Introduction

Mono Beany, A259

Beany Block, Newcastle

Drexus 100

Max-E Channel, Bedford

Mono Slot Drain, Derby

Drexus XL

Mini Beany, Conservation, Bedford

Birco 150, London

Why Choose Marshalls?

Marshalls plc is the UK's leading hard landscaping company. We have achieved this status through progressive product innovation and by demonstrating outstanding service levels to our customers. This privileged position will be sustained by continuous investment in our brand, our products, and our people.

This dedication to excellence is exemplified by Marshalls committment to developing a first class range of linear channel drainage products that fit even the most bespoke hydraulic system requirements.

Marshalls experience and expertise can ensure that the right system is selected, detailed, delivered and installed to give total peace of mind.

Marshalls pledges that all of the drainage products featured in this book comply with relevant industry standards, are manufactured to the highest standards, are fit for purpose and are designed to optimise savings in manufacture and use.

Marshalls' purchasing policy sets out the standards and ethics by which we conduct our business and operate our management systems to manage our suppliers.

The majority of our products are manufactured in the UK; where products are sourced from outside the UK an ethical risk assessment is completed and an appropriate action plan agreed - multi-stakeholder independent social audits are part of our best practice. Marshalls is a member of both the Ethical Trading Initiative and UN Global Compact.

Marshalls accepts legal compliance as an absolute minimum standard to which we work and, where no legislation is in place, we use industry best practice. Legal compliance is monitored through our independently audited management systems. Our Board is ultimately responsible for ensuring the business operates in a socially responsible way, including compliance with relevant legislation.

We're dedicated to creating spaces that make the world a better place for everybody – one pavement, one car park, and one city centre at a time.

Our vision is built upon four pillars: values by which our every decision is guided, no matter how big or small.

Demonstrating leadership.

We believe in driving the industry forward. It's an ambition we've been acting on for 120 years, thanks to our size, capability, range of products and unmatched market knowledge.

Delivering excellence.

We have very high standards. Our products have to be innovative, our people have to be the best, our workmanship has to be perfect. Only then can we deliver the quality we're renowned for, at every stage of the process.

Building trust.

Everyone at Marshalls acts with integrity, treating customers and their projects with care and respect. It means people trust us with their home, their business, their town. And it's how we foster relationships for the long-term.

Being sustainable.

We use the world to source our products, so we have a responsibility to look after it. It's something we have been committed to for over 120 years and has ensured our longevity. Whether it's creating stronger communities, preserving environments, or contributing to the UN Global Compact, our work is always sustainable.

Marshalls is a member of the Ethical Trading Initiative (ETI).

OHS 69609 EMS 56194 FM 00004 IMR 72571

Design Service & Project Support

Engineering Solutions

Marshall is committed to ensuring that the right system is selected, detailed, delivered and installed. The understanding that the right selection of linear drainage system is crucial to the function of any hard landscaped area therefore Marshalls Linear Drainage Team will work in partnership with the specifer, engineer and contractor, to become an integrated part of the design process, helping transform and deliver ideas into hydraulic designs matched to the individual project requirements to give total peace of mind.

"Our everyday goal is simple – Support the customer's performance and aesthetic design aspirations with a commercially driven, value added Design Support Service, excelling through Computer Aided Drawings, engineered solutions and technical advice."

Marshalls free, no-obligation Drainage Design Service encompasses the following services:

In-House Design Support Services

By use of our bespoke computer software the Design Team can plan realistic and rapid solutions to your drainage needs. The Design Team will:

- Work with the project team to ensure the client's expectation are met
- Operate with either electronic (CAD) or hard copy drawings
- Assist in the selection of the most appropriate system
- Provide hydraulic data to support the adequacy of the selected system
- Provide schedule and / or layouts of the components as appropriate
- Value Engineer design to drive down project costs

NEW Online Hydraulic Design Software

Marshalls bespoke software (the online design tool) can enable you to plan realistic, precise and cost effective solutions to your drainage needs, all at your fingertips through a simple step-by-step process.

The software uses the modified rational method as described in the Wallingford procedure to calculate appropriate runoff rates for your project. A simple procedure is followed to ensure selection of the correct Marshalls linear drainage system from a structural, aesthetic and hydraulic perspective.

Flexible input options enable the user to generate required rainfall events in terms of duration and return period whilst also having the capability to adjust for climate change. These features ensure that each Marshalls linear drainage design can be tailored to meet the requirements of a specific project.

The Online Design Tool will:

- Give access at all times from most web active devices
- Save designs to a personal online library within your account
- Give access to pre-designed templates for fast track designing
- Automatically update with additional or new product and technical data
- Calculate flow rates and capacity levels required

CPD Presentations and Training

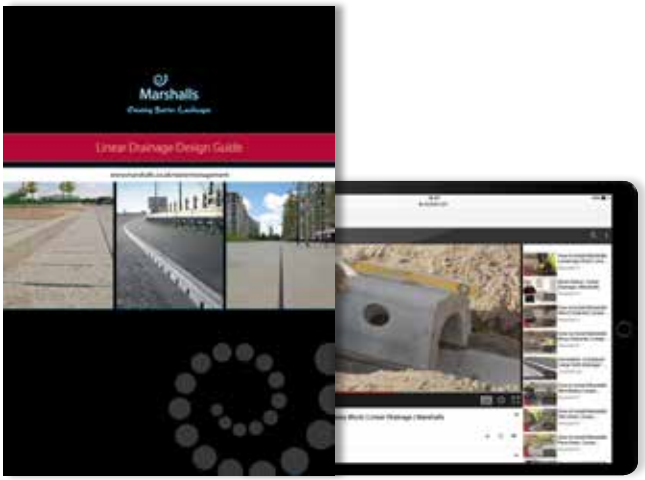
Marshalls Linear Drainage Team provides free of charge comprehensive and industry leading range of CPD (Continuous Professional Development) seminars to architects, engineers and contractors.

Marshalls CPD seminars cover a whole range of water management topics and solutions from permeable paving to linear and combined kerb and drainage systems.

Technical Design Guide

The fully comprehensive Marshalls Linear Drainage Design Guide draws from Marshalls experience in linear drainage, and aims to help the reader to understand more about this subject in a comprehensive and easy to understand way.

The guide, walks the reader through all the Product Range, the case for linear drainage, cost comparisons, the product selection process and design principles. The guide also provides technical information, offering advice on design, installation, materials and maintenance.



Further Technical documentation is also available;

- Microdrainage conduit files
- Computer Aided Design product drawings
- Technical product data and specification sheets
- Declaration of performances in accordance with BS EN 1433:2002
- Maintenance and cleaning regimes
- Online installation guides & videos.

MARSHALLS 360

360 Service Package

Our 360 Service Package provides comprehensive support including pre-construction appraisal, product sampling and CAD facilities. Marshalls Water Management and hydraulic engineering consultants are on hand at all stages of planning and construction to help ensure sound hydraulic design and sustainable performance of the drainage installation. To smooth project management our construction service teams employ state of the art traffic planning software for real time tracking and priority delivery schedules. All of this is underpinned with RIBA accredited training seminars for project teams. Visit marshalls.co.uk/360 to find out how your project can benefit.

For contact details see the further information page

BIM & Product innovation

Marshalls is an early adopter of Building Information Modelling (BIM) and has invested heavily in developing our people and skills to create the appropriate BIM objects and data that large commercial projects will soon demand. The company is continuously building a BIM object library that will be unrivalled in the Landscape sector and currently collaborates with relevant industry bodies to develop the training strategies, product data and software that will drive BIM adoption across the industry.

Bespoke Solutions

Detailed design features often make the difference between good and great. Marshalls is always delighted to take challenging briefs for bespoke landscape linear drainage features.

Liverpool Lime Street Station required a discreet drainage solution to follow the curvature of the architecture. Marshalls was able to develop a true radius slot drain to meet the clients requirements.

The client of the Welding Institute in Cambridge required a linear drainage solution for a multi story car park. Marshalls was able to recommend and supply Marshalls Birco Profil, a shallow steel channel designed for low construction heights whilst providing optimum drainage performance, reliable traffic safety and attractive design.

Marshalls
DESIGN SPACE

Design Space

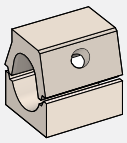
A bespoke London work space to inspire landscape design professionals. Bookable spaces for meetings, brainstorm sessions, or simply quiet space to think and create. Fully kitted to explore materials, colours and textures, BIM Models, technical data and social media platforms all on screen.

Extra events are a regular programme of seminars, notable speakers, and CPD. Open Space for big ideas, Personal Space for quiet contemplation, Inner Space for imagination.

Product Range Combined Kerb & Drainage

Beany® Block

Combined Kerb & Drainage System



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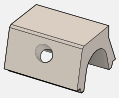
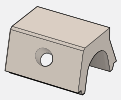
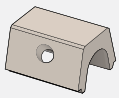


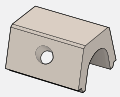
HB Straight Backed Low Hole



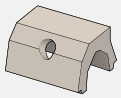
HB Symmetrical



Symmetrical Low Hole



45° Splayed



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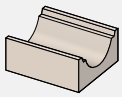

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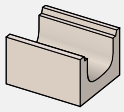

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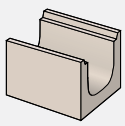

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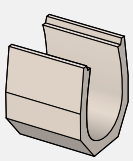
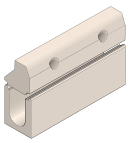
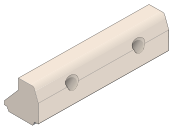


Mini Beany®

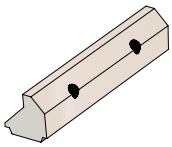
Combined Kerb & Drainage System



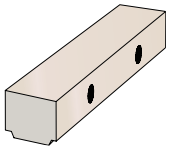
1m Half Battered Top



1m 45° Splayed Top



1m Conservation 205 x 255 profile



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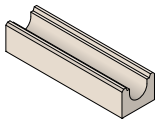

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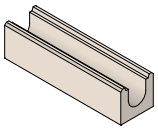

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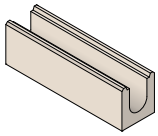

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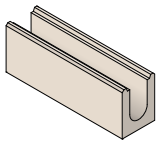


Mono Beany®

Combined Kerb & Drainage System

HB Mono 321 1m

HB Mono 502 1m

SP Mono 321 1m

SP Mono 502 1m

HB Mono 321 0.5m

HB Mono 502 0.5m

SP Mono 321 0.5m

SP Mono 502 0.5m

Bridge Beany®

Combined Kerb & Drainage System

45° Splayed 500 x 150 x 100mm

45° Splayed 500 x 175 x 100mm

45° Splayed 500 x 275 x 100mm

45° Splayed 500 x 350 x 100mm

45° Splayed 500 x 450 x 100mm

HB 500 x 150 x 100mm

HB 500 x 175 x 100mm

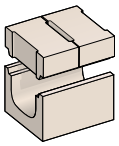
HB 500 x 275 x 100mm

HB 500 x 350 x 100mm

HB 500 x 450 x 100mm

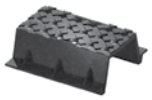
Max-E-Channel

Concrete Drainage System



Reinforced Concrete E600

Cast Iron F900



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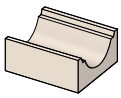

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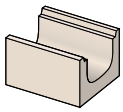

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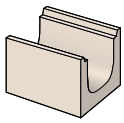

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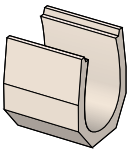
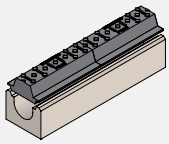


Traffic Drain

Grate Drainage System



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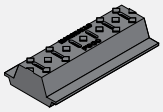

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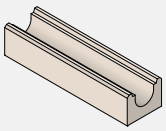

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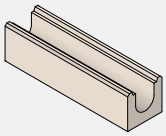

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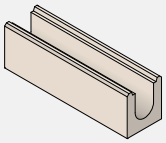

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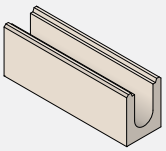
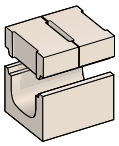


Product Range Channel Drainage

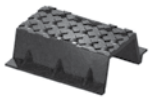
Max-E-Channel

Concrete Drainage System



Reinforced Concrete E600

Cast Iron F900



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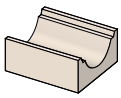

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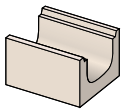

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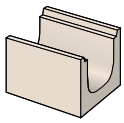

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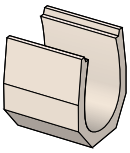
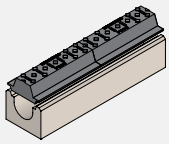


Traffic Drain

Grate Drainage System



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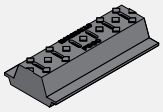

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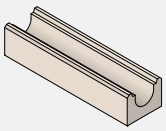

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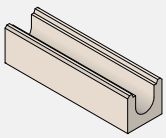

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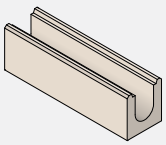

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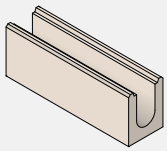
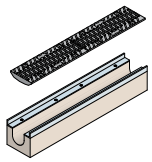


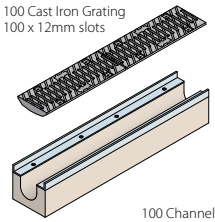
Birco

Grate Drainage System



Birco 100

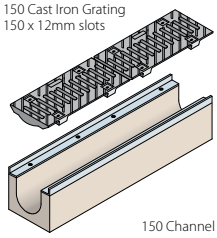
100 Cast Iron Grating
100 x 12mm slots



100 Channel

Birco 150

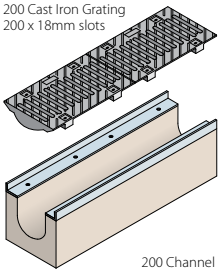
150 Cast Iron Grating
150 x 12mm slots



150 Channel

Birco 200

200 Cast Iron Grating
200 x 18mm slots



200 Channel

Birco 300$_{AS}$

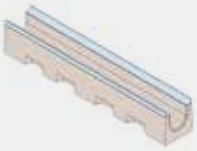
300 Cast Iron Grating
125 x 20mm slots

300 Channel

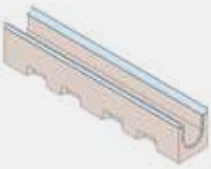
Drexus 100

Grate Drainage System

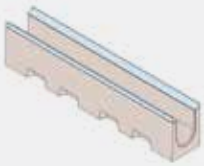
0/0 Channel



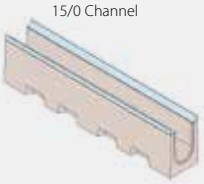
5/0 Channel



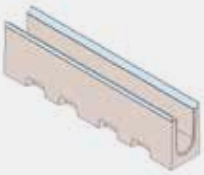
10/0 Channel



15/0 Channel



20/0 Channel



Drexus Pave Drain

Concrete Drainage System

Natural Stone Top

Concrete Top

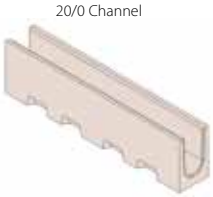
0/0 Channel

5/0 Channel

10/0 Channel

15/0 Channel

20/0 Channel



Drexus Slot Drain

Slot Drainage System

Mono Slot Top

Duo Slot Top

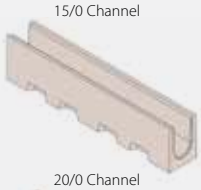
Offset Duo Slot Top

0/0 Channel

5/0 Channel

10/0 Channel

15/0 Channel



20/0 Channel

Drexus XL

Concrete Drainage System

325 Channel

425 Channel

525 Channel

675 Channel

825 Channel

The Case for Linear Drainage

Introduction

The growing demand for more cost-effective and less complicated drainage systems has led to modern linear drainage becoming the preferred choice amongst specifiers and contractors alike.

