MJB Industries

Concrete Pipe & Precast

PIPE & PRECAST MANUAL

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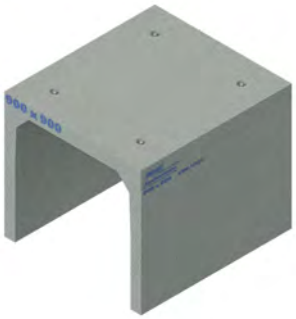

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Introduction

MJB Industries Pty Ltd is a state wide supplier of concrete pipe and precast products that prides itself on quality and service. A family business, MJB travels the path of continuous improvement in all facets of the business, from product manufacture to training of our staff. Since the beginning, MJB has become a supplier of choice for many civil contractors throughout Western Australia.

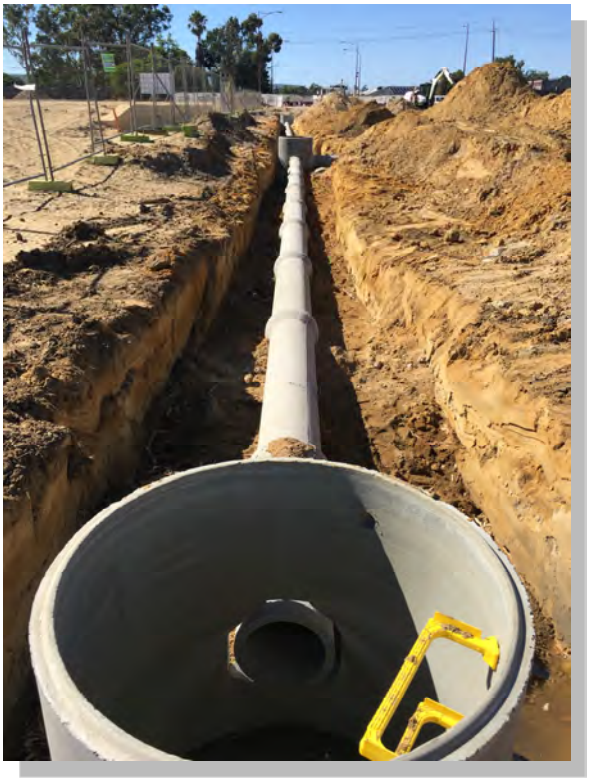
The precast range includes up to six metre span Box Culverts, Grated/Junction/Side Entry Pit Covers including the Main Roads range (i.e GT, HN, RT) and precast base slabs to suit. We produce some of the largest size Headwalls in the industry, allowing for multiple barrels and Main Road Traversable Headwalls with Guard Rails. Three metre high and greater L-Shape and T-Shape Retaining Walls, Custom Size Panels, Cattle Troughs, Septic Systems and many more, all whilst maintaining a high quality product and great customer service.

The diverse range of products includes 300Ø pipes through to 2100Ø. Our small to medium pipe range is manufactured using Bi-Directional technology, ensuring dimensional accuracy and identical joins for all pipe classes. The 'D' profile rubber ring design improves jointing properties. There is very little waste from the pipe production, and any waste concrete is stored for future recycling purposes.

MJB continues to be a major supplier to the South West and beyond, using its own transport division to supply to Kununurra in the North and Esperance in the South.

To complement the range of products that MJB manufactures we also stock:

- Stormwater Pipe (To Main Road Specification)
- Stormwater Pits
- Main Roads Covers: GT, GN, HN & RN
- Box Culverts To Main Road Specification, Rail and Custom Loading
- Specialised Precast
- Tilt Panels



We invite you to call us with any enquiries that you may have. Please contact our sales team at sales@mjbindustries.com

As the company grows, MJB follows the path of continual improvement, developing our workforce and meeting our customer needs to ensure the highest quality product is produced and delivered. MJB is committed to the following objectives:

- Compliance with Australian Standards & Regulatory Requirements.
- Continual Improvement of our processes.
- Training and competency of our workforce.
- Building Customer Relationships.
- Maintaining partnerships with our Suppliers.

Customised Design and Development for the Client

MJB Industries design and draft to provide solutions that meet customer needs. MJB work with the customer to achieve effective outcomes.

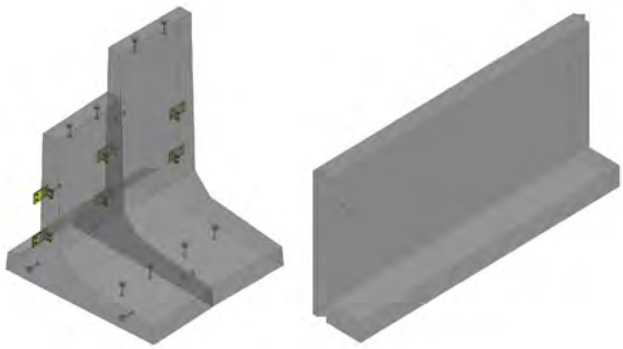
We seek to understand the customer requirements and give them a value for money solution which ticks all the boxes, including engineering, aesthetics and practicality.

MJB manufactures custom made products, including boat ramps, reef structures, bridge beams, tilt panels and more.

Each product is strictly quality controlled, subject to the Quality Assurance standard ISO 9001.

MJB is constantly refining its processes, and this occasionally leads to research and development of new methods and technology. MJB aims to deliver research based solutions to its customers when required.

Contact MJB to discuss your needs and see how we can assist you in developing a solution for your job at sales@mjbindustries.com or (08) 9797 0999.



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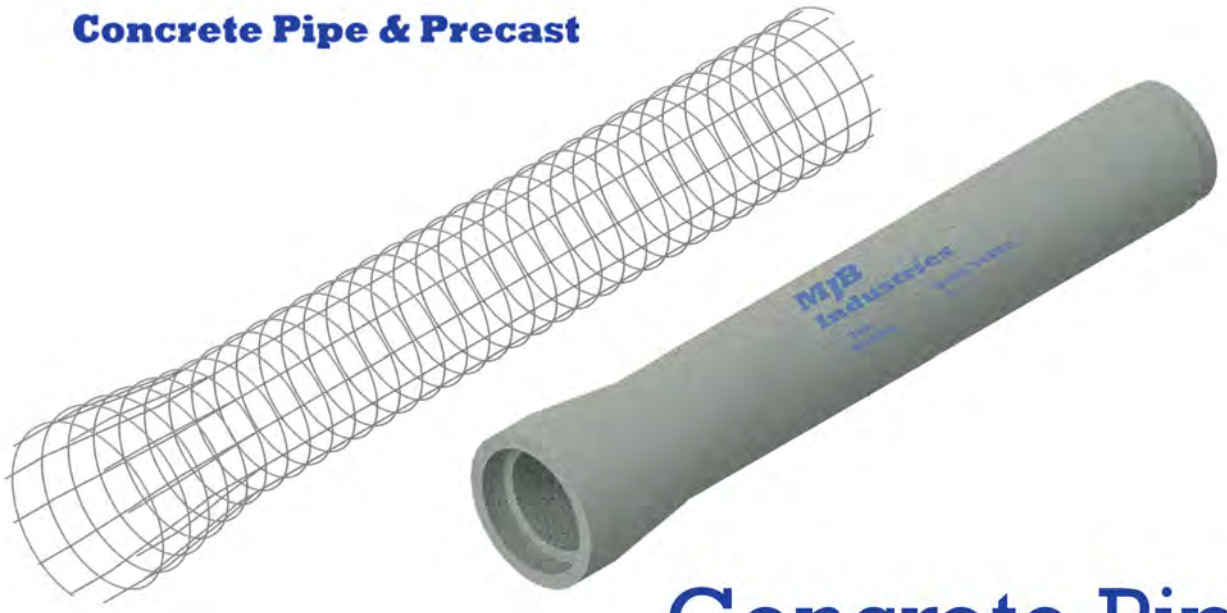

Concrete Pipes
General Information

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Concrete Pipes

This manual is to be read in conjunction with AS/NZ 3725 Design for installation of buried concrete pipes and AS/NZ 4850 Precast concrete pipes (pressure and non-pressure)

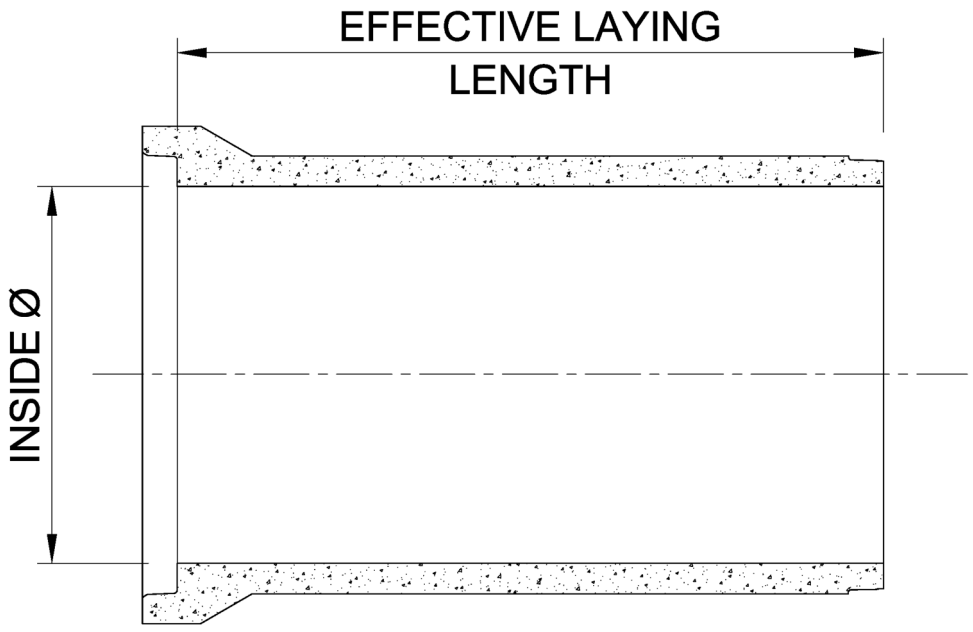
Manufacturing

MJB Industries manufactures steel reinforced concrete pipes made from coarse and fine aggregates and cement. MJB Industries concrete pipes are manufactured with a rubber ring joint type (RRJ). Our products undergo an extensive quality checking procedure according to the AS/NZ 4058. Once the pipes have been checked the pipes are then marked with a red tick.

Pipes classes are easily identified by following the colour code specification laid out in the AS/NZ 4058. White is used for Class 2 pipes, red for Class 3 pipes, yellow for Class 4 pipes and green for Pipe Class's greater than 4.

When elliptical reinforcement is used in pipe diameters from Ø1200 and larger , a blue marker indicating top of pipe is applied on top of the class coding colour.

Reinforced concrete pipes are typically manufactured in nominal 2.34m to 2.44m lengths to optimize transport and handling. Custom lengths can be manufactured on request.



