway loading and cover.
- Recommended minimum cover over the box culvert is 400 – 500 mm.

### Concrete Surface Finishes

- Hynds Box Culverts are generally manufactured to F3/F4 finish as detailed in NZS3114:1987 – Specification for Concrete Surface Finishes. This finish is typical of structures which will not be seen or are only going to be observed from a distance.

- Higher classes of finish may be required in elements subject to frequent observation (F4), subject to frequent close scrutiny (F5) or elements with painted surfaces. In these instances the finish required must be advised at time of quotation and a sample panel will be cast and approved prior to commencement of manufacture.

## Installation

Culvert and wingwall units are delivered to site by our trucks. Off-loading can be arranged if required. Culvert installation should be done by an experienced contractor who understands the necessity of jointing, bedding and backfilling the structure properly as well as the highway safety requirements applicable to such an installation.

## Handling

Box culvert units are normally supplied with swiftlift anchors cast into the top of each unit. Appropriately rated chains and lifting beam must be used when handling the units.

Lifting anchor positioning and lifting equipment specifications can be supplied upon request.

All Hynds Box Culvert System incorporate Swiftlift lifting anchors for safe lifting and must be used with the correct lifting clutch.

Hynds Pipe Systems has designed and manufactured Hynds Box Culvert System with a minimum dynamic factor of 1.2. This dynamic factor requires that all the following conditions are observed when lifting, moving or placing the culverts:

1. Lifting with mobile plant (*such as an excavator or similar*) where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
  - a. Transporting the element as close as practical to ground level (300mm recommended)
  - b. Establishing and maintaining exclusion zones
  - c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
  - d. Inspecting lifting anchors both after transportation and before final lifting into place

Refer to "Safe work with precast concrete - Handling, transportation and erection of precast concrete elements" published by Worksafe New Zealand (October 2018)

Shock loads resulting from travelling with suspended Hynds Box Culvert System over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.

## Basic Bedding Preparation

- Sufficient foundation support and backfill compaction is required to prevent settlement of the imported layers conduit after installation.
- The bedding must be able to support the full load of the installed culvert, its contents, and the loads above the culvert. For this reason the box culvert should be laid on compacted granular hardfill to the specified line and gradient.
- Bedding design for a box culvert conduit should be undertaken by a local consulting engineer as local knowledge of ground conditions is important to ensure a successful installation.
- As a general guide, the compacted thickness of a basic bedding over the full width of the trench can vary between 150 to 250 mm (depending on culvert bearing loads) with compacted layers not exceeding 150 mm thick.
- Trench width for most installations should be equal to the external width of the culvert plus 600 mm.
- Local soft spots in the trench must be excavated and the voids filled with well compacted hardfill to provide uniform support under the entire structure. This must provide a bearing capacity of a minimum of 100kPa. Failure to do so could result in settlement of the units at a later stage.

## Jointing

- Hynds Box Culverts are manufactured with the quatro joint which together with the dog bone connector locates and locks adjacent units together.
- Joint gaps will vary from 5 to 20 mm and in most cases can be left open.
- Joint sealing can be formed with the use of butyl mastic sealing strips, epoxy, sand-mortar mix, or silicone sealant. Contact your local Hynds Sales Branch for these products.

## Laying

- A box culvert line is usually laid from the downstream end with the sockets facing upstream to receive the next culvert to be laid.
- The box culvert units should be inspected before laying to ensure that the jointing surfaces are clean.
- The unit is then lowered carefully onto the prepared base, aligning the spigot with the socket of the unit already laid.
- Loose surface bedding material must not enter the joint space between the units – particularly along the bottom – during positioning of the unit.
- If any adjustment of level is necessary, remove the box culvert, adjust the surface layer of the bedding and place again. Do not use local packers to adjust the level



- Hynds Box Culverts are manufactured with our exclusive Dog Bone Connector System. The units can then be tied together on site by a specialist contractor once the units have been installed. Recommended practise is as follow:

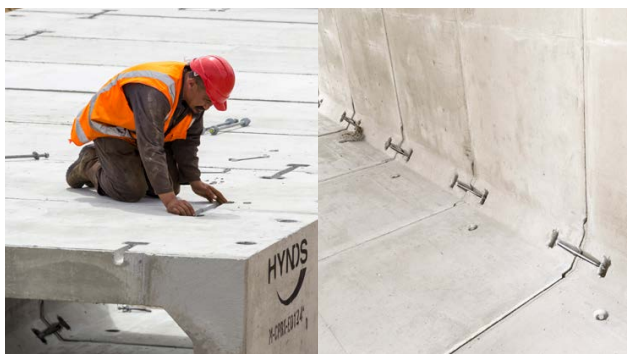
- Place first box culvert into required position.
- Using the crane, position the second culvert as close as possible to the previously installed culvert, and whilst being supported by the crane pull the culverts together with come-alongs attached to the internal swiftlifts.

**Note:** DO NOT use the dog-bone connectors to pull the culverts together.

- Line up two half dog-bone connector recesses.
- Place threaded rod connecting set in groove.
- Tighten nuts equally at each end using a socket wrench and an  $\varnothing$  16 set to a maximum torque of 100Nm (standard use). Fill recess with Sikagrout 212 or equivalent.
- See Figures 1-4 for visual steps.
- Alternatively Hynds Box Culverts can be manufactured with a duct in each corner. The units can then be bolted together or post-tensioned on site. Recommended



**FIG. 1** Place first culvert into required position  
practise is to insert the tie rods as the first unit is placed and push through subsequent units as they are installed.



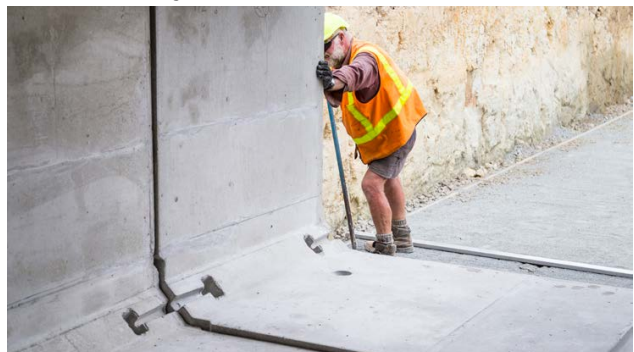
**FIG. 3** Place threaded rod connecting set in groove. Tighten nuts equally at each end, using a socket wrench to a maximum torque of:  
 $\varnothing$ 16 set: 100 Nm;  $\varnothing$ 20 set: 125 Nm;  $\varnothing$ 24 set: 150 Nm

### Dog Bone Connector Jointing System:

Hynds Box Culverts are manufactured with our exclusive Dog Bone Connector System, the ideal solution for tying together culvert sections. This system combined with the preformed Quatro joint allows a fast and accurate lock of adjacent units.

### 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 culvert working evenly on each side.
- Use selected backfill material well compacted in layers not exceeding 200 mm thickness.
- Do not use heavy vibratory equipment.
- Continue to fill the culvert conduit in well compacted layers
- Do not run heavy rollers or construction equipment over the culvert conduit without checking beforehand that the units are designed to withstand these loads.



**FIG. 2** Place the next culvert as close as possible to desired position and then pull into correct position with a come-along, connected to the swiftlifts in the culvert. Line up two half dog-bone connector recesses.



**FIG. 4** Fill recess with Sikagrout 212 or equivalent.

Branches Nationwide Support Office & Technical Services 0800 93 7473

**Disclaimer:** While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.