Marshalls' unique linear drainage systems combine the clear-cut advantages of linear drainage over traditional point drainage, with the benefits of a high quality, robust concrete system.

Surface water interception

- More efficient at intercepting running water
- Ponding is reduced or eliminated as is streaming water across a site

Shallow depth of construction

- Inherently shallow construction required
- Savings due to reduced excavation
- Reduces construction time, offering further savings
- Less conflict with existing underground services
- Reduced quantities of spoil to be disposed of

Ease of design

- Performs more efficiently with just the use of concrete channels, grates, outfalls and reduced amounts of pipework.
- Only requires shallow depth construction
- Limited number of components required
- Does not require complex crossfalls to be incorporated
- Design of crossfalls and longitudinal falls of adjacent hard landscaping is straightforward
- Improved end user performance

Ease of installation

- Channel line and level can be set out with ease
- Crossfalls are less complex to set out or construct compared with point drainage
- Expensive construction time saved due to shallow construction
- On-site errors are easier to avoid
- Unlike other options, Marshalls' systems do not require temporary ballast (e.g. Sand) during installation
- Inherently strong and robust concrete reduces on-site damage

Significant cost savings by reducing carrier pipes

- Many schemes can utilise the inherent ability of a channel or combined kerb and drainage system to act not just as the traditional gully in point drainage, but also as the carrier pipe in storing and transporting surface water.
- Any carrier pipes will be at a shallower depth with resultant cost savings
- Fewer expensive manholes required
- Less spoil to be removed from site
- Improved health and safety on site through reduced need for deep excavation work

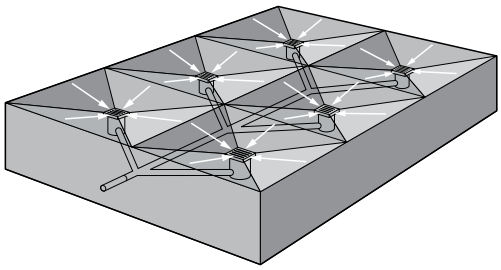


Fig. 1 Typical point drainage system, illustrating the need for complex crossfalls with attendant implications for design, installation and cost

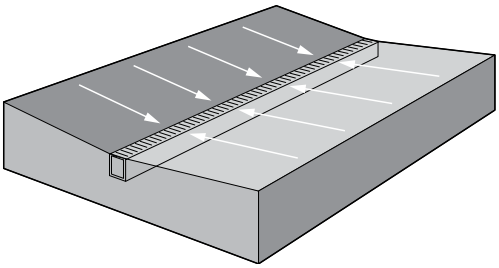


Fig. 2 Typical equivalent linear drainage system

Storage of surface water

Linear drainage can utilise the storage capability of its channels to good effect where there are limitations placed on the total outflow of the scheme. This temporary storage facility has been utilised to:

- Attenuate peak flows
- Avoid or reduce costs of balancing ponds or reservoirs
- Reduce pipework sizes at outfalls

Reduced maintenance

- Easier and less costly to maintain than other forms of surface water drainage systems
- Easy to access along the whole length of the linear drainage system via removable gratings or regular access points
- Blockages will not completely disrupt the whole system and can be dealt with easily
- Inherently strong and robust precast concrete systems resistant to the effects of freeze thaw and de-icing salts

Aesthetics

- Wide choice of decorative metal gratings or textured and coloured top blocks to enhance the aesthetics of a scheme
- Straight lines of linear drainage can be incorporated into the overall design

Control of spillage

- Allows total control of unwanted liquids in an emergency

End user comfort

- Eliminates false falls and consequent 'roller coaster' effect for vehicular traffic associated with point drainage
- Level surface offers greater comfort to pedestrians & road users

Selection Process

Linear Drainage Product Selection Procedure

The following pages describe the procedure for choosing the most appropriate Marshalls linear drainage system for a particular application.

Marshalls' comprehensive range of drainage systems can be split into four categories;

1. **Combined Kerb and Drainage systems specifically designed for kerbside use;**
   - Beany® Block
   - Mini Beany®
   - Mono Beany®
   - Bridge Beany®

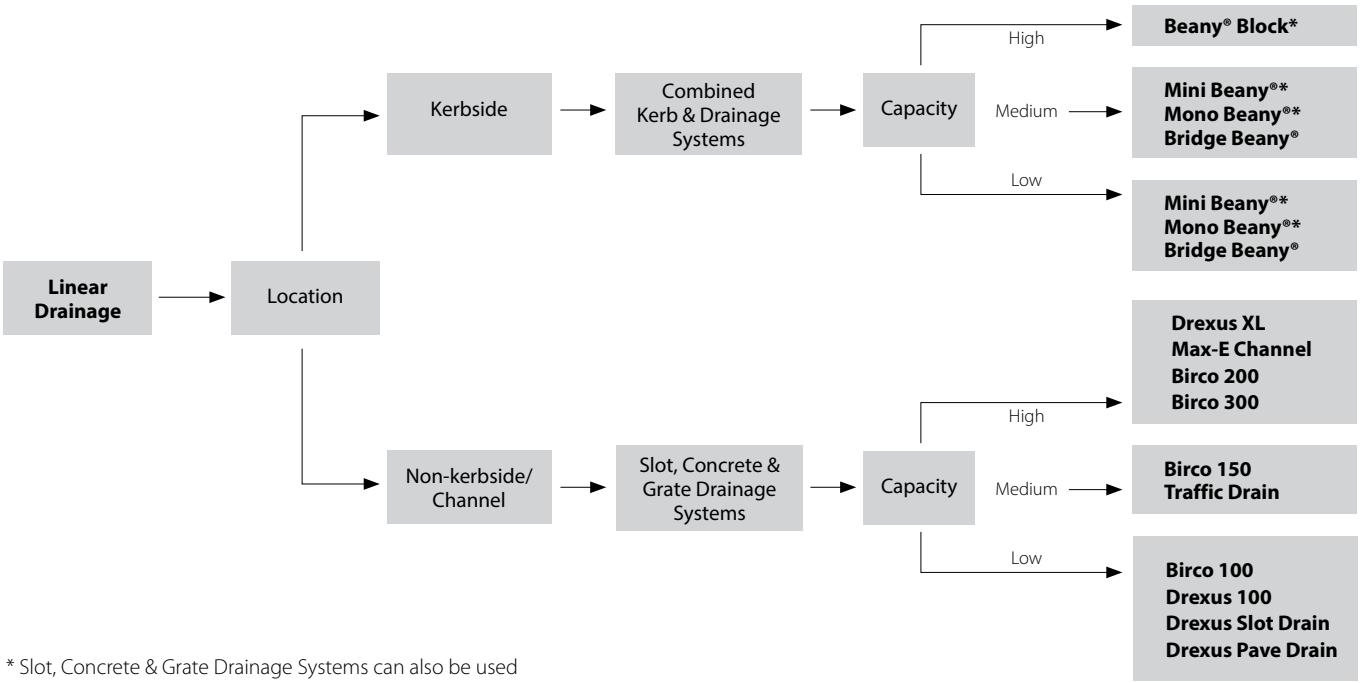
2. **Slot Drainage Systems designed primarily (though not exclusively) for non-kerbside use;**
   - Drexus Slot Drain Duo & Mono

3. **Grate Drainage Systems designed primarily (though not exclusively) for non-kerbside use;**
   - Birco
   - Drexus 100
   - Traffic Drain

4. **Concrete Drainage Systems designed primarily (though not exclusively) for non-kerbside use;**
   - Max-E Channel
   - Drexus Pave Drain
   - Drexus XL

The position of outfall, the area to be drained, topography and rainfall intensity will each affect the final decision as to which is the most appropriate system. However, there are two fundamental factors which, more than any other, determine which system is most appropriate;

- Location(i.e. kerbside or non-kerbside)
- Capacity



* Slot, Concrete & Grate Drainage Systems can also be used in kerbside locations. Where this is the case follow the design procedure for non-kerbside/ channel drainage

Fig. 3 General Principles for Selecting the Appropriate System

Selection Process

Channel Drainage Systems

Seven channel linear drainage systems are available from Marshalls, designed primarily (though not exclusively) for non-kerbside applications;

- Max-E-Channel
- Birco
- Drexus 100
- Drexus Pave Drain
- Drexus Slot Drain
- Traffic Drain
- Drexus XL

Selection Procedure

The choice of channel drainage system will often be determined by site parameters, such as size of area to be drained, existing levels and length of drainage runs. The following steps should be followed to establish the most appropriate Marshalls channel.

Step 1

Determine the location of the channel drainage system within the drained area.

Step 2

Determine the length of run of the channel.

Step 3

If the channel length is approx 60m, refer to Birco 100, Drexus 100, Drexus Pave Drain or Drexus Slot Drain. (See note 1).

Step 4

If the channel length is well in excess of 60m, refer to the Max-E-Channel range and Drexus XL. Choose either a large capacity system with few outfalls or a medium capacity system with more outfalls (See note 2).

Step 5

Determine the load classification of the channel system's application and specify the appropriate grating or top unit (See note 3).

In addition to the above, the following factors should also be considered:

Location of Existing Main Drainage

- If the location of the existing drainage system is fixed, it will determine outfall locations and optimum design of the linear drainage system may not be possible

Outfall Pipe Capacity

- Whatever linear drainage system is used, the outfall pipework must be designed to accommodate the peak discharge from the system
- Consider the available working width & depths for the site where runs are proposed taking into account the chosen system dimensions & launch detail(s)

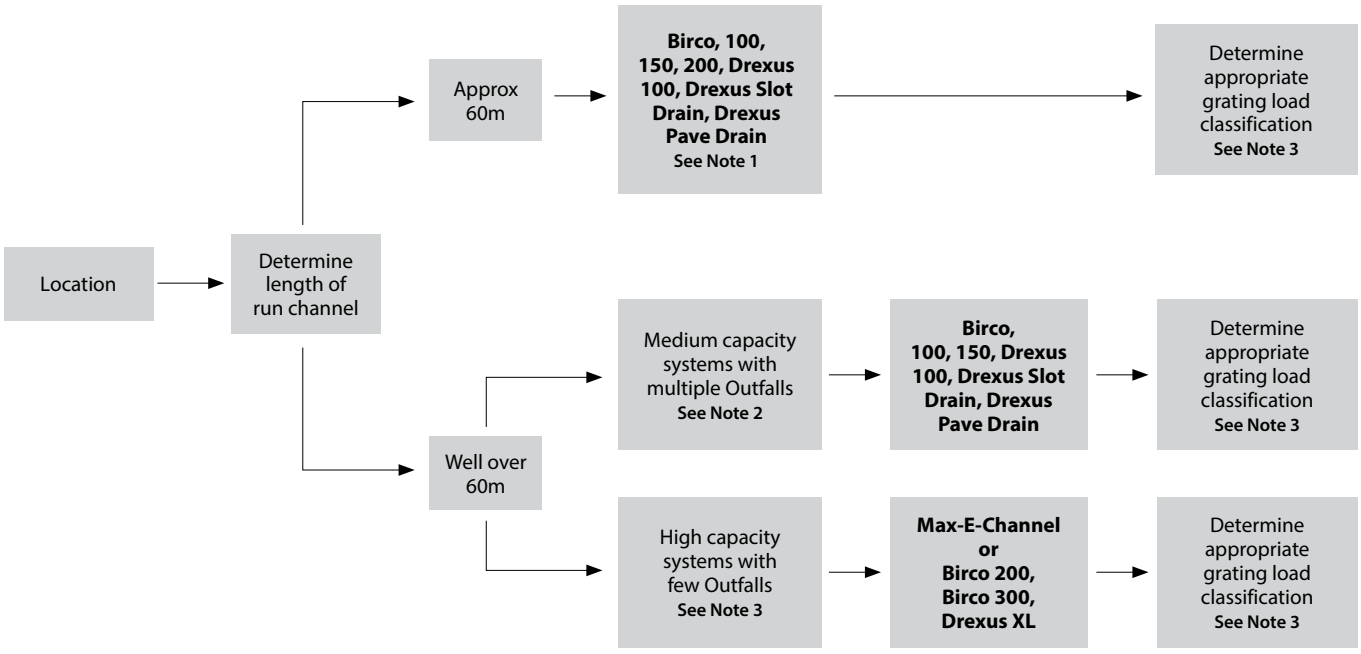


Fig 5. Summary of General Principles for Selecting an Appropriate Marshalls' Channel System

Notes

1) Generally, where the linear drainage channel length is in the order of 60m, one centrally located outfall will be sufficient and a medium capacity system such as Drexus 100, Drexus Slot Drain, Drexus Pave Drain or Birco 100 can be used.

Example
A relatively small paved area of dimensions 50 x 50m can be easily drained by a 100mm wide channel system such as Drexus 100, Drexus Slot Drain, Drexus Pave Drain or Birco 100. One centrally located outfall to suit the existing main drainage system will be sufficient.