Variable properties of a concrete pipe

MJB Industries pipe dimensions

MJB Industries
Concrete Pipe & Precast

Pipe Size / Class	Wall Thickness (mm)	Pipe Wgt (t)	Socket O.D. (mm)	Socket I.D. (mm)	Socket Depth (mm)	Barrell O.D. (mm)	Spigot O.D. (mm)	Laying Length (m)
300 / 2 / 4	38	0.250	454	370	78	375	348	2.34
375 / 2 / 4	37	0.310	546	451	78	449	435	2.34
450 / 2	43	0.410	643	540	92	536	518	2.34
450 / 4	50	0.510	643	540	92	550	518	2.34
525 / 2	46	0.560	734	620	95	617	599	2.34
525 / 4	59	0.670	734	620	95	643	599	2.34
600 / 2	49	0.660	822	697	99	698	659	2.34
600 / 4	62	0.750	822	697	99	724	659	2.34
750 / 2	65	1.107	1005	871	99	880	850	2.34
750 / 4	75	1.190	1005	871	99	900	850	2.34
900 / 2	69	1.376	1184	1041	106	1038	1019	2.34
900 / 4	84	1.550	1184	1041	106	1068	1019	2.34
1050 / 2	72	1.760	1340		106	1195	1163	2.34
1050 / 4	100	2.190	1340		106	1250	1163	2.34
1200 / 2	85	2.240	1527		106	1370	1324	2.34
1200 / 4	115	2.900	1527		106	1430	1324	2.34
1350 / 2*	85	2.700	1716	1514	120	1510	1475	2.44
1350 / 4*	115	3.420	1716	1514	120	1510	1475	2.44
1500 / 2*	95	3.450	1886	1674	130	1670	1634	2.44
1500 / 4*	120	4.180	1886	1674	130	1670	1634	2.44
1650 / 2*	95	3.660	2055	1834	130	1830	1794	2.44
1650 / 4*	115	4.280	2055	1834	130	1830	1794	2.44
1800 / 2*	100	4.215	2226	1994	130	1990	1948	2.44
1800 / 4*	135	5.553	2226	1994	130	1990	1948	2.44

- Dimensions are in millimetres (mm) and are considered nominal measurements only.
- Nominal laying length dimensions is in metre (m).
- Product weights given are in tonnes (t).
- * Indicates elliptical reinforcement with top of pipe marking.

Durability

MJB Industries pipes are designed to comply with AS/NZ 4058. Based on past experience of concrete pipe installations, a service life of 100 years could be expected when pipes are installed in accordance with AS/NZS 3725 in a 'normal environment' and 'marine environment', as defined in this Standard. Pipes subject to 'other environments' (i.e. more aggressive) should be assessed for suitability using appropriate engineering judgement.

There are a number of concrete properties that influence the durability of the product. These properties include compressive strength, density, water absorption, water/cement ratio, alkalinity (the amount of cement in the concrete), cement type, and aggregates.

The **compressive strength** of MJB concrete pipes are in the range of 60 MPa. The strength of the pipe is dependent on the materials used in the concrete mix, such as aggregates, cementitious material, and additives. It is also dependent on the mix design, manufacturing techniques and the curing process. MJB have through rigorous testing perfected its concrete mixes to achieve a high strength to ensure our product exceeds the requirements of Australian Standard 4058.

Water absorption is used to check the density and impermeability of the concrete. Water absorption can be greatly influenced by both the aggregates and the manufacturing process used. AS/NZS4058-2007 specifies a maximum allowable absorption of 6% for all concrete pipes.

A **low water/cement (W/C) ratio** is related to a high compressive strength and makes for a durable concrete pipe. Typical reinforced concrete pipe in Australia and New Zealand have a water/cement ratio that ranges between 0.35 to 0.40.

Alkalinity is influenced by the cementitious content in the mix, and includes both cement and fly ash. The key to high alkalinity and proper cementitious content is in the design of the mix, with consideration given to all the material properties used, as well as the manufacturing and curing processes. Alkaline concrete is usually indicated by pH values between 12 and 13.

Coarse and fine concrete pipe **aggregates** meet the requirements of AS2758. Aggregates are key in producing a quality concrete pipe. With regards to strength, durability and performance, all aspects of the aggregates should be considered. These include gradation, absorption, specific gravity, hardness, and in some cases alkalinity.

Non Pressure Pipe

All pipes manufactured by MJB are for non-pressure and non-watertight applications

Load testing

The numeric classification system adopted to identify the load carrying capacity of concrete pipes is based on the rationale that any particular pipe class is able to carry approximately the same proportionate height of fill. For example, a class 10 pipe can carry five times the height of fill of a class 2 pipe, under the same installation conditions.

Routine performance tests are carried out on all diameter sizes manufactured. Pipes are tested, using appropriate testing to withstand both proof loading (cracking) and ultimate loading.

Proof loading is the indicated load applied on a concrete pipe without the formation of cracks greater than the test cracks specified in accordance with AS/NZ 4058.

Ultimate loading is calculated as 1.5 the proof loading for standard strength classes, and 1.25 the proof loading for super strength classes. It represents the maximum designed load which the pipe can withstand before reaching structural failure. Tabulated below is all the specific loading classes to which all manufactured pipes have to comply with.

The required strength of a concrete pipe depends on both the load to be carried by the installed pipe, and the supporting ground installation conditions.

The load class for concrete pipes can be determined by consulting AS/NZS 3725: Design for Installation of Buried Concrete Pipes which provides methods for determining the installed load on concrete pipes from the earth fill over the pipes as well as any induced live (vehicle) load effects.

The load transmitted onto the pipe depends on the height and the type of fill material. Also, when installed in a trench, the width of the trench at the top of the pipe is important.

Generally, the wider the trench, the greater the load for any height of fill over the pipe.

Load testing

Test loads for various classes of concrete pipes according to AS/NZ 4058

MJB Industries Concrete Pipe & Precast

		Class 2		Class 3		Class 4	
Size / Class / Wall	Cover to Steel	Proof	Ultimate	Proof	Ultimate	Proof	Ultimate
300 / 2, 4 / 34	13mm	35.10	53.82	53.82	79.56	70.20	105.30
375 / 2, 4 / 37	14.5mm	39.78	60.84	60.84	91.26	79.56	119.34
450 / 2 / 43	17mm	46.80	70.20				
450 / 4 / 50	20+mm			70.20	105.30	93.60	140.40
525 / 2 / 46	17.4mm	53.82	81.90				
525 / 4 / 59	20+mm			81.90	121.68	107.64	161.46
600 / 2 / 49	18.9mm	60.84	91.26				
600 / 4 / 62	20+mm			91.26	138.06	121.68	182.52
750 / 2 / 65	20+mm	74.88	112.32				
750 / 4 / 75	20+mm			112.32	168.48	149.76	224.64
900 / 2 / 69	20+mm	86.58	131.04				
900 / 4 / 84	20+mm			131.04	196.56	173.16	259.74
1050 / 64 / 73 / 83	20+mm	102.48	153.72	153.72	231.80	204.96	307.44
1200 / 82 / 82 / 102	20+mm	112.24	168.36	168.36	253.76	224.48	336.72
1350 / 85 / 95 / 105	20+mm	122.00	183.00	183.00	275.72	244.00	366.00
1500 / 90 / 100 / 120	20+mm	131.76	197.64	197.64	297.68	263.52	395.28
1650 / 95 / 105 / 115	20+mm	141.52	212.28	212.28	319.64	283.04	424.56
1800 / 100 / 110 / 140	20+mm	151.28	226.92	226.92	339.16	302.56	453.84
2100 / 100 / 110 / 140	20+mm	170.80	256.20	256.20	385.52	341.60	512.40

- Test loads in kilonewtons (kN) per length

Pipes for drainage applications

Rubber Ring Joint (RRJ) pipes are recommended for Stormwater drainage systems. RRJ pipes up to Ø1800 are supplied with a belled-socket joint, while those larger that Ø1800 are supplied with an in-wall joint (see figures 4.1 and 4.2).

RRJs provide concrete pipes with a high degree of flexibility to accommodate ground settlement or alignment adjustments.

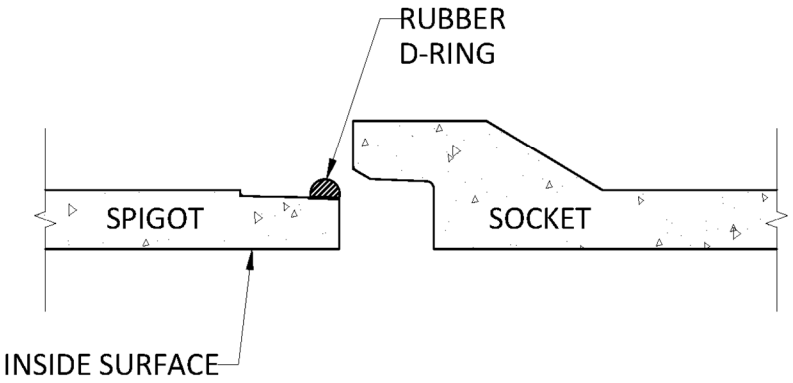


Figure 4.1a - RRJ Pipe with Belled Socket Joint—Before

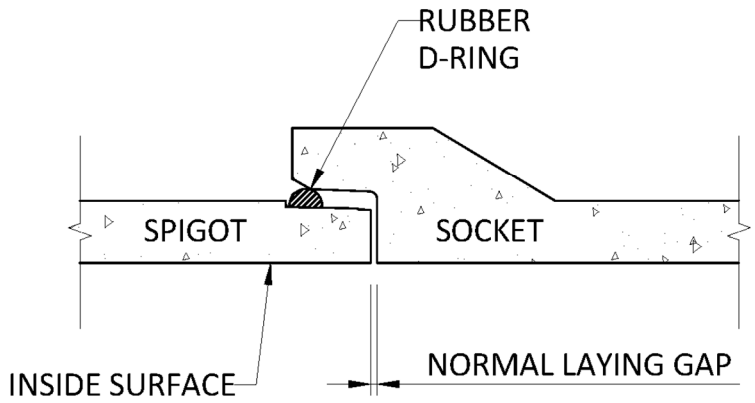


Figure 4.1b - RRJ Pipe with Belled Socket Joint—After

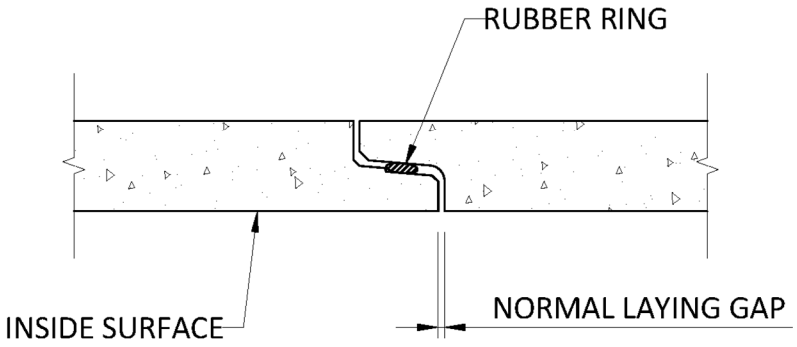
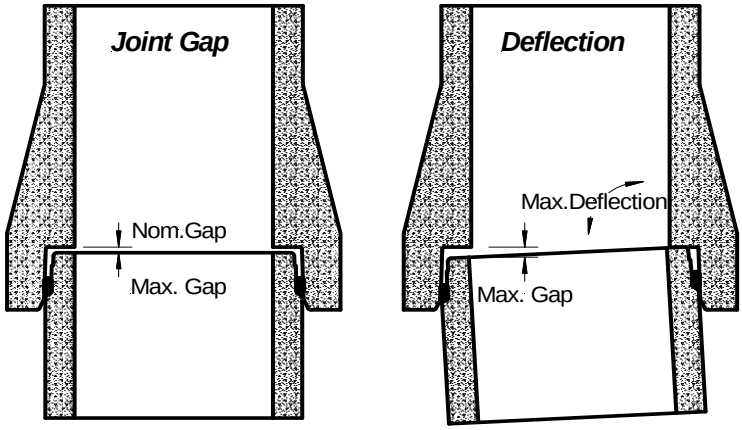


Figure 4.2 - RRJ Pipe with In-Wall (Skid) Joint

Pipes for drainage applications

The RRJ profile is designed for ease of installation. The table below represents the minimum pipe joint laying tolerances in the pipeline for the standard range of pipes.



Pipe Size	Nom. Gap (mm)	Max Gap (mm)	Deflection Angle
300 / 2 / 3 / 4	0-3	17	2.4
375 / 2 / 3 / 4	0-4	17	1.9
450 / 2	0-4	15	1.4
450 / 3 / 4	0-4	15	1.4
525 / 2	0-5	18	1.4
525 / 3 / 4	0-5	18	1.4
600 / 2	0-5	22	1.6
600 / 3 / 4	0-5	22	1.6
750 / 2	0-6	22	1.2
750 / 3 / 4	0-6	22	1.2
900 / 2	0-6	29	1.4
900 / 3 / 4	0-6	29	1.4
1050 / 2	0-9	22	0.6
1050 / 3 / 4	0-9	22	0.6
1200 / 2	0-9	23	0.5
1200 / 3 / 4	0-9	23	0.5
1350 / 2	0-9	24	0.5
1350 / 3 / 4	0-9	24	0.5
1500 / 2	0-9	24	0.6
1500 / 3 / 4	0-9	24	0.6
1650 / 2	0-9	27	0.5
1650 / 3 / 4	0-9	27	0.5
1800 / 2	0-9	35	1.6
1800 / 3 / 4	0-9	35	1.6

Hydraulics

The **hydraulic capacity** (the amount of water a pipe can convey) of all types of pipe depends on the smoothness of the interior pipe wall. The smoother the wall, the greater the hydraulic capacity of the pipe. Smoothness of pipe can be represented by any of the following:

- the Colebrook Roughness Coefficient “ks” mm
- the Hazen and Williams “c”

Manning's Roughness Coefficient "n"

In all, the lower value, the greater the volume of water that will flow through pipe.

Hydraulic analysis for drainage systems involves the estimation of the design flow rate based on climatological and watershed characteristics. The hydraulic design of a drainage system always includes an economic evaluation. A wide spectrum of flood flows with associated probabilities will occur at the site during its design life. The benefits of constructing a large capacity system to accommodate all of these storm events with no detrimental flooding effects are normally outweighed by the initial construction costs. An economic analysis of the trade-offs is performed with varying degrees of effort and thoroughness. Risk analysis balances the drainage system cost with the damages associated with inadequate performance. With concrete pipe, there is no risk. With its long service life and hydraulic efficiency, concrete pipe handles the requirements of a system's hydraulic design.

The selection of **appropriate roughness** coefficients for stormwater drainage is not precise because of the necessity to assess the effects of any debris which is carried by the stormflows. Unfortunately, but understandably, there is a dearth of relevant test data for in-service stormwater drains. To design a stormwater drainage system without allowance for debris (that is, for clean water with “ks”= 0.06 mm for concrete pipe), represents an unlikely situation. Equally, the effect of debris on equivalent pipe roughness is unlikely to be as severe as the influence of biological slimes in a heavily slimed sewer. For these reasons the concrete pipe industry recommends the adoption of a “ks” value of 0.6 mm for most stormwater drain designs, but this value of “ks” should be modified through engineering judgment where additional data is available. A value of “ks” of 0.6 mm is conservative compared with the “ks” range (0.15 mm to 0.30 mm) recommended in Australian Rainfall and Runoff, but again it should be noted that generally the cost penalty for adopting “ks”= 0.6 mm compared with 0.06 mm is at most one step in pipe diameter.

Research has concluded that designs using concrete pipe can be downsized by at least one size in most cases when compared to steel, aluminium, and lined corrugated HDPE pipe. For design engineers and owners to select the proper drainage pipe for a specific culvert or sewer application, it is critically important that the applied roughness co-efficient values are design values rather than laboratory values.

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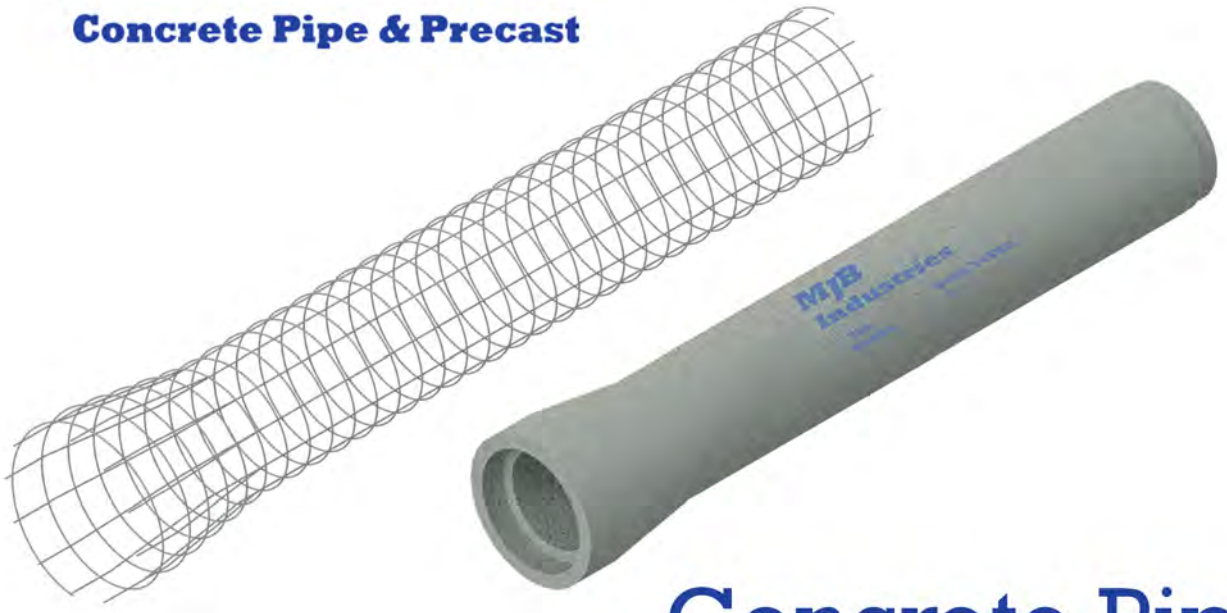
Concrete Pipe & Precast



Concrete Pipes
Installation Information

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Installation

Installation of Pipes

When installing Rubber Ring Joint pipes, be sure to store the rubber rings out of direct sunlight, preferably left in the bag and placed in the barrel of the pipes is best. 300mm to 1800mm Pipe Rubber Rings do not need primer or lubrication, they will roll when in contact with concrete naturally.

Ensure both ends of the pipe are clean and dry.

The ring should be checked to ensure no twists or tears are around its circumference. If pipes are joined and excessive spring back experienced, the joint should pull open and the rubber ring fitted again.

Installation of Pipes Larger than 1200mm

The following is MJB Industries recommended guide on the current industry standard for installing Reinforced Concrete Pipes larger than 1200mm in diameter.

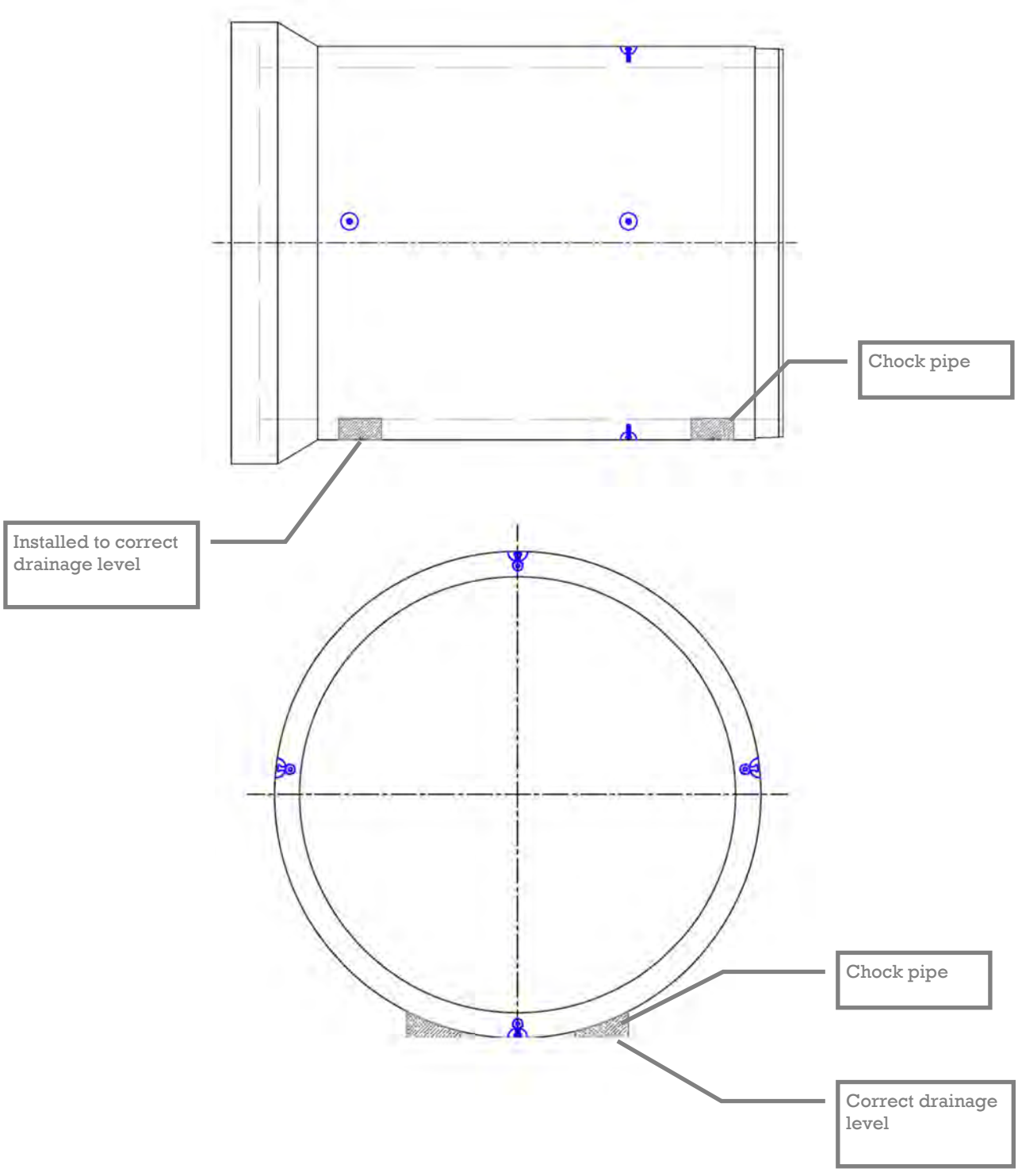
Pipes with elliptical grid reinforcement must be laid with the word “TOP” at the crown and within 10° each side of the vertical centerline.