2) Where linear drainage channel runs are well in excess of 60m, say 200m, then there is a choice of 2 options;

Option 1 - a high capacity system (Max-E-Channel or Drexus XL) with few outfalls or, alternatively;

Option 2 - a medium capacity system (eg Birco 150) with multiple outfalls

Example
For a paved area of dimensions 200 x 150m, then the options are as follows;

Option 1

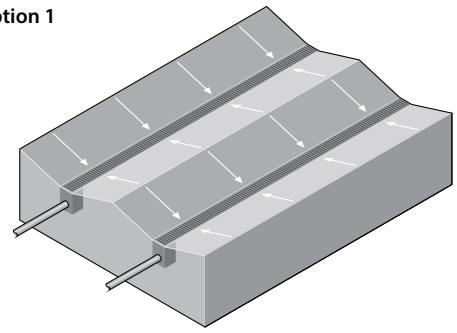


Fig. 6 High Capacity System with Few Outfalls

This example shows Marshalls' Max-E Channel or Drexus XL, draining the area with only one outfall at the end of the channel run. Less carrier pipes are used, resulting in even greater cost savings. There will also be less excavation with this design.

Option 2

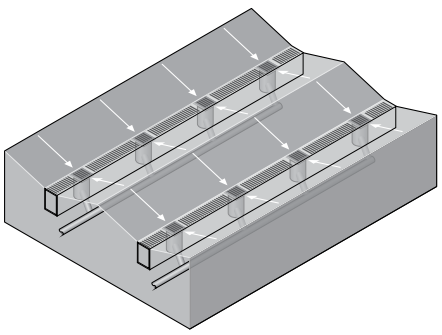


Fig.7 Medium Capacity System with Multiple Outfalls

This example shows typically two Birco 100 or Drexus 100, Drexus Slot Drain, Drexus Pave Drain runs utilising in-built fall or transition channels, with four outfalls discharging into a carrier pipe system. This is a highly cost-effective solution and would result in considerable savings compared to an alternative point drainage solution.

3) The loading classifications, as defined in BS EN 1433: 2002 'Drainage channels for vehicular and pedestrian areas - classification, design and testing requirements, marking and quality control, are as follows;

Class A15	Areas which can only be used by pedestrians and pedal cyclists
Class B125	Footways, pedestrian areas and compatible areas, private car parks or parking decks
Class C250	Kerbside and non-trafficked areas of hard shoulder that extend to a maximum of 0.5m into the trafficked area
Class D400	Carriageways of roads, hard shoulders and parking areas for all vehicles
Class E600	Areas subject to high wheel loads e.g. ports and docksides, warehousing and distribution.
Class F900	Areas subject to especially high wheel loads e.g. aircraft pavements

Design Principles

Introduction

The basis of hydraulic design of any linear drainage system is fundamentally like any other engineering analysis; an assessment is made of the required performance level that the element has to achieve and this is compared to the element's ability to accommodate this. In the case of linear drainage, how much water (peak run-off) will be flowing down the channel compared to the maximum stated flow capacity of the channel for the given conditions without causing any problems such as flooding.

There are therefore two elements to any linear drainage design; a determination of the peak run-off or maximum flow along and out of the channel and a determination of the system's maximum capacity.

Peak Run-Off

The determination of peak run-off will depend upon many considerations including;

- Size and location of the drained area
- Use and application of the drained area
- Chosen or calculated rainfall intensity

Whilst several methods of calculating the peak storm water run-off exist, there are two which [Marshalls recommend] should be considered when designing linear drainage systems;

- The Simple Area Run-Off Method
- The Modified Rational Method (often referred to as The Wallingford Procedure)

The Simple Area Run-Off Method

In the Simple Area Run-Off Method, it is assumed that the whole of the drained area contributes to the peak flow, that the rainfall intensity is uniform over the whole area and additionally that a value for the rainfall intensity is actually assumed. Therefore the assumed value for rainfall intensity is directly proportional to the peak run-off. A balance is often made between cost and the level of performance required but it is generally accepted that this method will yield conservative results.

The peak run-off formula used in this method is:-

$Q = A \times i/3600$, where

Q is the peak storm water run-off (in litres per second)

A is the drained area (in square metres)

"i" is the rainfall intensity (in millimetres per hour)

Some typical values assumed for rainfall intensity are given below. Engineers and designers must choose carefully and give due consideration to the performance level required;

- 75mm/hr (0.021 l/m^2/s) Areas where the consequences of flooding are serious such as where roof drainage [or entrances to buildings] is involved
- 50mm/hr (0.014 l/m^2/s) Car parks, pedestrian areas, roads or highways
- 40mm/hr (0.011 l/m^2/s) Service yards
- 30mm/hr (0.008 l/m^2/s) Large storage areas such as ports

In addition, this method of peak run-off determination should be limited to use when designing relatively small drained areas (less than 10,000m^2) and when designing relatively short runs of linear drainage (less than 200m).

The Modified Rational Method

The Modified Rational Method (often referred to as The Wallingford Procedure) is considered more accurate for larger schemes with longer drainage runs. Whilst the method generally assumes that the whole drained area contributes to the peak run-off, it uses typical storm profiles based upon actual data and takes into account actual geographical rainfall variations. In this way, the critical rainfall intensity for a given set of parameters and conditions can be calculated. The only decision that a designer makes is to choose a storm return period. Again several factors will influence this choice but periods of between 1 in one year to 1 in two years are typical for designing the linear drainage systems for most applications with only more onerous designs considering a 1 in five years return period. Reference can be made to BS EN 752 for advice on the choice of return period and the Modified Rational Method document advises "time of entry" for chosen return period.

Maximum System Capacity

Analysis of water flow along a linear drainage system where water continuously enters the system laterally is complex and differs in some respects to flow in circular pipes. It is usual to assume that flow in pipes is uniform or steady as the "flow in" equates to the "flow out" and that as the parameters along the system will generally remain unchanged, the flow is essentially unaltered. For these conditions, flow capacity has been determined from traditional methods such as the Colebrook-White formulae.

Where continuous lateral inflow is involved and particularly where large flows for large drained areas are concerned, a steady flow state may not be achieved and an alternative to steady state flow capacity determination may need to be considered.

Recent research work carried out at HR Wallingford has considered this aspect of Marshalls' linear drainage systems. The principle of spatially variable flow was established where, particularly for shallow gradients, the position of peak depth and hence the critical location moves from the assumed location at the outfall upstream towards the head of the run. The research work confirmed that for Marshalls' Beany Block system, where flow-capacities have traditionally been calculated using Colebrook-White, for all practical applications the capacities quoted were realistic and accurate. However, Colebrook-White gave very conservative figures for shallow gradients or flat applications and more cost-effective designs can be completed using data derived from the HR Wallingford work. The theory and practical application of flat channel flow is confirmed in TRL Report 602.

Flow data contained in the Marshalls Drainage Design Guide are derived from both HR Wallingford research and from traditional methods. Each system's data will indicate its source.

In addition to flow capacity figures, velocity data is also included. The velocity data has been determined by dividing the appropriate flow capacity by the full cross section area for the section under consideration. For Colebrook-White derived flows, this is accurate; for HR Wallingford derived flows this is ***conservative***.

Design Capacities
When using inbuilt fall Channels exclusively or in combination with flat invert Channels, drainage capacities should be calculated at the nearest upstream prime invert depth Channel.

Other Considerations
There are other aspects of linear drainage design beyond the factors given above. These include:

Maintenance
All surface water collection and transport systems will require maintenance to ensure efficient performance. Where linear drainage is designed for shallow gradients due care must be taken in the design for the effects of silting. Many systems are kept free from silting by the action of fast flow, but HR Wallingford's research confirmed that velocities flows as low as 0.4m/s "caused silt to move".

Existing Drainage
The location of existing drainage systems may often determine the location of the linear drainage outfall. This may or may not coincide with the most cost effective or efficient linear drainage design.

Ground Levels
Existing ground levels will determine low points and gradients, particularly so for roads and highways. This can mean that outfall locations are not determined by the hydraulic design. Where the channel longitudinal gradients varies, an equivalent uniform gradient may be derived from the HA advice note HA37. Specific advice on the application of this for Marshalls' linear drainage or combined kerb and drainage systems is available upon request.

Cross Falls and Drained Widths
Generally, cross falls should be between 1 in 40 to 1 in 80 whilst the maximum drained distance to any linear drainage should typically not exceed 50m.

Outfalls
As indicated the location of outfalls is sometimes not determined by the hydraulic design. Where the choice of outfall location is within the designer's control, and particularly where long drainage runs are being designed, the capacity of the outfall pipe work can sometimes limit the efficiency of the system. Capacity figures for Marshalls' outfalls are given in the appropriate sections. These figures are based upon theoretical but conservative calculations. Details are available upon request.

The Simple Way To Design Linear Drainage Systems

By use of Marshalls bespoke software the online design tool can enable you to plan realistic, precise and cost effective value engineered solutions to your drainage needs, all at your fingertips through a sample step-by-step process.

For more information visit:
www.commercialtoolbox/linear-drainage/details

Design Principles

Drainage Arrangements

Due to the manufacturing flexibility available to Marshalls, we are able to offer several of our linear drainage and combined kerb and drainage systems with pre-sloped or inbuilt fall channels or transition units.

The inherent flexibility of inbuilt fall and transition base systems gives the designer a number of options to increase the flow capacity of the drainage run as circumstances dictate:

- Constant depth invert channels can be laid flat, or to a slope to increase the flow and discharge capacity (Figs. 8 & 9 opposite).
- Channels with progressively deeper inverts can be introduced towards the outfall end forming a stepped construction. Again the slope will increase flow and discharge capacity (Figs. 10 & 11 opposite).
- Channels with inbuilt/transition falls can be used (Fig. 12 opposite).

Inbuilt falls

Drexus Pave Drain, Drexus Slot Drain and Drexus 100 and Birco are all available with either inbuilt or transition falls. Inbuilt fall or transition Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Channels with inbuilt falls or transitions have benefits in a number of specific applications:

- In flat areas, such as supermarket car parks, where pavement falls must be minimised to prevent "runaway trolley" syndrome
- Adjacent to buildings where architectural detail dictates that pavement level is parallel to roof level
- To maintain a level pavement adjacent to internal flooring in warehouse areas
- Where insufficient fall is present, inbuilt fall or transition Channels allow the creation of an artificial valley with either a gully at the centre or at each end of a drainage run (Figs. 13 & 14 opposite)

Inbuilt fall Channels are designed as a 20 Channel set (20 linear metres) but are manufactured individually and can be ordered in any permutation. They can be laid in virtually any given length in combination with constant depth invert Channels (Fig. 16 opposite). Inbuilt fall channels may also be laid to a gradient to increase the invert slope and flow capacity.

Transition Channels are designed as a 4 Channel set (4 linear metres) but are manufactured individually and can be ordered in any permutation. They can be laid in virtually any given length in combination with constant depth invert Channels (Fig. 16 opposite). Inbuilt fall channels may also be laid to a gradient to increase the invert slope and flow capacity.

Prime incremental depth

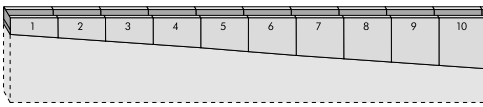
A set of 20 No. inbuilt fall channels take the system from the shallowest to the deepest constant depth channel in increments. For most of the Birco systems (100 and 150), the increment is 10mm per metre long channel (1%). For Birco 200, the increment is 5mm per metre long channel (0.5%). These increments correspond to the various constant depth or invert channels "prime depths" of 0/0, 5/0, 10/0, 15/0 and 20/0 every 5 linear metres (Fig. 16 opposite).

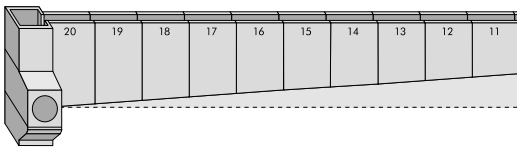
Inbuilt fall Channels are available as follows:

Channel Type	Fall	Type	Units Per Set
Birco 100	1%	10 mm/1000 mm channel	20 no.
Birco 150	1%	10 mm/1000 mm channel	20 no.
Birco 200	0.5%	5 mm/1000 mm channel	20 no.

Transition Channels are availabel as follows:

Channel Type	Fall	Type	Units Per Set
Drexus 100	2.5%	25mm/1000mm channel	4 no.
Drexus Pave Drain	2.5%	25mm/1000mm channel	4 no.
Drexus Slot Drain	2.5%	25mm/1000mm channel	4 no.





Note: Drawings show exaggerated fall for illustrative purposes only (not to scale)