2100mm diameter pipes have a self lubricated ring provided by MJB. Do not use petroleum based lubricants.

MJB Industries recommended guide for installing Large Reinforced Concrete Pipes

Step 1. Place first pipe and chock

⇒ Concrete pipe must be installed to the correct drainage height and on **compacted** ground.

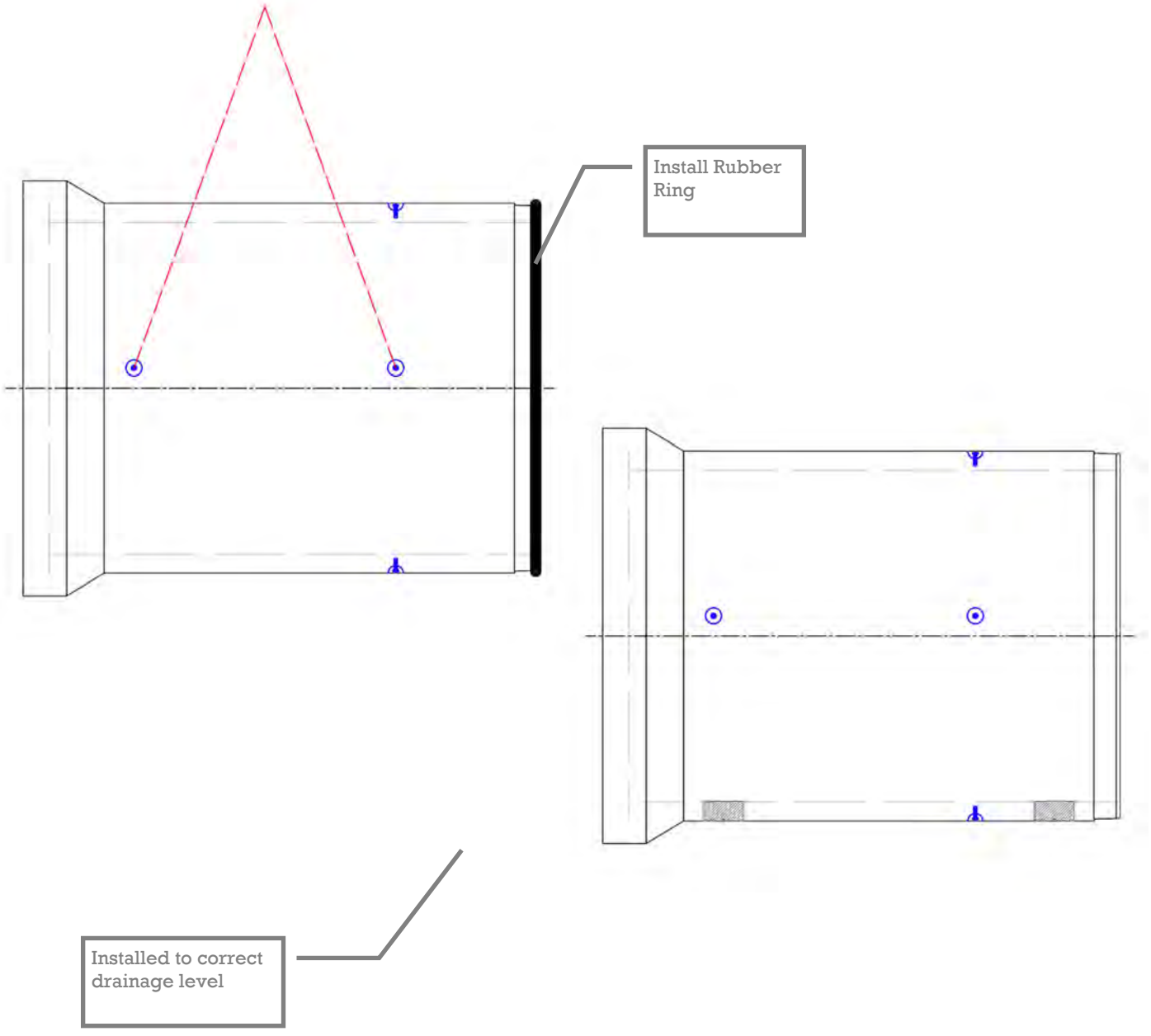


MJB Industries recommended guide for installing Large Reinforced Concrete Pipes

Step 2. Prepare the next pipe

⇒ Prepare the next concrete pipe. Pipe must be installed to the correct drainage height and on **compacted** ground.

⇒ Fit the rubber ring to the spigot end of the next pipe



MJB Industries recommended guide for installing Large Reinforced Concrete Pipes

Step 3. Install the next pipe

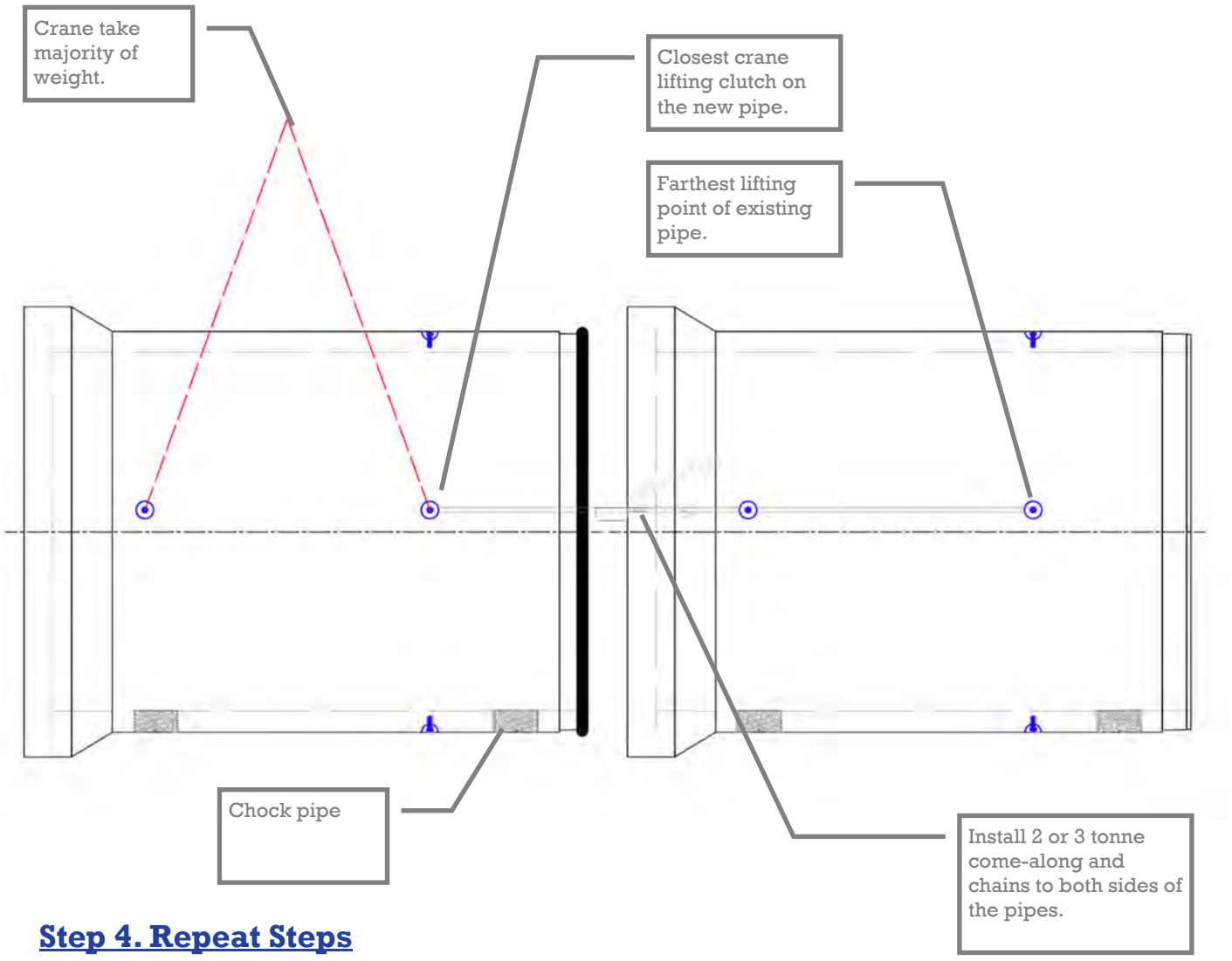
⇒ Install the next pipe, chock pipe in place.

⇒ Crane to remain in place, taking majority of pipe weight.

⇒ Fit a 2 or 3 tonne come-along and chains to both sides of the pipe. Ensure to connect to the farthest lifting pin of the existing pipe, and the closest crane lifting clutch of the new pipe.

⇒ Tighten both come alongs **at the same time**, until the pipe is installed.

⇒ If during installation the existing pipe begins to "creep" when using the come-along to install a new pipe, MJB recommend anchoring the last installed pipe to another installed pipe that is set back 2 or 3 pipe lengths along the drainage run.



Step 4. Repeat Steps

⇒ Ensure to leave two of the bell end chocks in place for every pipe.

Installation

Transportation

The transportation of steel reinforced concrete pipes is a delicate task which requires the correct equipment in order to ensure the safe delivery of the product purchased without compromising its structural abilities (no cracks).

A platform semitrailer is required for transportation of the product from the production site to the client's site. Platform semitrailers allow the forklifts easy access to load up the cargo from the sides without incurring any logistical problems.

The stacking process requires the pipes to be chocked and positioned on top of gluts and one on top of the other in rows. The restraining of the loads should be in accordance with the National Transport Commission of Australia. Safety and conserving the structural integrity of the pipes is the main aim of such process.

Always remember to position your load correctly, use good quality restraint equipment and check your load before, during and after your trip.

Handling On-Site

MJB's large pipe range (1200-1800) is manufactured with elliptical steel reinforcement. When storing pipe on site ensures pipes are placed with "TOP" facing upwards and ensure **extra** care is taken when double stacking.

Prior to handling the pipes check their mass and make sure the handling equipment is of adequate capability.

When pipes are supplied with swift lifting points, ensure that correctly rated lifting clutches are utilized and the product lifted in accordance with the lifting design. For example, if the pipe has 4 installed lifting points, do not lift the pipe by 3, 2 or 1 point only. Customers should be aware of the correct lifting technique to use during unloading & installations of products.

Care should be taken when tramming/moving the products so as to avoid shock treatment to lifting pins.

Installation condition

This manual also provides a range of recommended bedding support type options. The range varies from no support, to haunch support, to haunch and side support.

Refer also to the Concrete Pipe Association of Australia “A Foreman’s Guide to Laying Concrete Pipes”

Foundation: A naturally occurring or replaced material beneath the pipe bed.

Bed Zone: The area between the foundation and the level of the bottom of the pipe, whose depth is determined In accordance with Clause 9.2 from AS/NZ 3725 (see figure 1(a) and (b)).

Bedding: The specified type and extent of materials supporting the lower portion of the pipe, usually taken to be the materials occupying the bed zone and the haunch zone (see figure 1(a) and (b)).

Haunch Zones: The areas bounded by the trench walls and the outside of the pipe, the top of the bed zone and a level surface whose height above the bottom of the pipe is determined in accordance with Clause 9.3 from AS/NZ 3725 (see figure 1(a) and (b)).

Side Zones: The areas bounded by the trench walls and the outside of the pipe, the top of the haunch zones and a level surface whose height above the bottom of the pipe is no less than 0.5D (see figure 1(a) and (b)).

Overlay Zone: The area extending around the outside of the pipe to the top of the last placed side zone, haunch zone or bed zone, as appropriate. Each has a breadth of not less than 150mm at any point measured radially from the outside of the pipe (see figure 1(a) and (b)).

Embankment Fill: The material placed over the overlay zone for the purpose of refilling a trench or creating an embankment (see figure 1(a) and (b)). Fill design requirements to be engineer/client specific.

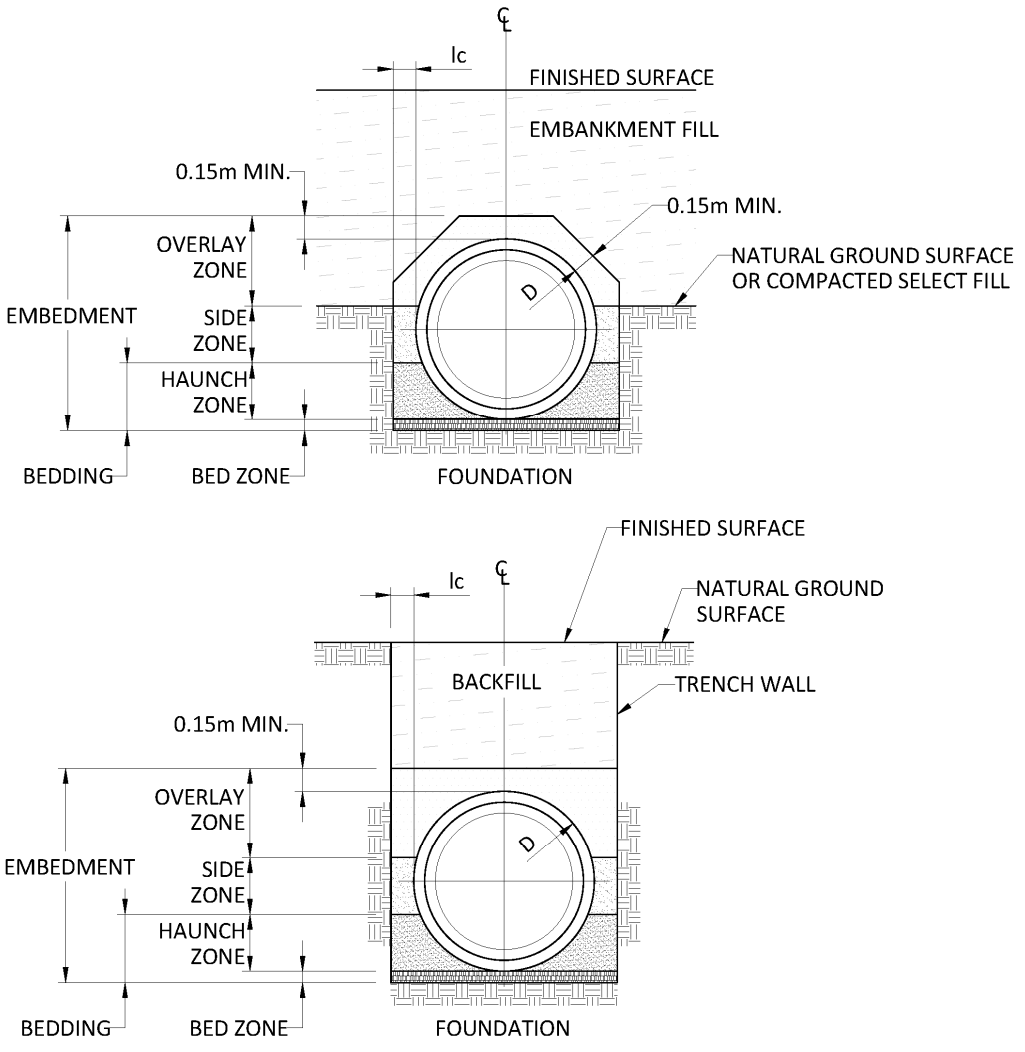


Figure 1 - Fill and Pipe Support Terms

Installation condition

Support Conditions

A stable and uniform foundation is necessary for satisfactory performance of any buried pipeline. The foundation must maintain the pipe in proper alignment and sustain the weight of earth, traffic and construction loading over the pipeline.

The Bed Zone is the area between the pipe and the foundation. It is commonly 100 mm thick and assists in providing even support along the pipe. Its function is to provide support to the underside of the pipe and reduce the intensity of the reactive forces. For concrete pipes larger than 1500 mm in external diameter this thickness should be increased to 150 mm. The Haunch Zone is located directly above the Bed Zone and extends to a height of between 10% and 30% of the outside diameter of the pipe above the Bed Zone. It provides support to the underside of the pipe, thus reducing bending moment effects in the pipe wall by more effectively distributing the applied loads into the foundation. The Side Zone provides support to the pipe sides and extends from the top of the Haunch Zone to a level of at least 50% of the external pipe diameter above the top of the Bed Zone. An Overlay Zone extending to a level 150mm above the top of the pipe provides protection from physical damage by oversize material in the Backfill or Embankment Fill.

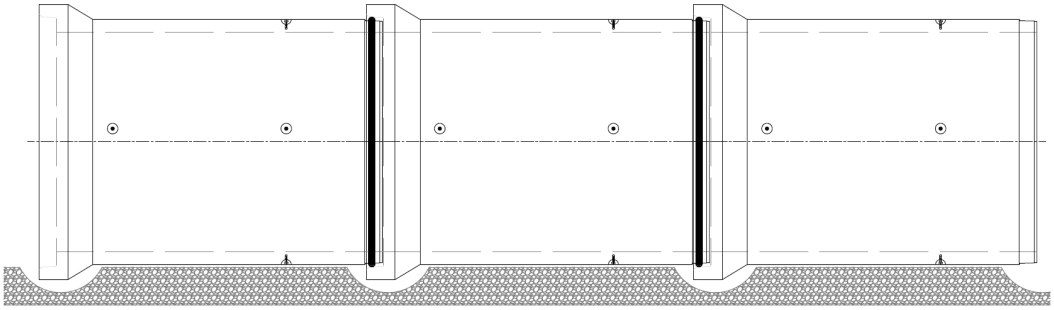


Figure 1.1 - Weight of barrel must be supported at all times by bedding material. Rubber rings are not designed to take the entire weight of a pipe and will not install properly if so.

Trench Condition

Trenches are defined as narrow excavations in earth or rock. When a pipe is installed in a trench and the trench backfilled, the backfill material will tend to settle over time. This settlement of backfill places a load on the pipe. This load is reduced by the upward acting frictional forces that develop between the fill and the trench sides. The fill (or dead) load acting on the top of the pipe is taken as the weight of the fill material in a rectangular prism over the total width of the trench, less the frictional forces developed at the trench walls. The adjacent natural material is considered to be self-supporting and therefore, does not transfer load to the pipe.

To minimise loads on the pipe, trenches should be kept as narrow as possible. The trench width adopted and therefore the load will depend on Excavator bucket width, Trench depth, Pipe diameter, Access required at sides of pipe to install and compact pipe support materials, Need for trench support.

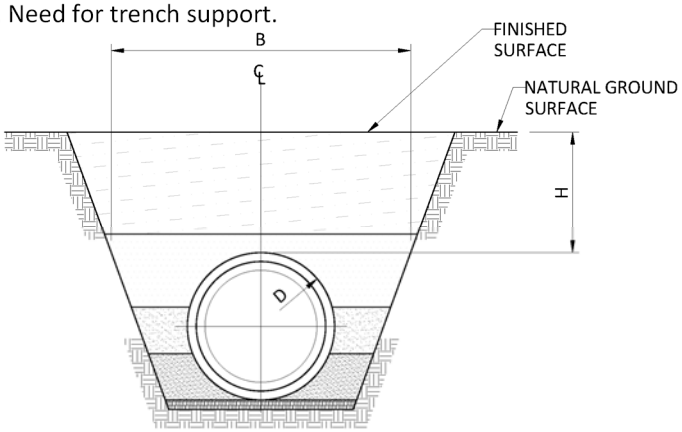


Figure 2 - Trench Condition

Installation condition

Embankment Condition

Embankment condition for a pipe is created when the pipe is laid at or close to natural ground (or as an induced trench) and fill material is placed over the top in the form of an embankment. Irrespective of the nature of the fill material and its method of placement, some settlement of the fill can be expected. In positive projection situations, the pipe projects above the natural ground level and differential fill settlement over the top of the pipe will occur compared to that on each side. The fill load acting on the top of the pipe is taken as the mass of the fill material in a trapezoidal prism over the width (diameter) of the pipe, plus the frictional forces developed between the soil prism and the adjacent embankment fill (compare this with the trench condition). The load on a pipe under embankment conditions will therefore generally be dependent on: pipe diameter and height of embankment fill.