Fig.8
Constant depth invert Channels, laid to level ground

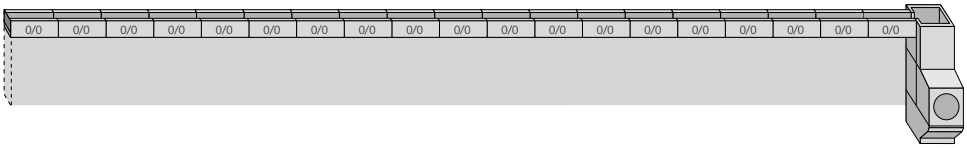


Fig.9
Constant depth invert Channels, laid on sloping ground

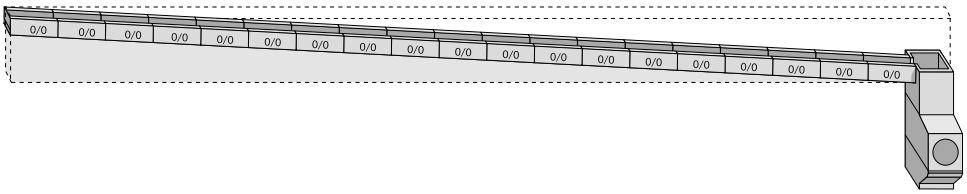


Fig.10
Channels laid to a stepped construction laid to level ground

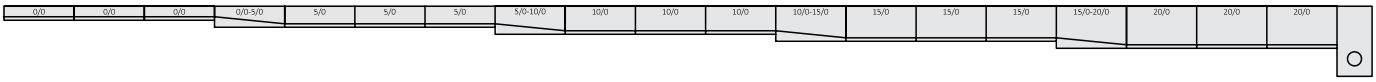


Fig.11
Stepped constant depth channels laid on sloping ground

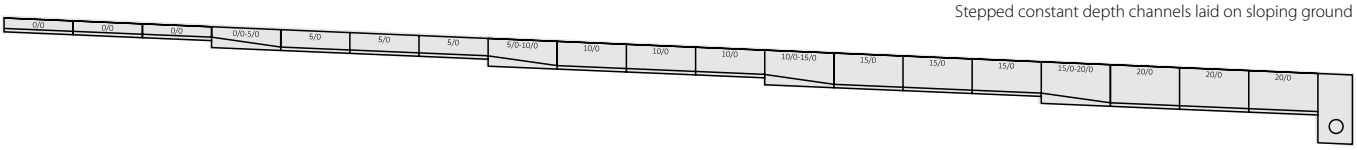


Fig.12
Inbuilt fall Channels, laid on level ground

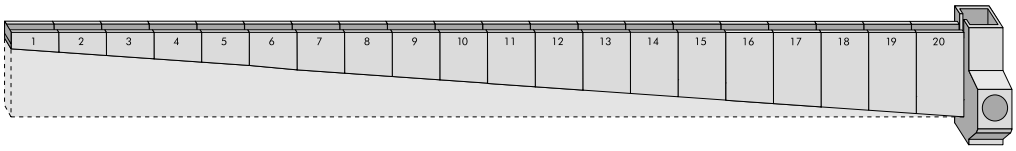


Fig.13
Artificial valley with Outfall at the centre, laid on level ground

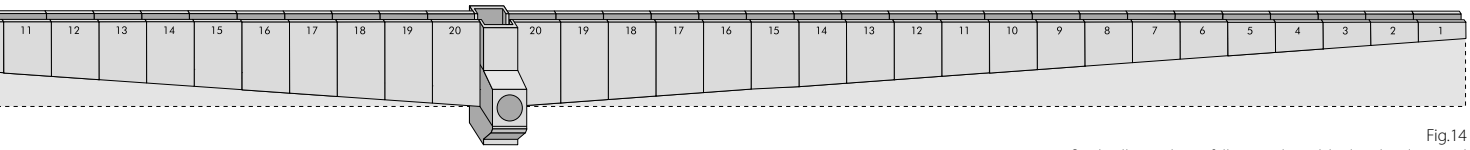


Fig.14
Artificial valley with Outfalls at each end, laid on level ground

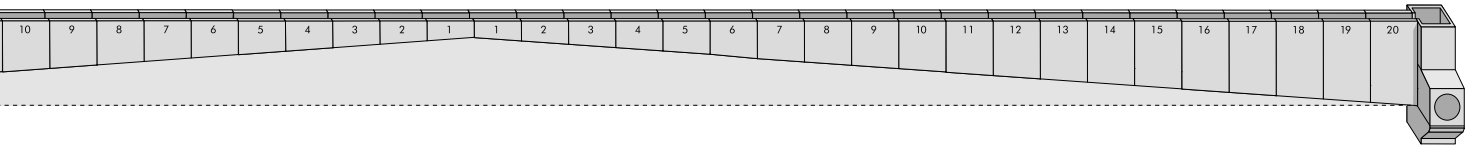


Fig.15
Combination of constant depth invert Channels and inbuilt fall Channels

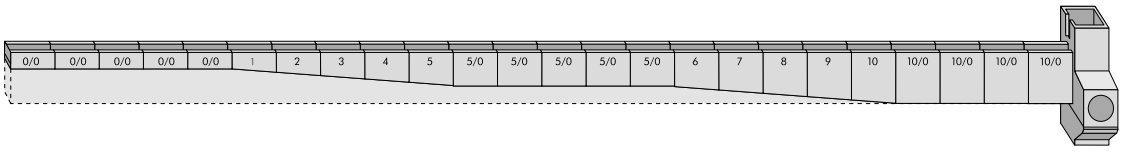
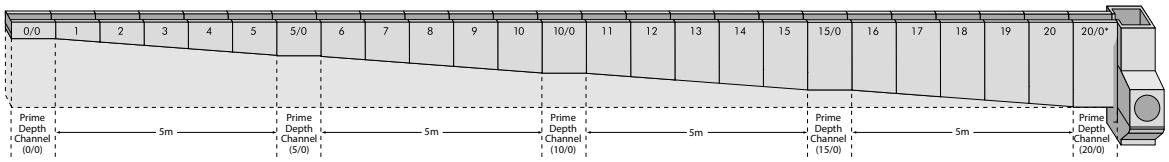


Fig.16
5 prime depth Channels laid with a full set of inbuilt fall Channels



*Not available for Birco 200

General Construction

Manual Handling

As a substance, cured concrete is non-hazardous; however it is heavy, hard and abrasive. Manual handling of these products therefore has associated hazards. Only individuals who have received training in kinetic handling techniques should be allowed to handle these products. Gloves should be worn when handling concrete products to avoid cuts, abrasions and/or skin irritations.

Marshalls advises that the majority of their drainage components be installed using mechanical handling equipment. Techniques using mechanical handling equipment, such as vacuum machines, have been proven to eliminate manual handling on many sites. Overall project savings have been shown through the benefits of easier, more efficient and less wasteful installation. Suitable equipment is available from Probst Handling and Laying Systems.

A DVD clearly showing the principles and advantages of using mechanical handling equipment and techniques for the installation of Beany Block is available by contacting the Marshalls Drainage Design Team.

Inclement weather

Installation operations should be discontinued if weather conditions are such that the performance of the inspection chamber may be jeopardised.

Installation should not be undertaken when the temperature is below 3°C on a falling thermometer and below 1°C on a rising thermometer.

COSHH

All relevant health and safety information, including COSHH data sheets, can be obtained from Marshalls Advisory Services or Drainage Design Team.

Protection

All necessary Personal Protective Equipment (PPE) should be worn on site, as the site rules dictate. Goggles, ear protection, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

Cast Iron

Cast Iron

Throughout this Design Guide reference is made to cast iron as a generic material.

Cast iron is available as either 'grey' iron (flake graphite) or 'ductile' iron (spheroidal graphite). We do not believe that, for the product's intended use, the material type will affect performance. However, if you wish to know the material type this is given in the specific product data sheet.

The coating applied to our cast iron is a temporary bitumen based coating that will become dull and lose its gloss over a period of time. It is not intended to protect the casting in use and would be expected to break down over a short period of time, either through weathering, or by being worn off when trafficked. As this happens the product would be expected to show signs of surface oxidation.

From the perspective of long term structural performance, the application of such coatings is not intended to serve any purpose; the corrosion mechanism of cast iron is very different to that of steel and is not detrimental to structural performance.

Both grey and ductile iron contain high quantities of silicon, which upon oxidation converts to silica (alongside the iron oxide) producing a tough non-porous homogenous surface coating. In addition, there is a slight reduction in volume, causing this coating to bind tightly onto the surface which effectively protects the iron and prevents further oxidation.

If the area is regularly trafficked, the grates will fairly quickly polish up to a dark colour.

If the area is not regularly trafficked and where aesthetics are important, then galvanised steel, stainless steel or powder coated cast iron gratings (all options that are available) should be considered.

Design Service

Drainage Design Support

Marshall is committed to ensuring that the right system is selected, detailed, delivered and installed. The understanding that the right selection of linear drainage system is crucial to the function of any hard landscaped area reinforced the need for us to share our knowledge with you. We do not underestimate the importance of the hydraulic design matched to the individual project requirements to give total peace of mind. We offer design support from conception to completion with experienced personnel and proven procedures.

To ensure specification of the correct system and components, we offer a free, no-obligation Drainage Design Service. By use of our bespoke computer software the design team can plan realistic and rapid solutions to your drainage needs.

The Design Team will:-

- Work with the project team to ensure the client's expectation are met
- Operate with either electronic (CAD) or hard copy drawings
- Assist in the selection of the most appropriate system
- Provide hydraulic data to support the adequacy of the selected system
- Provide schedule and/or layouts of the components as appropriate
- Give general advice based on a wealth of knowledge

A team of field based Drainage Engineers is also available to support our sales team and offer you technical advice on site or in your office.

NEW Online Hydraulic Design Software

Marshalls bespoke software (the online design tool) can enable you to plan realistic, precise and cost effective solutions to your drainage needs, all at your fingertips through a simple step-by-step process.

The software uses the modified rational method as described in the Wallingford procedure to calculate appropriate runoff rates for your project. A simple procedure is followed to ensure selection of the correct Marshalls linear drainage system from a structural, aesthetic and hydraulic perspective.

Further Infromation

The following further information is available:-

Technical Support, Product Data Sheets and COSHH	**Marshalls Advisory Service** **Tel: 0370 4112233** **Fax: 01422 312943** **e-mail: advisoryservice @marshalls.co.uk**
Free Design Service	**Drainage Design Team** **Tel: 0345 30 20 708** **e-mail: design.team@marshalls.co.uk**
Sales Office: Quotes and Orders	**Tel: 0345 3020400** **e-mail: wmsales@marshalls.co.uk**
Contract Information: Appendix 5/5 for Combined Kerb and Drainage systems Appendix 5/6 for Linear and Drainage systems Appendix 5/3 for Slot Drainage systems Method of Measurement Contract Schedule	

References & Further Reading

1. BS EN 1433:2002 - Drainage channels for vehicular and pedestrian areas – classification, design, and testing requirements, marking and evaluation of conformity

2. BS EN 206-1:2000 – Concrete. Specification, performance, production and conformity

3. BS 8500-2:2002 - Concrete Complementary British Standard to BS EN 206-1

4. BS EN 998-2 : 2003 - Specification for Mortar for Masonry

5. BS 7263-3 : 2001 - Precast concrete flags, kerbs, channels, edgings and quadrants

6. BS EN ISO 1461: 1999 - Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

7. BS EN 752-1:1996 - Drain and sewer systems outside buildings. Generalities and definitions

8. BS EN 752-2:1997 - Drain and sewer systems outside buildings. Performance requirements

9. BS EN 752-3:1997 - Drain and sewer systems outside buildings. Planning

10. BS EN 752-4:1998 - Drain and sewer systems outside buildings. Hydraulic design and environmental considerations

11. TRRL Laboratory Report 602 - Drainage of level or nearly level roads

12. Highways Agency's Design Manual for Roads and Bridges
HA 37 - Hydraulic Design of Road-edge Surface Water Channels
HA 102 - Spacing of Road Gullies
HA 33 - Surface and Sub-surface Drainage Systems For Highways
HA 105/04 - Sumpless Gullies

13. Highways Agency's Manual of Contract Documents for Highway Works
Specification for Highway Works
Notes for Guidance on the Specification for Highway Works
Highway Construction Details

14. HR Wallingford WP5 - The Wallingford Procedure for the design and analysis of urban storm drainage 1981

15. HR Wallingford WP6 - Wallingford Procedure for Europe: Best Practice Guide to Urban Drainage Modelling CD ROM 2001

16. HR Wallingford SR 581 - Hydraulic Capacity of Drainage Channels with Lateral Inflow 2001

17. HR Wallingford SR 606 - Hydraulic Design of Paved Areas 2002

18. Design of Linear Drainage by Dr. M Naqvi, Thomas Telford publishing 2003

19. The Building Regulations 2002 - Approved Document H3, Section 2, 'Drainage of Paved Areas'

20. Building Standards (Scotland) Regulations 1990, Technical Standard M 'Drainage and Sanitary Facilities'

21. Sewers for Adoption – 7th Edition

22. Sewers for Scotland - 2nd Edition

Beany® Block

Beany Block, Newcastle

Conservation Silver Grey

Standard Grey

Beany® Block

Combined Kerb and Drainage System

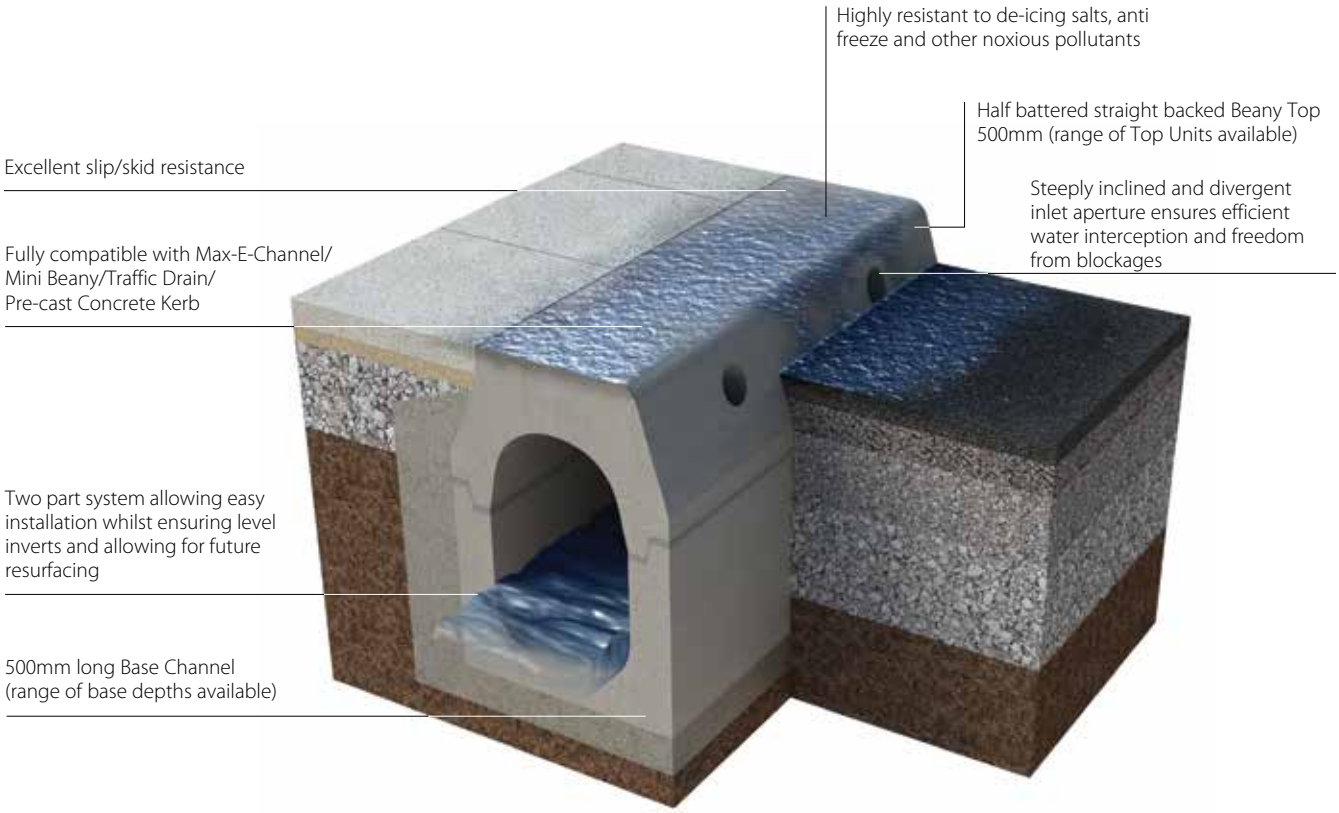
The original and the largest capacity combined kerb and drainage system on the market. Trusted and proven over more than 30 years with over 1 million linear meters installed and working. A two piece concrete system available in either standard or textured finishes combines the largest hydraulic capacity with the strongest loading classification. Supported by a range of accessories to deliver a flexible, versatile and aesthetically appealing solution for a variety of projects.

NBS Plus

Q10 190
Q25 800

Beany Block

Combined Kerb and Drainage System



- Beany Block carries the British Standard Kitemark
- High capacity.
- Proven and trusted.
- Great problem solver.
- General installation detail ensures load classification E600.
- A full and comprehensive range.
- Withstands installation damage.

Beany Block is the original combined kerb and drainage system which has been on the market for over 30 years. This tried, tested and proven system provides a unique, flexible and cost-effective solution to highway drainage requirements.
Mini Beany, Traffic Drain and Max-E-Channel further extend the use of this product.

The System

Beany Block consists of base units of standard channel section and top units of inverted channel section, with an elliptical aperture in the centre of one side face. When installed they form a combined kerb and surface water drainage system strong enough to withstand loadings imposed by both road and construction traffic.

The system has excellent surface drainage efficiency which coupled with its large flow capacity, makes Beany Block superior to and much less expensive than conventional kerb and point drainage on many highway and non-highway schemes.

Versatile

Beany Block is suitable for inclusion in highway schemes (although the system is likely to be most cost-effective in flat areas), reconstruction works where existing drainage systems have failed or where there is no existing surface water drain. Beany Block has been installed in schemes ranging from a few metres to several kilometres, from motorways and trunk roads to estate roads, service yards and car parks throughout the UK, Ireland and mainland Europe.

Despite its simplicity, Beany Block has many important design features which give it significant engineering benefits over alternative systems.

Note

Engineers wishing to incorporate Beany Block within a scheme should read this or use our free, no obligation Design Service.

Beany Block installation, mechanically handled

Cost Advantages

Beany Block is ideal where specific problems would arise with conventional drainage methods for example:

- Where there is insufficient fall to the outfall point.
- Where, in flat areas, either numerous, closely spaced gullies or false falls would be required in the carriageway.
- Where long gully connections would be needed.
- Where surface water drainage pipes would conflict with service mains and cables.
- Where ponding would occur at low points.
- Where traffic safety and control measures would be required when widening existing carriageway.

Beany Block is likely to be more economical than conventional kerb/point drainage where carriageways have crossfall, few vehicular crossings or where a surface water drain would be required for highway drainage purposes. Cost savings have been significant on highway and non-highway schemes incorporating lengths of the Beany Block system. For comparison purposes, conventional methods should include the following as appropriate:

- Surface water drain (including reinstatement).
- Gullies.
- Gully connections.
- Manholes.
- Kerbs.
- Channel Blocks.
- Extra 200mm width of footway plus a small amount of carriageway.
- Service diversions.
- Traffic safety and control (existing carriageways).

Beany Block is a simple two part system Straight Backed Top Unit and 295 Base

High Capacity Performance

- Beany Block is a high capacity system able to store storm water. Where limitations are placed on outfall capacities, Beany can help eliminate the need for storage reservoirs or balancing ponds.
- Beany Block can be used in flat areas or steep gradients.
- Inlet apertures are less than 500mm apart, reducing running or fast flowing water on the carriageway and eliminating ponding.

Construction Savings

- The Beany System combines water interception and transportation in one system. This minimises or eliminates the need for carrier drains, gullies and manholes, reducing construction costs and saving time.
- Simple two-part system – straightforward to design and detail, reducing design times and cost. Easy to set out and straightforward to install.
- The overall construction period can be reduced as carriageway materials may be laid in a continuous sequence. Unlike laying conventional drainage, excavations are kept to a minimum without exposing the formation and sub-base surfaces to possible periods of adverse weather.
- Underground cables and services can be avoided so contractual/ insurance claims are likely to be much less than when laying conventional drainage.

Low Maintenance

- Beany Block will require periodic inspection and emptying of Silt Traps, Outfalls and Catchpits. The number of Silt Traps and Outfalls are likely to be fewer than in a conventional drainage systems*. If a blockage does occur, it can easily be located and rectified by rodding or jetting from an access point or through a top block aperture adjacent to the blockage.

** It is reccommended to have an access point at the head of the run and every 50m and a Silt Trap every 100m*

Conservation Beany Block

- A silver grey coarse textured finish top unit, manufactured with granite aggregate, complements perfectly areas of high architectural, historical and scenic value. This product complements Marshalls Silver Grey Conservation Paving Kerb and Edging along with Mistral Concrete Block Paving and Conservation Setts. Mini Beany and Mono Beany are also available in Conservation.
- Conservation Beany is available with coarse texture to 2 or 3 faces and manufactured to order for an agreed quantity.

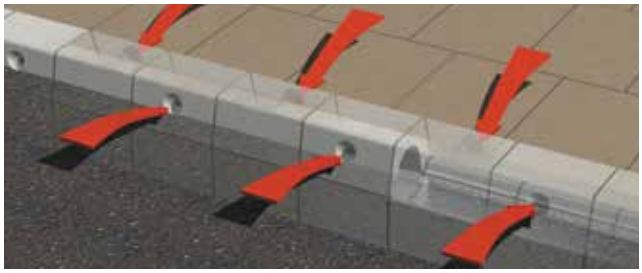
Engineering Benefits

Manufacture
Principal components are manufactured from natural coloured, hydraulically pressed concrete.

The high inherent strength and durability of pressed concrete means the Beany System can:

- Allow complete compaction of surfacing materials adjacent to the channel during construction.
- Provide resistance to horizontal displacement by heavy vehicles when held rigidly in place on site by backing concrete and the road materials on the front face.
- Withstand de-icing salts and freeze/thaw effects reducing maintenance and increasing service life.
- The manufacturing process enables tight dimensional control which produces consistent units for ease of on-site construction.

Top Blocks
- Symmetrical Top Units available to allow reversal of the units as appropriate to collect storm water from both sides of a run.
- Allows access for road rollers to fully compact carriageway surfacing material right up to the channels edge without damaging the units – of particular importance where carriageways have steep super elevation



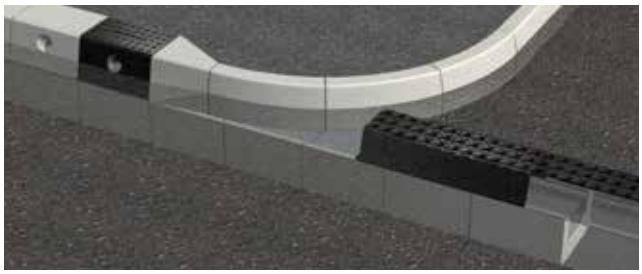
Beany Drainage from both sides using symmetrical top

Elliptical Water Inlet Aperture
- Located centrally within each top block to give maximum strength and wider on the inside of the top block – preventing resistance against loads imposed by overriding heavy vehicles.
- Positioned and shaped to give maximum drainage efficiency as well as a pleasing appearance.
- Wider on the inside of the top block to prevent blockages, inclined at 45 degrees to prevent silting and also to allow inspection of and rodding access to the base unit inverts.
- The elliptical inlet aperture is 120mm wide and 90mm in height

Wider on the inside of the Top Block to prevent blockages. Inclined at 45º to prevent 'silting' and also to allow inspection of and rodding access to the Base Unit inverts.

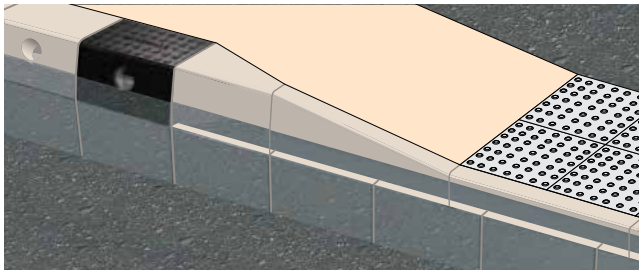
Road and Vehicular Crossings
- The system has been specifically designed so that where base units and cover plates are used to carry flows under carriageways or vehicular crossings, a minimum of 150mm of road material can be laid above the units to prevent damage and reflective carriageway surface cracking.
- The base unit maintains line and level under road crossings helping to keep construction time and costs to a minimum.
- Beany Block is fully compatible with the Max-E-Channel system. This allows for easy transition of Beany Block to Max-E-Channel.
- Instances where the flow collected in a run of Beany needs to continue across a junction or entrance and where interception of surface run-off is still required is possible with the use of Max-E-Channel.
- The invert is maintained and the differential height of the Beany and Max-E-Channel system is specifically designed to allow continuity of pavement level.

Beany to Cover Plates



Beany to Max-E-Channel (cast iron with holes)

Pedestrian Crossing
- The system has been designed to allow for the construction of pedestrian drop crossings. Flow can continue in base units and cover plate support the standard kerbs used at the crossing.
- The advantage of separate base and top blocks is that it is easy to retrofit pedestrian crossings in any length of Beany.

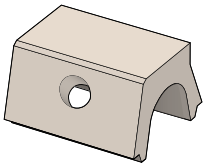


Beany at pedestrian crossing point

Components

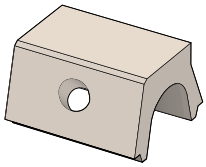
TOP COMPONENTS

Half battered straight backed



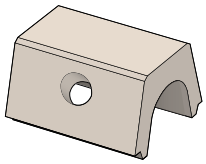
- Half battered front face profile.
- Straight back to assist with paving up to the back of the unit.
- Kerb upstand 75-125mm.
- 500mm in length.

Half battered straight backed (low hole)



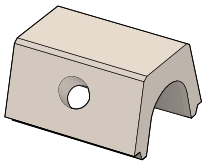
- Half battered front face profile.
- Straight back to assist with paving up to the back of the unit.
- Kerb upstand 150mm.
- For use with porous asphalt or high kerb upstand applications.
- 500mm in length.

Half battered symmetrical



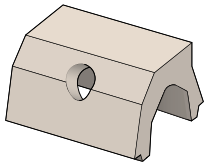
- Half battered profile to both front and back face.
- Symmetrical to allow top to be rotated to drain from both sides.
- Kerb upstand 75-125mm.
- 500mm in length.

Half battered symmetrical (low hole)



- Half battered profile to both front and back face.
- Symmetrical to allow top to be rotated to drain from both sides.
- Kerb upstand 150mm.
- For use with porous asphalt or applications requiring high kerb upstand.
- 500mm in length.

45° splayed straight backed

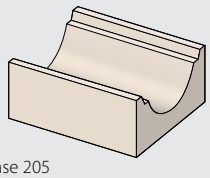


- 45 degree splayed front face profile.
- Straight back to assist with paving up to the back of the unit.
- Kerb upstand 75-100mm.
- 500mm in length.

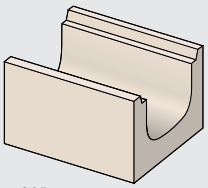
BEANY BLOCK BASE COMPONENTS

All Base Units, Ancillary items and Transition Units are 500mm long

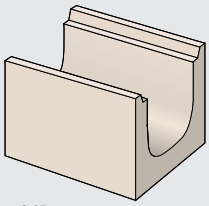
BASE UNITS



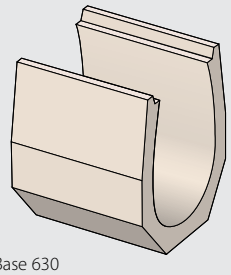
Base 205



Base 295

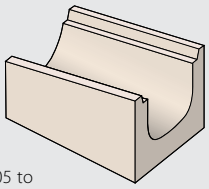


Base 365

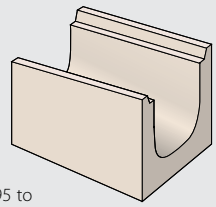


Base 630

TRANSITION UNITS

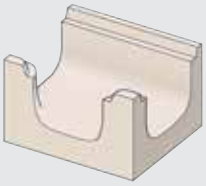


205 to
295 Transition

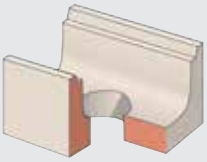


295 to
365 Transition

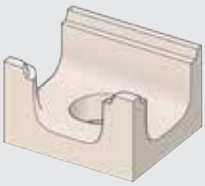
ANCILLARY ITEMS



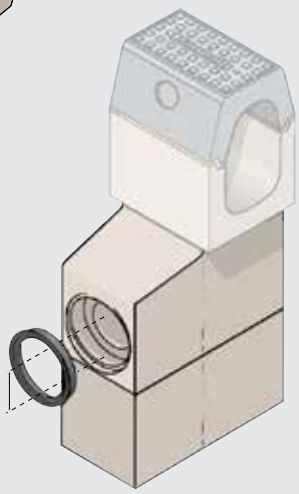
Junction
For Base 205 & 295



Outfall (shown sectioned for illustrative purposes)
For Base 205, 295 & 365



Junction/Outfall
For Base 205 & 295

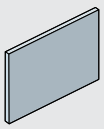


A trapped outfall is available to suit either 150mm or 225mm diameter outfall pipe. **Note: Gully Outfall does not include base outfall or access cover and frame.**

BASE END CAPS

Base end caps are available for 205, 295 and 365 base units. The galvanised steel plates act as permanent formwork to a concrete surround.

This is an optional detail to the use of engineering bricks.



Components

Top Components

Cover Plates

- Allows for 150mm of cover above the base unit with cover plate.
- Permits the use of standard drop kerbs at vehicular/pedestrian crossings before and after cover plated units.
- Allows sufficient road construction material above the protective concrete cover to avoid possible damage to the units and plates by heavy traffic.

Stop End Top Unit

- Available right and left handed (RH shown).
- Forms the transition from the Beany Block system to normal half battered kerbs at pedestrian or vehicular crossings.
- Forms the transition from the Beany Block system to normal half battered kerbs at pedestrian or vehicular crossings.

Access Covers

- All Beany Block access covers are now lockable for improved security.
- Cast Iron access covers and frames are available for use at outfalls, silt traps and access points.
- Compatible with all top blocks.
- Universal hinge can be changed to to either end of the acess lid to cater for offside or nearside applications
- Provide large access opening for the emptying of silt traps and outfall sumps using traditional equipment.