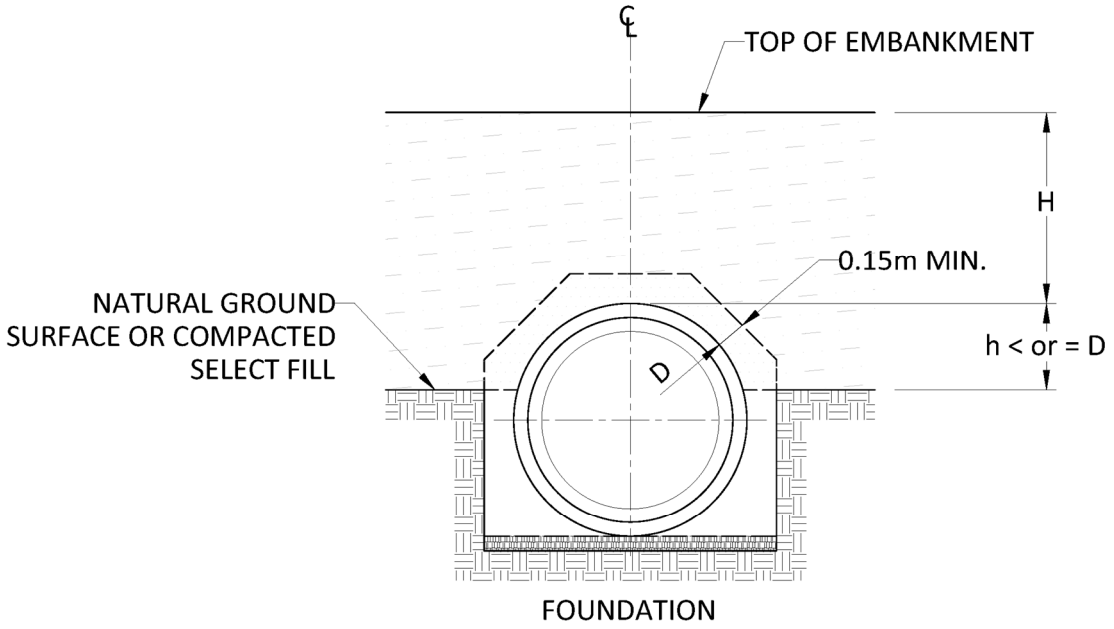


Figure 3A - Positive projection installation condition.

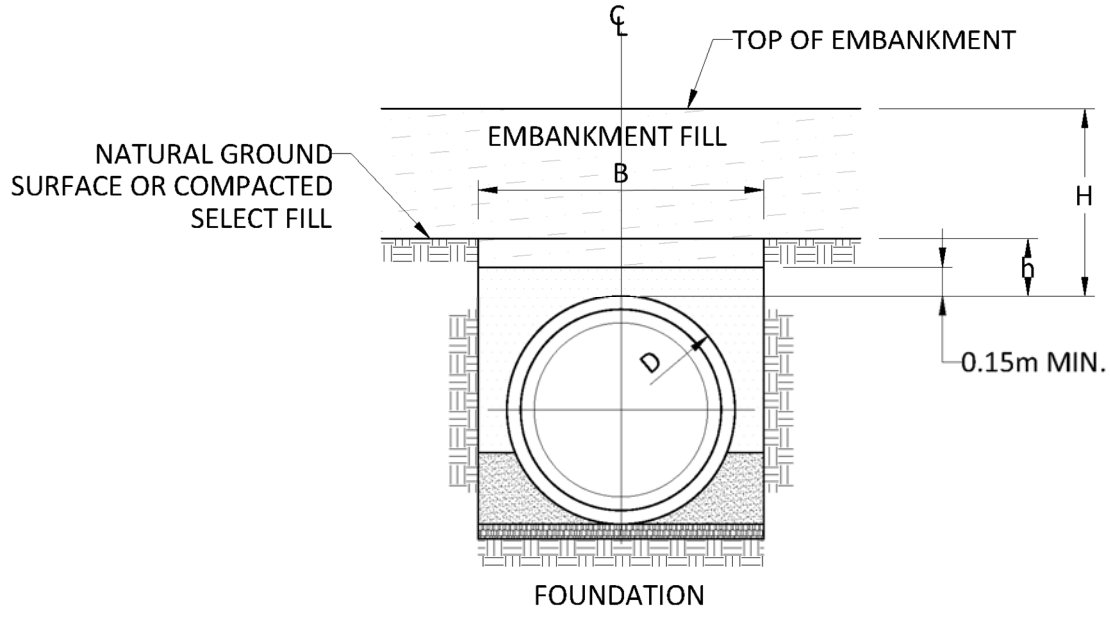


Figure 3B - Negative projection installation condition.

Installation condition

Multiple Pipes Condition

Pipes laid in two or more lines in the same trench or streambed should be separated enough to allow space for thorough compaction of backfill, whilst ensuring side support of the culverts to prevent collapse of the pipes due to unequal loading. The installation condition illustrated by Figure 4.

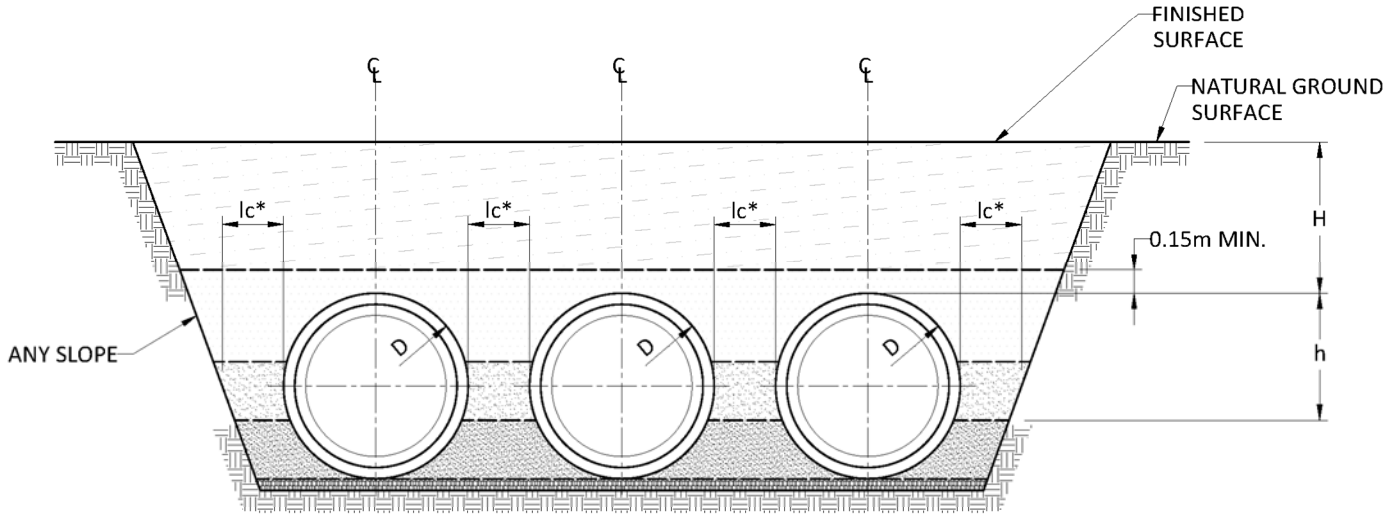


Figure 4 - Multiple Pipe Conditions

- * For socket pipes, a minimum 50mm should be maintained between adjacent pipe sockets

- The minimum values should only be used when necessary compaction between pipes can be assured.

Ground Support

The concrete pipes ready for installation have to be able to withstand the loads to which they have been designed to resist. In order to make sure the soil around the pipe is not subject to any movement which might compromise the short-term and long-term stability and functionality of the pipe system, proper ground support needs to be in place.

It is up to the design engineer's discretion to decide which technique of ground support to utilize in the final design. All specified design guidelines regarding depth of the embedment, width of the trench, haunch type and thickness and many other required variables can be found by consulting the Australia Standard AS/NZ-3725:2007.

This guideline outlines 3 major techniques of ground support for pipes Unsupported, Haunch Support and Haunch and Side Support.

Unsupported (Type U)

No bed, haunch or side support for the pipe. This design provides the least support for the pipe; it is however the cheapest and least time-consuming technique to install a concrete pipe. Refer to Figure 6.1 for the cross-sectional view of the pipe support.

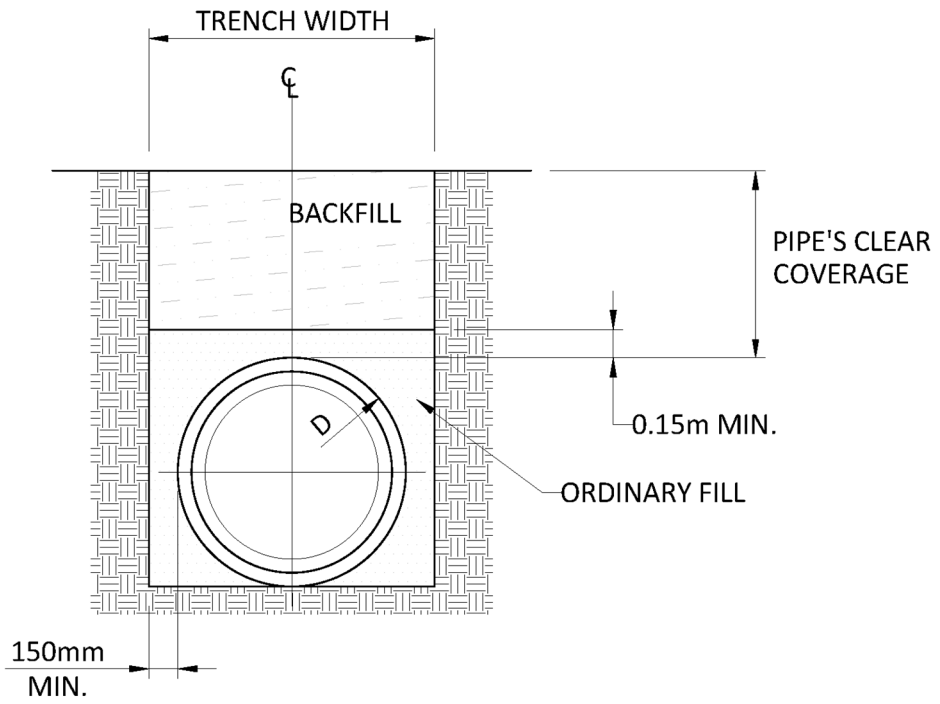


Figure 6.1 - Unsupported (Type U)

Ground Support

Haunch Support (Type H)

Bed layer and haunch support for the pipe are in place. This design provides medium support for the pipe. Refer to Figure 6.2 for the cross-sectional view of the pipe support.

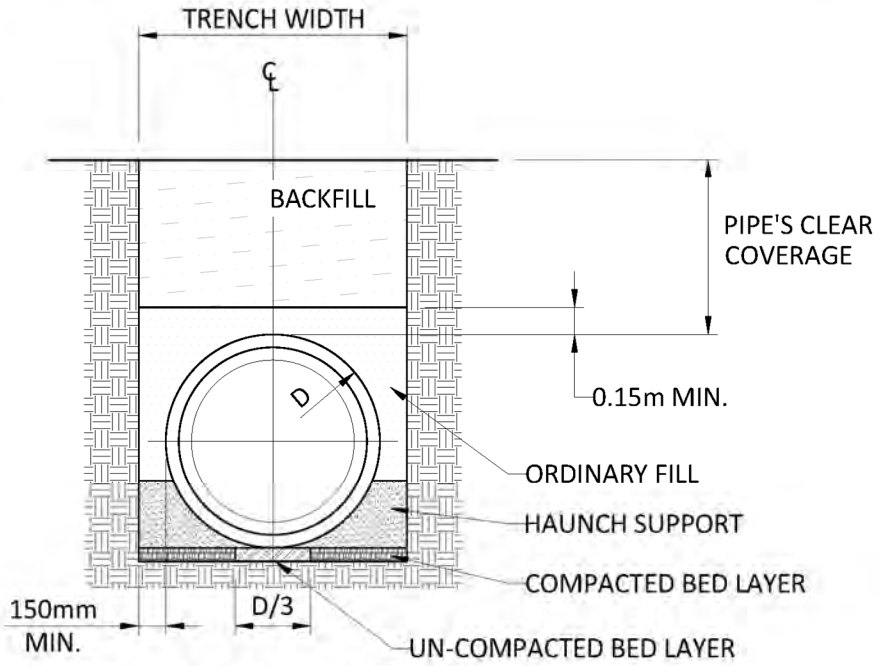


Figure 6.2 - Haunch Support (Type H)

Haunch & Side Support (Type HS)

Bed layer and haunch together with side support for the pipe are in place. This design provides the highest level of support for the pipe. It is however the costliest solution. Refer to Figure 6.3 for the cross-sectional view of the pipe support.

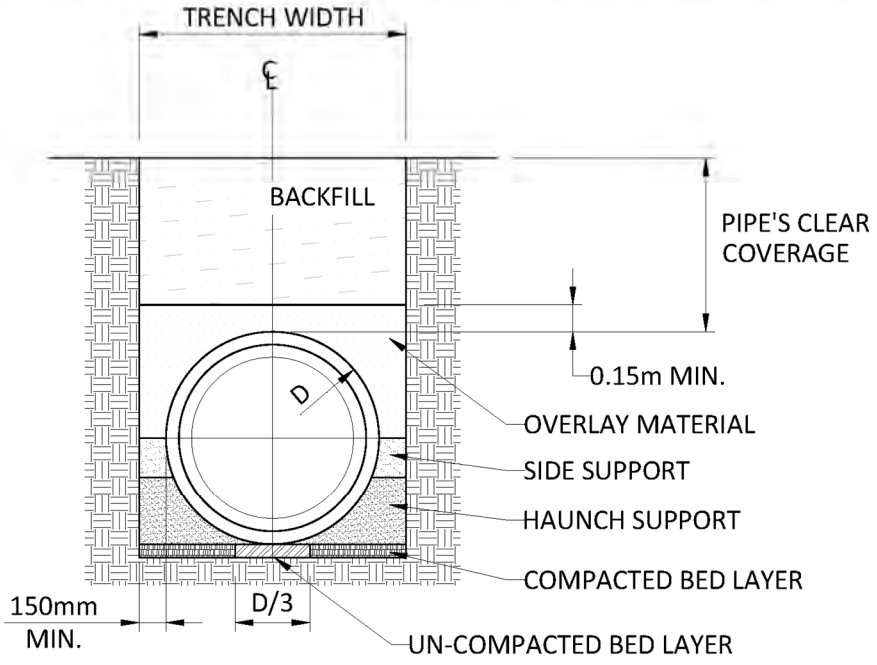
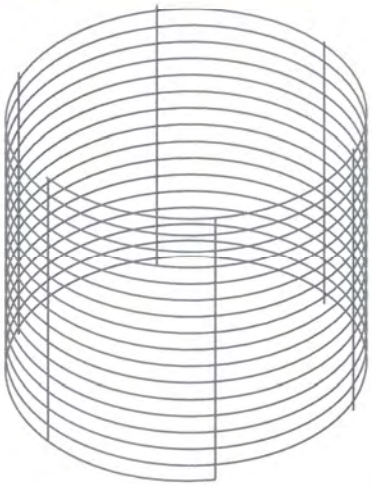


Figure 6.3 - Haunch and Side Support (Type HS)

MJB Industries

Concrete Pipe & Precast



Concrete Liners Installation Information

ISO 9001 certified Equal Assurance

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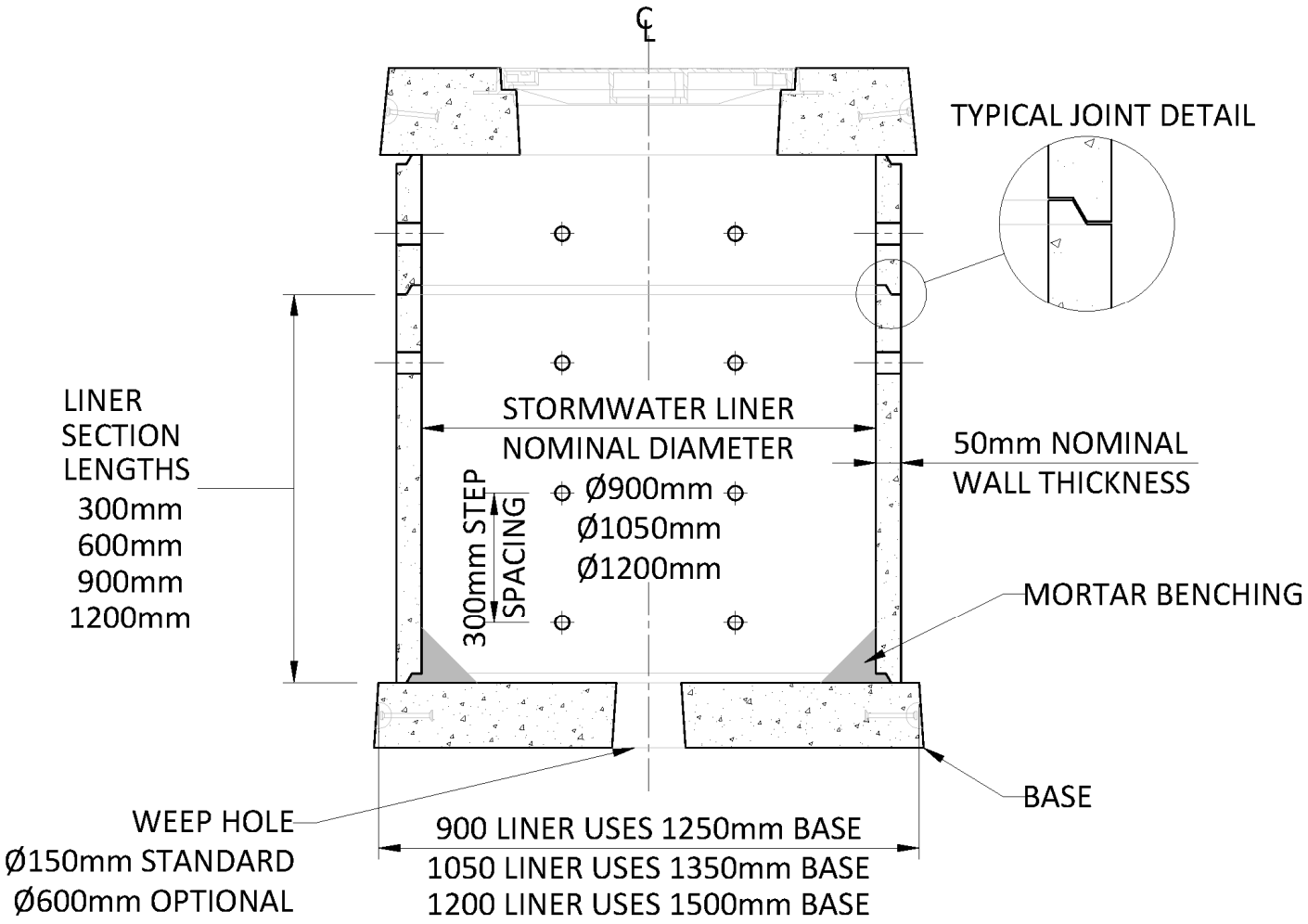
Installation of Liners

MJB Industries Spun Liners are factory manufactured as per AS/NZS 4058:2007 with Class 2 reinforcing. Liners are available from 900mm diameter up to 2100mm. These are available in various heights to suit your drainage requirements.

Holes of sufficient size to accommodate entry and exit pipes shall be cut with quick cut without cracking the liner or causing unnecessary damage. Subject to project specification we recommend the hole to accommodate the pipe to be no greater than the pipe diameter plus 100 mm. Cement mortar or Epoxy mortar shall be used in sealing around holes formed in structures to accommodate entry and exit conduits.

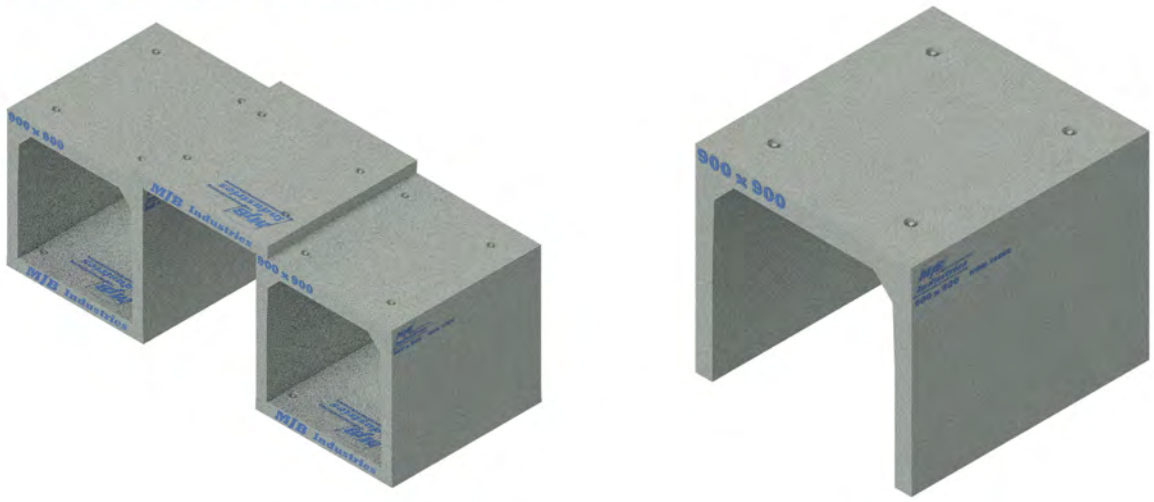
We recommend liners be installed in accordance with Main Roads Western Australia minimum requirements. The maximum inlet/outlet pipe outside diameter must be less than 60% of the liner internal diameter. A minimum space of 200mm is required between holes in the liner and a minimum of 40% of the liner shall remain in any horizontal plane.

The MJB Industries Liner System comes in a range of sizes with various lids, covers and surrounds to complete the system.



MJB Industries

Concrete Pipe & Precast



Concrete Box Culverts
General Information

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Box Culverts

This manual is to be read in conjunction with:

- AS/NZ 1597.1 Small culverts (not exceeding 1200mm span and 1200mm height)
- AS/NZ 1597.2 Large culverts (exceeding 1200mm span or 1200mm height and up to and including 4200mm span and 4200mm height)
- Main Roads Technical Library for latest box culvert drawings (1930-0666 and 0530-1470) and installation drawings. (https://www.mainroads.wa.gov.au/technical-commercial/technical-library/)

Manufacturing

MJB Industries manufactures a wide range of steel reinforced concrete box culverts made from coarse and fine aggregates, cement as per AS/NZ 3972 and hard drawn or deformed steel reinforcement as per AS/NZ 4671.