Cable Duct Blocks

- Polymer concrete cable duct units are available to permit insertion of traffic signal loop detector or other small cables between carriageway and footway/verge.

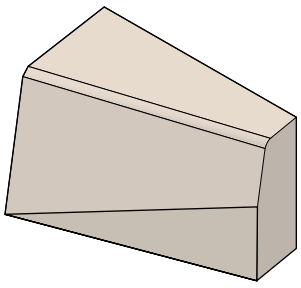
Bus Stop Units

- The Beany Bus Stop CKD's height and positioning means that passengers can be confident of safe and easy access to buses and other road transportation.
- The units also have our elliptical water inlet aperture to allow surface water collection from the carriageway and avoids standing water on the carriageway around the bus stop.

Radius Blocks

- Top and base units for external and internal horizontal curve radii from 50 metres down to 6 metres.
- Smaller radii can be manufactured to order.

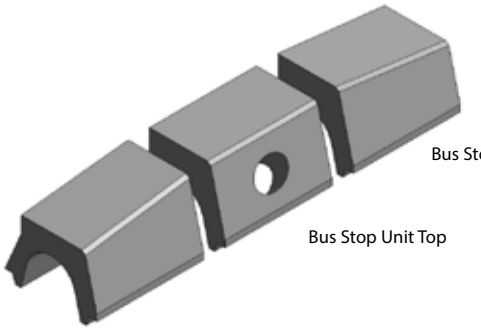
Radius	Type of Unit
>50	Standard
50.0-19.1	50/20
19.0-10.8	19/11
10.7-7.7	10/8
7.6-6.0	7/6
<6.0	Special to order
Right angle	90°
45° angle	45°



Stop End Top Unit (RH)

Straight Backed/Symmetrical Access Cover

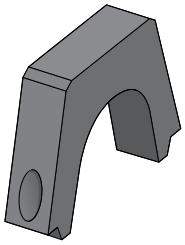
45° Splayed Access Cover



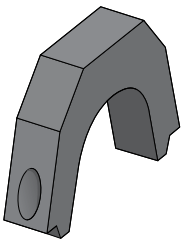
Bus Stop Unit Top (LH)

Bus Stop Unit Top

Bus Stop Unit Top (RH)



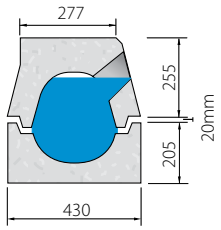
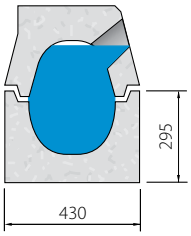
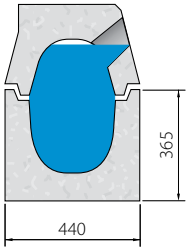
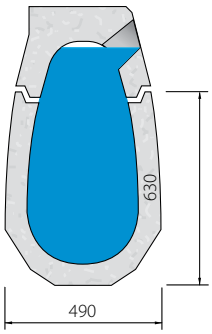
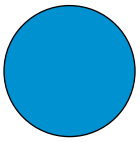
Straight Backed/ Symmetrical Cable Duct - ø50

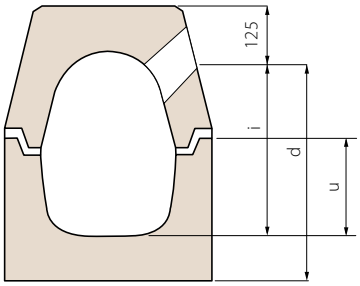
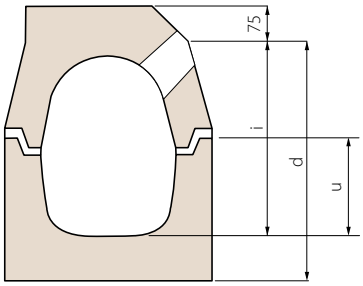


45° Splayed Cable Duct ø50

Hydraulic Data

FLOW CAPACITY

Beany Block Straight Backed, Half Battered with Base 205 Unit	Beany Block Straight Backed, Half Battered with Base 295 Unit	Beany Block Straight Backed, Half Battered with Base 365 Unit	Beany Block Straight Backed, Half Battered with Base 630 Unit
			
			
Equivalent Pipe Diameter (mm) 300	Equivalent Pipe Diameter (mm) 350	Equivalent Pipe Diameter (mm) 375	Equivalent Pipe Diameter (mm) 525

	Beany Block Half Battered Symmetrical			Beany Block 45° Splayed		
						
ref.	d	i	u	d	i	u
Base 205	355	285	135	405	335	135
Base 295	445	355	205	495	405	205
Base 365	515	425	275	565	475	275
Base 630	780	705	555	830	755	555

Hydraulic Data

The Beany Block hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using spatially variable flow design principles.

Symmetrical HB & Straight Backed Top Block

Base 205

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	31	0.48	37	0.58	42	0.66	45	0.70	48	0.75	55	0.86	64	1.00	79	1.23
100	27	0.42	36	0.56	43	0.67	47	0.73	52	0.81	62	0.97	71	1.11	86	1.34
150	24	0.38	35	0.55	44	0.69	48	0.75	55	0.86	69	1.08	78	1.22	93	1.45
200	20	0.31	33	0.52	44	0.69	50	0.78	59	0.92	76	1.19	85	1.33	99	1.55
250	17	0.27	32	0.50	45	0.70	52	0.81	62	0.97	83	1.30	92	1.44	106	1.66

Base 295

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	47	0.53	56	0.64	63	0.72	66	0.75	71	0.81	80	0.91	93	1.06	115	1.31
100	43	0.49	55	0.63	64	0.73	68	0.77	75	0.85	89	1.01	102	1.16	123	1.40
150	37	0.42	53	0.60	65	0.74	70	0.80	79	0.90	96	1.09	110	1.25	131	1.49
200	35	0.40	51	0.58	65	0.74	72	0.82	83	0.94	105	1.19	118	1.34	140	1.59
250	30	0.34	50	0.57	66	0.75	74	0.84	87	0.99	113	1.28	127	1.44	148	1.68
300	26	0.30	48	0.55	67	0.76	76	0.86	91	1.03	122	1.39	135	1.53	156	1.77
350	22	0.25	46	0.52	68	0.77	78	0.89	95	1.08	130	1.48	143	1.63	164	1.86

Base 365

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	61	0.58	73	0.70	81	0.77	85	0.81	91	0.87	102	0.97	119	1.13	147	1.40
100	57	0.54	71	0.68	82	0.78	87	0.83	95	0.90	111	1.06	128	1.22	155	1.48
150	53	0.50	69	0.66	83	0.79	89	0.85	99	0.94	120	1.14	137	1.30	164	1.56
200	48	0.46	68	0.65	84	0.80	91	0.87	104	0.99	128	1.22	145	1.38	173	1.65
250	44	0.42	66	0.63	85	0.81	94	0.90	108	1.03	137	1.30	154	1.47	182	1.73
300	39	0.37	64	0.61	85	0.81	96	0.91	112	1.07	146	1.39	163	1.55	191	1.82
350	35	0.33	62	0.59	86	0.82	98	0.93	117	1.11	155	1.48	172	1.64	200	1.90
400	31	0.30	61	0.58	87	0.83	100	0.95	121	1.15	164	1.56	181	1.72	208	1.98

Base 630

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
100	136	0.66	164	0.79	183	0.88	192	0.93	206	1.00	233	1.13	271	1.31	334	1.61
150	131	0.63	161	0.78	184	0.89	195	0.94	212	1.02	245	1.18	283	1.37	345	1.67
200	125	0.60	159	0.77	186	0.90	198	0.96	217	1.05	256	1.24	295	1.43	357	1.72
250	119	0.57	157	0.76	187	0.90	201	0.97	223	1.08	268	1.29	307	1.48	369	1.78
300	113	0.55	154	0.74	188	0.91	204	0.99	229	1.11	280	1.35	319	1.54	381	1.84
350	107	0.52	152	0.73	189	0.91	207	1.00	235	1.14	292	1.41	331	1.60	393	1.90
400	101	0.49	150	0.72	190	0.92	210	1.01	241	1.16	303	1.46	342	1.65	404	1.95
450	96	0.46	147	0.71	191	0.92	213	1.03	246	1.19	316	1.53	354	1.71	416	2.00
500	90	0.43	145	0.70	193	0.93	216	1.04	252	1.22	327	1.58	366	1.77	428	2.07
550	84	0.41	143	0.69	194	0.94	219	1.06	258	1.25	339	1.64	377	1.82	440	2.13
600	78	0.38	140	0.68	195	0.94	222	1.07	264	1.28	351	1.70	390	1.88	451	2.18

Hydraulic Data

Beany® Block & 45° Splayed Top Block

Base 205

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	30	0.47	36	0.56	41	0.64	43	0.67	46	0.72	53	0.83	61	0.95	75	1.17
100	27	0.42	35	0.55	41	0.64	44	0.69	49	0.77	59	0.92	67	1.05	81	1.27
150	24	0.38	34	0.53	42	0.66	46	0.72	52	0.81	65	1.02	73	1.14	87	1.36
200	21	0.33	33	0.52	42	0.66	47	0.73	55	0.86	71	1.11	79	1.23	93	1.45
250	18	0.28	31	0.48	43	0.67	49	0.77	58	0.91	77	1.20	85	1.33	99	1.55
300	15	0.23	30	0.47	44	0.69	50	0.78	61	0.95	83	1.30	91	1.42	105	1.64

Base 295

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	45	0.51	55	0.63	61	0.69	64	0.73	68	0.77	77	0.88	90	1.02	111	1.26
100	42	0.48	53	0.60	62	0.70	66	0.75	72	0.82	85	0.97	97	1.10	118	1.34
150	39	0.44	52	0.59	63	0.72	68	0.77	76	0.86	92	1.05	105	1.19	125	1.42
200	35	0.40	50	0.57	63	0.72	69	0.78	79	0.90	99	1.13	112	1.27	133	1.51
250	31	0.35	49	0.56	64	0.73	71	0.81	83	0.94	106	1.20	119	1.35	140	1.59
300	28	0.32	47	0.53	65	0.74	73	0.83	86	0.98	114	1.30	126	1.43	147	1.67
350	24	0.27	46	0.52	65	0.74	75	0.85	90	1.02	121	1.38	134	1.52	154	1.75

Base 365

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	60	0.57	71	0.68	79	0.75	83	0.79	88	0.84	99	0.94	115	1.10	142	1.35
100	56	0.53	70	0.67	80	0.76	85	0.81	92	0.88	107	1.02	123	1.17	150	1.43
150	53	0.50	68	0.65	81	0.77	87	0.83	96	0.91	115	1.10	131	1.25	158	1.50
200	49	0.47	67	0.64	81	0.77	89	0.85	100	0.95	122	1.16	139	1.32	167	1.59
250	45	0.43	65	0.62	82	0.78	91	0.87	103	0.98	130	1.24	147	1.40	174	1.66
300	41	0.39	64	0.61	83	0.79	93	0.89	107	1.02	138	1.31	155	1.48	182	1.73
350	37	0.35	62	0.59	84	0.80	94	0.90	111	1.06	146	1.39	163	1.55	190	1.81
400	33	0.31	60	0.57	85	0.81	96	0.91	115	1.10	154	1.47	171	1.63	197	1.88

Base 630

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
100	136	0.66	162	0.78	181	0.87	190	0.92	203	0.98	229	1.11	267	1.29	329	1.59
150	130	0.63	160	0.77	182	0.88	192	0.93	208	1.01	241	1.16	278	1.34	340	1.64
200	125	0.60	158	0.76	183	0.88	195	0.94	214	1.03	252	1.22	289	1.40	351	1.70
250	119	0.57	155	0.75	184	0.89	198	0.96	219	1.06	263	1.27	301	1.45	362	1.75
300	114	0.55	153	0.74	185	0.89	201	0.97	225	1.09	274	1.32	311	1.50	373	1.80
350	108	0.52	151	0.73	186	0.90	203	0.98	230	1.11	285	1.38	323	1.56	384	1.86
400	103	0.50	149	0.72	188	0.91	206	1.00	235	1.14	296	1.43	334	1.61	395	1.91
450	97	0.47	145	0.70	189	0.91	209	1.00	241	1.16	307	1.48	345	1.67	406	1.96
500	91	0.44	144	0.70	190	0.92	212	1.02	246	1.19	318	1.54	356	1.72	417	2.01
550	86	0.42	142	0.69	191	0.92	214	1.03	252	1.22	329	1.59	367	1.77	428	2.07
600	80	0.39	140	0.68	192	0.93	217	1.05	257	1.24	340	1.64	378	1.83	439	2.12

Theoretical Outfall Capacities

Outfall Type	Outlet Pipe Diameter (mm)	l/s	m/s
Beany Outfall with Base 205	150	36	3.32
Beany Outfall with Base 295	150	38	3.52
Beany Outfall with Base 365	150	40	3.67
Beany Outfall with Base 205	225	82	3.40
Beany Outfall with Base 295	225	87	3.60
Beany Outfall with Base 365	225	91	3.75

For hydraulic rates of Beany bases and cover plates, refer to the Max-E Channel and concrete top hydraulic table.