Box culverts are an ideal alternative to pipes for limited fill height applications, precast open channels, underpasses and ducts for underground services.

Our products are manufactured and undergo an extensive quality checking procedure according to the AS/NZ 1579.1 & AS/NZ 1579.2 which will be marked with a red tick for quality approval.

Reinforced concrete box culverts are typically manufactured in nominal 1.2m to 2.4m lengths to optimize transport and handling.

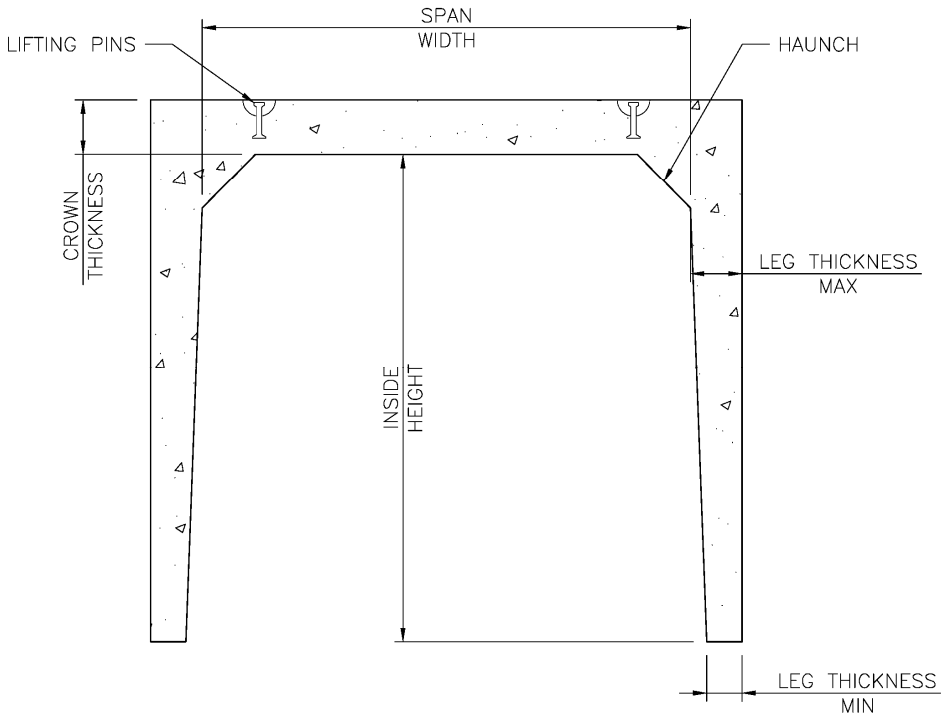
Custom lengths can be manufactured on request.

Design Loads

450—1200 span (B1) are in accordance with AS 1597.1 for 112kN Road Loading with a fill height from zero up to 2000mm.

450—1200 span (B2) are in accordance with Main Roads WA Drawing 1930-0666 for SM1600, HLP320 & HLP400 Loadings for a fill height from 200mm up to 2000mm.

1500 span and greater are in accordance with AS 1597.2 and Main Roads WA Drawing 0530-1470 for SM1600 Road Loading for a fill height from 350mm up to 4500mm.



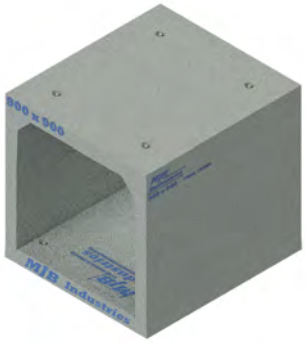
Variable properties of a box culvert

Types of Box Culverts

Crown Unit & Base – The crown unit can be placed on a precast base slab or this configuration also permits the use of an insitu base, to give continuity over poor foundations.

Invert & Lid – this type is the invert of the crown unit & base for where future access by lid removal is required.

Crown Units, base slab & link slab – used where more than one set of crown unit & base products is required for side by side installation.



Crown Unit and Base

Invert and Lid

Crown Units, Base Slab and Link Slab

Typical MJB Industries Box Culvert Dimensions

See table listing below for standard lengths and dimensional properties manufactured at MJB Industries premises.

Box Culvert Size (mm)	Exposure Classifications Available	Outside Width B1 / B2 (mm)	Crown Thickness B1 / B2 (mm)	Loading Designs Available
450mm Span	B1* / B2**	610 / 708	80 / 160	112kN / SM1600,HLP320,HLP400
600mm Span	B1* / B2**	778 / 879	100 / 160	112kN / SM1600,HLP320,HLP400
900mm Span	B1* / B2**	1090 / 1210	100 / 160	112kN / SM1600,HLP320,HLP400
1200mm Span	B1* / B2**	1404 / 1544	130 / 175	112kN / SM1600,HLP320,HLP400
1500mm Span*	B2***	1860	180	SM1600
1800mm Span	B2***	2110	205	SM1600
2100mm Span	B2***	2415	205	SM1600
2400mm Span	B2***	2780	210	SM1600
2700mm Span	B2***	3100	230	SM1600
3000mm Span	B2***	3400	250	SM1600
3600mm Span	B2***	4080	305	SM1600
4500mm Span	B2***	4982	350	SM1600
6000mm Span	B2***	6482	400	SM1600

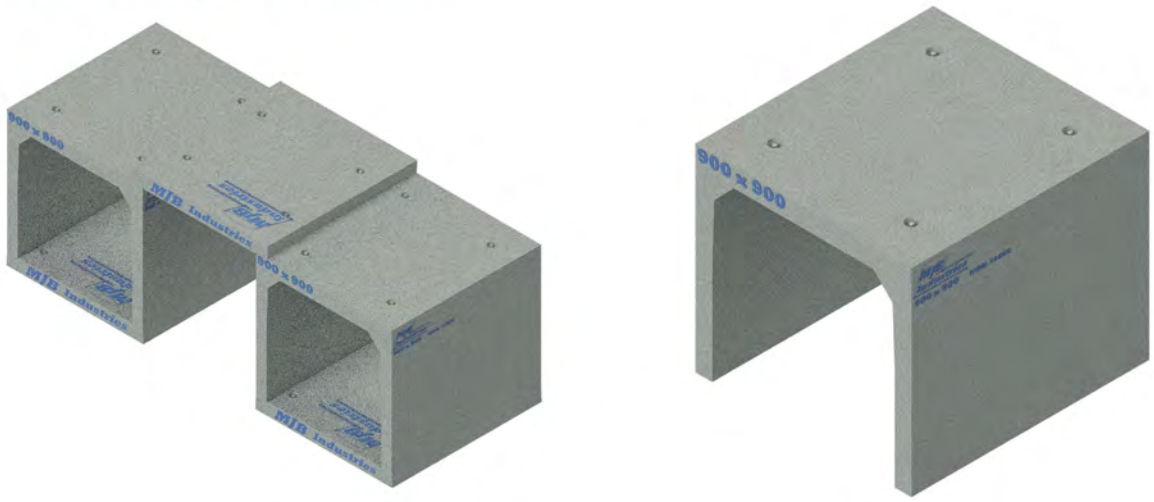
* 450-1200 B1 manufactured to Australian Standard 1597.1.

** 450-1200 B2 manufactured to Main Roads Drawing 1930-0666. Suitable for fill height from 200mm up to 2000mm.

*** ≥1500 RCBC manufactured to Main Roads Drawing 0530-1470. Suitable for fill height from 350mm up to 4500mm.

MJB Industries

Concrete Pipe & Precast



Concrete Box Culverts Installation Information

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Concrete Box Culverts

Transportation

The transportation of box culverts is a delicate task which requires the correct equipment in order to ensure the safe delivery of the product purchased without compromising its structural abilities (no cracks).

A platform semitrailer is required for transportation of the product from the production site to the client's site. Platform semitrailers allow the forklifts easy access to load up the cargo from the sides without incurring any logistical problems.

The loading process requires the box culverts to be secured on the deck with plastic angle between one another in rows. The restraining of the loads should be in accordance with the National Transport Commission of Australia. Safety and conserving the structural integrity of the box culverts is the main aim of such process.

Always remember to position your load correctly, use good quality restraint equipment and check your load before, during and after your trip.

Handling

MJB Industries box culverts are supplied with cast-in Swiftlift anchors of engineered and appropriate size. There are generally four anchors in the crown of the box culvert for handling and installation. Ensure that correctly rated lifting clutches are utilized and the product lifted in accordance with the lifting design. Customers should be aware of the correct lifting technique to use during unloading & installations of products.

Box culverts are generally lifted and transported in the legs down position and legs up for the invert culvert. Prior to handling check their mass and make sure the handling equipment is of adequate capability.

Slings should not be used under the centre of the top slab/crown of the unit. Lateral sliding of box culverts should always be avoided. Culverts should be lifted clear of the ground, not dragged, to avoid any lateral forces or damage to the bottom of the legs. If box culverts are to be stored on site, legs facing down and supports in the form of timber bearers should be placed under the legs.

Care should be taken when tramming/moving the products so as to avoid shock treatment to lifting pins.

Concrete Box Culverts

Installation

All box culvert units are to be installed in accordance with AS 1597.1 & AS 1597.2 or the relevant project specific drawings and project standards.

Box culvert installation should be done by an experienced contractor who is familiar with the set standards and understands the necessity of jointing, bedding and backfilling the units properly as well as other safety requirements applicable to such an installation.

Jointing – Joints between box culverts used in stormwater drainage conditions are a butt type joint. Joints between consecutive precast units are normally butted together and can have a gap of up to 10mm.

Laying – Box culvert units to be inspected before laying to ensure that the jointing surfaces are clean. Precast base slab units are to be laid on a prepared bedding. The bedding material can be compacted sand, cement, stabilizing sand or granular fill material. 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 base slab or box culvert unit, adjust the surface level of the bedding and place again. Do not use local packers to adjust the level. The compacted thickness of the bedding can range from 100mm to 200mm (depending on culvert bearing loads)

- When placing box culvert units on bases or slabs, the surface of the bearing area should be cleaned and covered with mortar or damp-proof course to ensure uniform bearing. In box culverts over 1500mm span, any gap between the inside at the leg and recess should be grouted. This will prevent the legs moving due to horizontal loads. Backfilling and compaction to units should be carried out in even layers of 150mm on both sides simultaneously.
- Trench widths for most of the installations should be equal to the external width of the culvert plus 600mm.
- Local soft spots in the trench must be excavated and the voids filled with well compacted hardfill to provide uniform support under entire structure. This must provide a bearing capacity of a minimum of 100kPa.
- Heavy earth moving or construction equipment should not run close to or over the culverts without first checking that the units can bare the loading that results. The foundation below the prepared bedding must be capable of providing a minimum safe bearing capacity (SBC) of 100kPa.

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