Beany Block Component Codes

A Top Blocks

Top Blocks	Length (mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code
HB Straight Back	500	430	255	71	**DR700020**
HB Straight Back Conservation	500	430	255	75	DR9300023
HB Straight Back Low Hole	500	430	255	71	DR700030
HB Symmetrical Low Hole	500	430	255	71	DR700035
HB Symmetrical	500	430	255	73	**DR700010**
45 Splayed Straight Back	500	430	255	76	**DR700060**
HB Bus Stop 180 Upstand	500	430	350	71	**DR791010**

*** Special finishes may be available upon request**

B Radial Tops

Radial Tops	Unit Weight (kg)	Item Code
HB 50/20m Ext	71	DR730020
HB 19/11m Ext	71	DR730030
HB Cut 10/8m Ext	71	DR730040
HB Cut 7/6m Ext	71	DR730050
HB Cut 10/8 Int	71	DR730240
HB Cut 7/6 Int	71	DR730250
HB Cut 50/20m Int	71	DR730210
HB Cut 19/11m Int	71	DR730230
HB St Back 10/8m Int	71	DR740240
HB St Back 7/6 Int	71	DR740250
HB St Back 7/6 Int	76	DR751050
HB St Back 50/20m Ext	69	**DR740020**
HB St Back 19/11m Ext	69	**DR740030**
HB St Back Cut 10/8m Ext	69	DR740040
HB St Back Cut 7/6m Ext	69	DR740050
HB St Back Cut 50/20 Int	69	DR740210
HB St Back Cut 19/11 Int	69	DR740230
45° SP Str Bk Cut 50/20 Int	76	DR751009
45° SP Str Bk Cut 50/20 Ext	76	DR751010
45° SP Str Bk Cut 19/11 Ext	76	DR751031
45° SP Str Bk Cut 10/8 Ext	76	DR751040

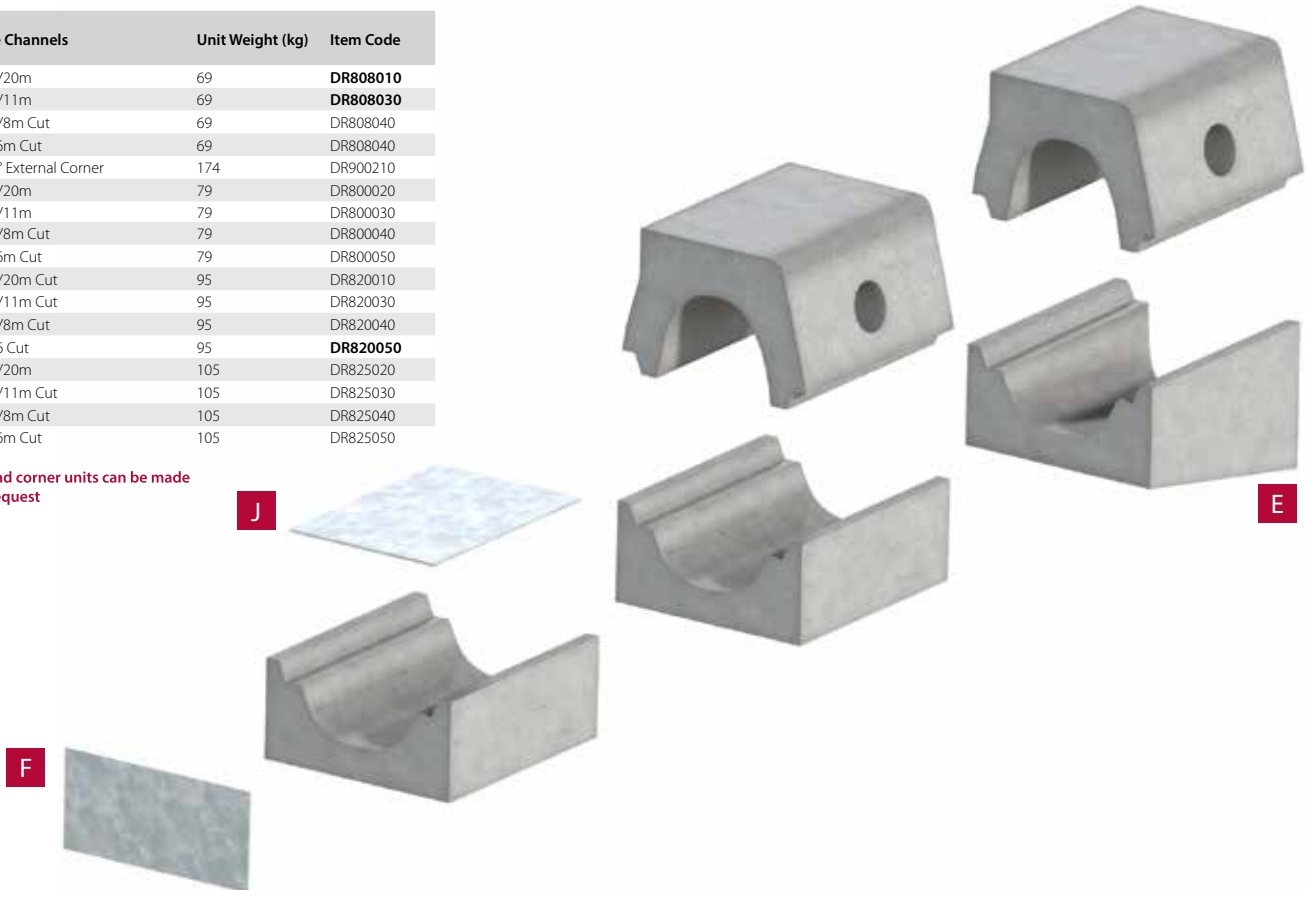
C Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
205 Press chan	500	430	280	205	135	70	**DR720021**
295 Press chan	500	430	280	295	205	85	**DR720010**
365 Press chan	500	440	280	365	275	96	**DR720030**
630 Press chan	500	440/490	280/360	630	555	110	**DR720045**

D Radial Channels

Radial Base Channels	Unit Weight (kg)	Item Code
205 Base 50/20m	69	**DR808010**
205 Base 19/11m	69	**DR808030**
205 Base 10/8m Cut	69	DR808040
205 Base 7/6m Cut	69	DR808040
205 Base 45° External Corner	174	DR900210
295 Base 50/20m	79	DR800020
295 Base 19/11m	79	DR800030
295 Base 10/8m Cut	79	DR800040
295 Base 7/6m Cut	79	DR800050
365 Base 50/20m Cut	95	DR820010
365 Base 19/11m Cut	95	DR820030
365 Base 10/8m Cut	95	DR820040
365 Base 7/6 Cut	95	**DR820050**
630 Base 50/20m	105	DR825020
630 Base 19/11m Cut	105	DR825030
630 Base 10/8m Cut	105	DR825040
630 Base 7/6m Cut	105	DR825050

More radius and corner units can be made available on request



Beany Block with reference numbers indicated in **bold** black are available ex-stock.
Beany Block with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

E Transition Channels

Transitions Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/Downstream	Invert Depth (mm) Upsteam/Downstream	Unit Weight (kg)	Item Code
205 - 295	500	430	280	205/295	135/205	100	DR870010
295 - 365	500	430	280	295/365	205/275	87	DR870021

F End Caps

End Caps	Unit Weight (kg)	Item Code
205 Base End Cap	2.2	**DR720025**
295 Base End Cap	3	**DR720015**
365 Base End Cap	3.8	**DR720035**

G Outfalls & Access Covers

Outfalls and Access Covers	Unit Weight (kg)	Item Code
205 Base Outfall	87	**DR850041**
205 Base Junction	87	DR850051
205 Base Outfall/Junction	87	DR850061
295 Base Outfall	87	**DR850010**
295 Base Junction	87	DR850020
295 Base Outfall/Junction	87	DR850030
365 Base Outfall	87	**DR850070**
Gully Outfall 150	227	**DR460401**
Gully Outfall 225	242	**DR460406**
HB Universal Access Cover	51	**DR915017**
45° SP Near Side Access Cover	95	**DR915020**
45° SP Offside Access Cover	95	**DR915025**

H Cable Duct Blocks

Cable Duct Blocks	Unit Weight (kg)	Item Code
Cable Duct Block HB	12	DR920040
Cable Duct Block Splay	12	DR920050

I Standard Kerb Transitions

Standard Kerb Transitions	Unit Weight (kg)	Item Code
Stop End Top Block L/H	87	**DR790010**
Stop End Top Block R/H	87	**DR790011**

J Cover Plates

Cover Plates	Unit Weight (kg)	Item Code
Cover Plate Cut 50/11m	16	DR910010
Cover Plate Standard	16	DR910005

*** Radius cover plates available upon request**

Standard Details

Drawing 1 of 8

45° Splayed Top Block With Base 630

Half Battered Top Block With Base 205, 295 or 365

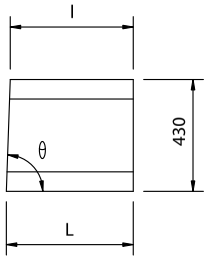
Base Unit	H (Mm)	h (Mm)	T (Mm)	Depth: C/way Channel To Invert (125 Kerb Upstand) (Mm)
Base 205	480	205	70	285
Base 295	570	295	90	355
Base 365	640	365	90	425
Base 630	905	630	75	705

Kerb Upstand (Mm)	75	100	110	120	125	150
X* (Mm)	46	40	37	34	33	27
Y (Mm)	200	175	165	155	150	125

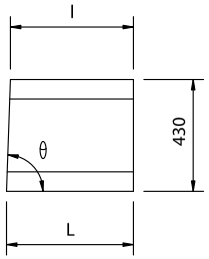
(*) For Base 630 Add 5mm To X Values

Where X Is Dimension To Top Outside Edge Of Base Block

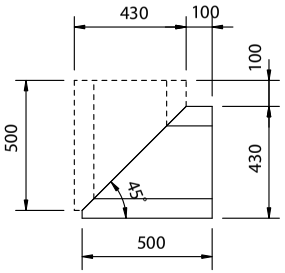
Base Unit Setting Out Detail



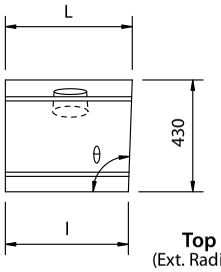
Base 205, 295 Or 365
(Ext. Or Int. Radius)



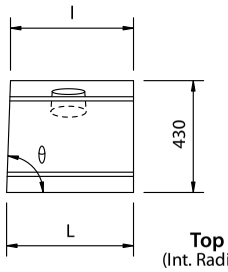
Base 630
(Ext. Or Int. Radius)



90° Top And Base
(Ext. Or Int. Radius)

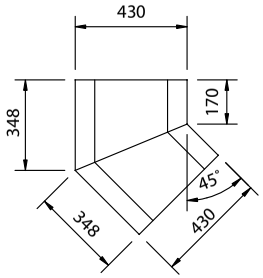


Top
(Ext. Radius)

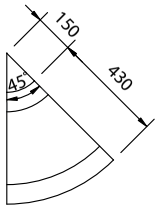


Top
(Int. Radius)

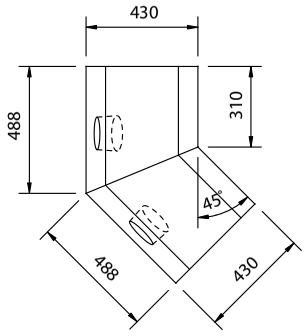
Cover Plate Dimensions:
- Straight: 500 X 340.
- 50/11, 10/8, 7/6 And 90°
Supplied To Match
Respective Bases.
- All 12.5 Thick.



45° Top And Base
(Internal)



Base Unit Bend



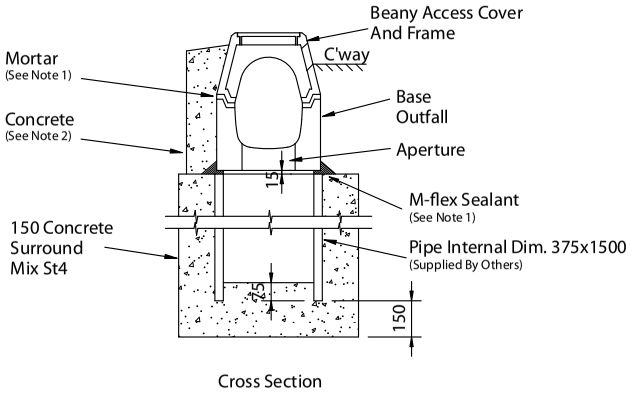
45° Top And Base
(External)

TYPE OF UNIT	RADIUS	L (mm)	l (mm)	θ°
50/20 - BASE 205, 295 OR 365 (EXT. & INT. RAD.)	50.0 - 19.1	488	481	89
19/11 " " "	19.0 - 10.8	488	473	88
10/8 " " "	10.7 - 7.7	488	464	87
7/6 " " "	7.6 - 6.0	488	457	86
50/20 - BASE 630 (EXT. & INT. RAD.)	50.0 - 19.1	500	493	89
19/11 " " "	19.0 - 10.8	500	484	88
10/8 " " "	10.7 - 7.7	500	473	87
7/6 " " "	7.6 - 6.0	500	463	86
50/20 - TOP (EXT. RAD.)	50.0 - 19.1	488	481	91
19/11 " "	19.0 - 10.8	488	473	92
10/8 " "	10.7 - 7.7	488	464	93
7/6 " "	7.6 - 6.0	488	457	94
50/20 - TOP (INT. RAD.)	50.0 - 19.1	488	481	89
19/11 " "	19.0 - 10.8	488	473	89
10/8 " "	10.7 - 7.7	488	464	87
7/6 " "	7.6 - 6.0	488	457	86

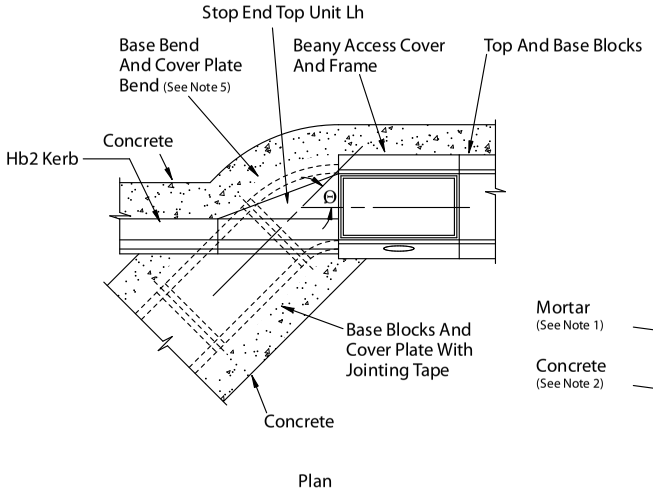
Standard Details

Drawing 3 of 8

Outfall Pipe Invert Depth From Carriageway Level(Mm)		
Beany Base	150ø	225ø
205	701	738
295	791	828
365	861	898
All Figures Assume 125mm Kerb Upstand		

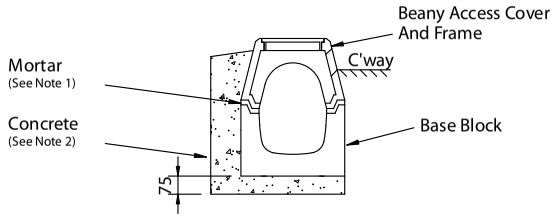


Cross Section



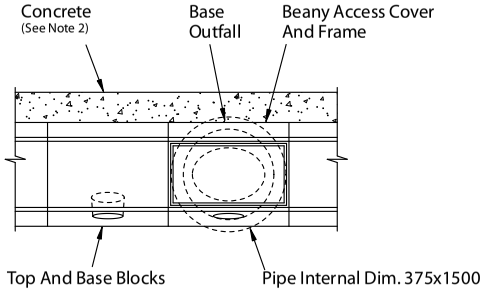
Plan

Beany Block Bend With Base And Cover Plates Beneath Carriageway



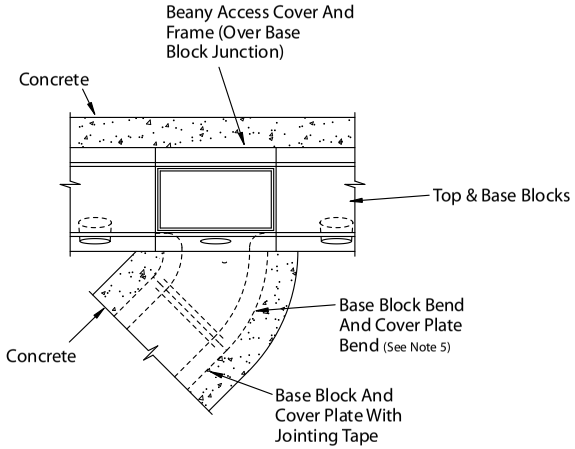
Cross Section

Access Cover



Plan

Silt Trap

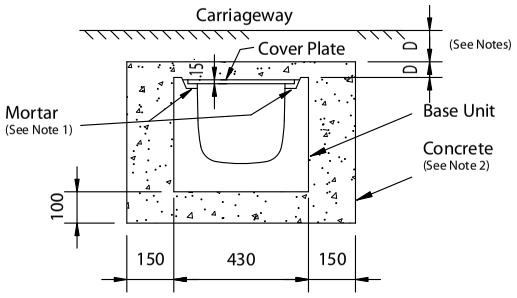


Plan

Beany Block Junction With Base And Cover Plates Beneath Carriageway

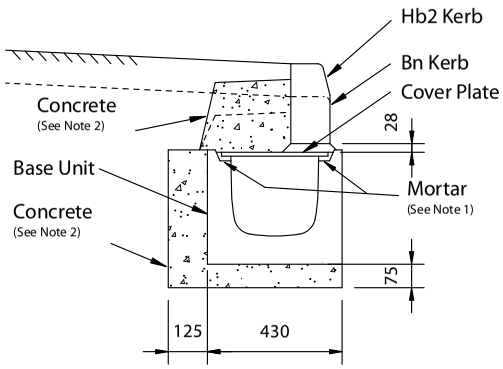
Standard Details

Drawing 5 of 8



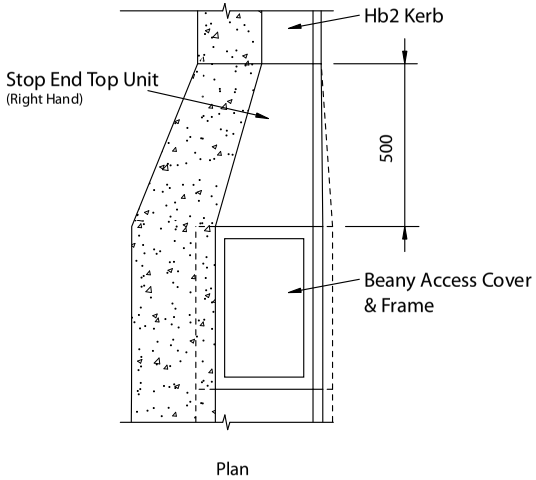
Cross Section

Base Unit & Cover Plate
Below Carriageway



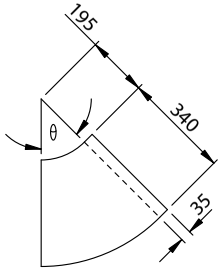
Cross Section

Base Unit & Cover Plate
At Dropped Carriageway



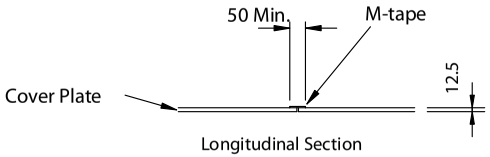
Plan

Stop End

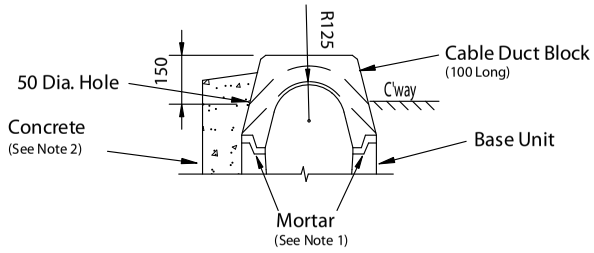


θ°= Angle As Shown In `Bend' Or `Junction'
Detail And Specified In Beany Block Schedule.
Standard Cover Plate Bend

Cover Plate Bend



Longitudinal Section



Cross Section

Cable Duct Block
(Also Supplied To Suit 45° Splayed Profile)

Standard Details

Drawing 7 of 8

Beany Block Dropped Crossing Detail - Plan

Beany Block Dropped Crossing Detail - Elevation

Drawing 8 of 8

Standard Details

Notes For Beany Block Details Sheets

Drawings 1 to 8

1. Mortars shall be;
i) A Mortar class 12 cement mortar to BS EN 998-2 for bedding the Top Blocks

ii) Marshalls' M-Flex for bedding Base Block Outfalls onto the Beany Trapped Gully Unit

iii) Marshalls' M-Flex for bedding the sections of the Marshalls' Trapped Gully Unit sections

2. Concrete bed, haunch and surround shall be;
i) A mix ST1 concrete to BS 8500-1&2 and BS EN 206-1 for Base Blocks used in the normal kerb application

ii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Base Blocks used within the carriageway (i.e. where Base Block are used with cover plates and are trafficked)

iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Beany Trapped Gully, Silt Traps, Catch Pits and outfall details

iv) The specification for carrier pipe concrete surround is by others

3. Marshalls' vertical joint sealant, M-Seal, shall be applied to all Base Blocks.

4. For Base 630 applications, all Outfalls, Silt Traps and junctions should be formed by a brick Catch Pit structure;
i) The outfall pipe diameter, gradient, depth to invert, depth of trap shall be by others

ii) The internal dimensions of the catch pit shall be 540 wide x 1000 long for Base 630 applications

iii) Corbelled brickwork with a maximum of 22mm steps shall be used to support the Access Cover and Frames

5. Beany Block Access Covers and Frames are universal for use in both "nearside" and "offside".

6. Movement joint details that fully isolate the Beany Block whilst maintaining restraint shall be provided adjacent to all concrete slabs, even when the slab is covered by other materials.

7. Stop End Top Blocks Units are available as left hand (LH) or right hand (RH) for use at transitions to half battered kerbs.

8. For Beany Block with cover plate a minimum of 50mm concrete cover (d) and 100mm of surfacing (D) will be required.

9. All dimensions are in millimetres.

Specification

Introduction
The following specification covers the complete Beany Block system including ancillary fittings and is compatible with the Standard Detail drawings.

Where the Manual of Contract Documents for Highway Works is used, information for 'Appendix 5/5: Combined Drainage and Kerb Systems' is available on request.

Beany Blocks

1. The combined kerb and drainage system shall be Beany Block, manufactured in pre-cast concrete, with the exception of certain fitments as supplied by Marshalls Halifax HX3 9HT in accordance with Standard Detail Sheets.

2. The combined kerb and drainage system shall consist of a two part system consisting of top blocks with a ***symmetrical half battered/ straight backed half battered/or 45º splayed profile**** together with base blocks that are ***205/ 295/365/ or 630mm**** deep.

3. All components of the Beany Blocks, shall comply with the British Standard BS EN1433, Load Classification E600 and the following:

(i) The water inlet aperture shall increase in size towards the inside of the unit with a minimum divergence angle of 5°

(ii) The angle of incline of the water inlet aperture shall be at least 30° to the horizontal

(iii) Water inlet apertures shall be wholly within individual units and not within 100mm of the end of each unit.

(iv) The Top Block shall have an Unpolished Skid Resistance Value (USRV) in excess of 70 when tested in accordance with BS 7263:Part 3

(v) The system shall have a minimum of 16,100mm^2/m water inlet aperture area

4. The combined kerb and drainage system comprising straight top and base blocks, splay cut top and base blocks for radius use, straight and radius cover plates, cable duct blocks, outfalls, silt traps, access covers, stop end top blocks, end caps and sealant shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.

Note: * delete as required

Construction

Introduction
Installation of the Beany Block Combined Kerb and Drainage System should be carried out in accordance with the Specification and Standard Detail drawings.

The following method of installation is recommended.

Excavation
Sufficient material should be excavated to accommodate Top and Base Units, concrete bedding and haunching. Any 'soft spots' or poorly compacted formation should be made good.

Where Base Units and Cover Plates are to be installed beneath new pavements, the pavements shall be completed to top of roadbase level for flexible construction, or to top of sub-base level for rigid construction, before excavation for the Units commences.

Setting Out
Setting out pins should be accurately located, in accordance with the Contract drawings, with a string line level with the top front corners of the Base Units. Line and level will depend on the kerb upstand. It may be advantageous to locate setting out pins to the rear of the Units to avoid having to lift the Units over the string line.

Plenty of setting out pins should be inserted where Beany Blocks are laid on horizontal curves (e.g. every 5m for radius of 30m) and the appropriate 'splay' Units used for radii of 50m or less.

Note:
The theoretical maximum gap between adjacent Top Block corners when laid to horizontal curves is 4mm and is zero when the radius is:

Type Of Block	Radius For Zero Gap (M)
50/20	30.0
19/11	14.0
10/8	8.7
7/6	6.8

In practice, gaps between Base Blocks are likely to be slightly greater due to laying tolerances and application of vertical joint sealant.

The approximate number of Blocks required for a quarter circle (external radius) i.e. 90° road junction, may be calculated from:
Top and Base 3.21 x R
Where R = horizontal radius (m)
e.g. for Standard Top and Base Blocks laid to a 15m radius,
No. = 3.21 x 15 = 48 Units (24m)

Base Units
Base Units shall be laid to correspond to carriageway channel levels, or where beneath the carriageway, be laid to a straight grade. Starting at the Outfall, i.e. working uphill, the Units should be bedded on to a freshly mixed foundation of the appropriate grade and thickness of concrete (refer to Standard Detail Sheet.). Concrete bed, haunch and surround shall be a standard mix complying with BS 8500-2:

(i) Mix ST1 for kerb installations

(ii) Mix ST4, for base and cover plates in the carriageway

Alternatively, the Units may be bedded on to a layer of cement mortar 10-40mm thick on a previously prepared concrete foundation.

Sufficient M-Seal bituminous mastic jointing compound should be trowelled on to one or both end faces so that the joint will be well sealed when the next Unit is tamped into position. Surplus sealant shall be removed from the inner surface of the Units as work proceeds.

18 litres of M-Seal should be sufficient for the following length of Beany Block:

M-Seal Requirement	
Base Type	**Coverage (lin.m/18l)**
205	90
295	70
365	55
630	35

Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter. Cutting of Base Junctions or Outfall Units is not recommended.

Top Blocks
The string line should be set to the level of the top corner of Units. Again, starting at the Outfall, the Units should be set directly onto a liberal quantity of stiff, cement mortar to completely fill the whole of the joint. Cement mortar shall be Class M12 in accordance with BS EN 998-2. These should be tamped into position close to previously laid Units and the alignment checked. The levels should be checked using the string line and a spirit level. In addition, the general alignment should be checked from all directions as each Block is laid. Any Unit deviating by more than 3mm in 3m from line and level shall be made good by lifting and relaying.

The inside and outside of the joints between Base and Top Units should be pointed and cleaned out with a brush or rag as work proceeds.

Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units, other than cast iron or steel, shall be carried out with a concrete saw or disc cutter.

Cover Plates
Cover Plates should be bedded on cement mortar to the specified thickness, pointed inside and outside of the joints with the inside of the Base Units being cleaned out as work proceeds. The Cover Plates should be close jointed and the joints sealed with 50mm wide M-Tape. Cover Plates shall be suitably protected before and during installation in order that the protective coating is not damaged.

Where cutting is necessary, one or two plates shall be cut so that no single plate is less than 250mm. Cut or damaged plates shall be renovated in accordance with BS 729: 1971 (1986).

Beany Block Stop End Top Unit
The Beany Block Stop End Top Units should be used at any transitions from Beany Block to half battered kerbs. At the ends of Beany Block runs,

Construction

these should be bedded onto freshly mixed concrete and kerb installation continued. Where they are to be used at dropped crossing, they should be bedded onto freshly mixed mortar and the dropper kerb and centre stone installation continued.

Beany Block End Caps

Where the Beany Block run does not terminate at an outfall, the base unit shall be sealed using the Beany Block End Cap. This is available for Base 250, 295 and 365 and is formed of galvanised mild steel. The End Cap shall be securely placed against the vertical end of the base unit and haunched with fresh concrete.

Notes

1. In order to obtain a 'good line', it is very important to lay the Top Units on the specified thickness of compacted mortar using the string line and Base Units as a guide. Too thin a layer of mortar will not allow sufficient sideways movement of the units to achieve an acceptable alignment.

2. It is not necessary for Top and Base Unit vertical joints to line up although there will be more tolerance for adjustment of the Tops, if the joints are close together on curves of 10m radius or less.

3. Where Beany Block is laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the units and haunching adjacent to the slab joints and also longitudinal movement joints between the haunching and the slabs. Where necessary, Top Unit drainage openings shall be protected against the ingress of material during concreting operations by covering with Waterproof Cloth Tape.

4 . Outfalls, Silt Traps and Access Covers shall be constructed in accordance with the Standard Detail Sheet using the appropriate type of Base Unit. Units shall be bedded on sufficient M-Flex sealant over a gully pot, Outfall Unit or vertical pipe, to make a watertight joint. Where necessary in situ smooth concrete benching shall be shaped to the full depth of the Base Unit. In Silt Traps, the pipe shall be bedded into mix ST4 concrete which shall be fully compacted to make a watertight seal.

5. Cable Duct Blocks shall be bedded on cement mortar in accordance with the Standard Detail Sheet.

6. In situ concrete haunching or surround should not be placed until the installed blocks have been inspected and approved by the Engineer. The haunching/surrounding should be carried out as one operation to complete lines of Top and Base Units/Cover Plates in accordance with the Standard Detail Sheet. The top of the concrete surround for Base Units and Cover Plates under new carriageways shall be finished level with the top of the roadbase for flexible construction or top of sub-base level for rigid construction (see Note 10). Construction plant or vehicles crossing the Units shall be suitable in relation to thickness of concrete cover so that damage is not caused to the Units, Cover Plates, concrete bedding or haunching.

7. In order to reduce the risk of carriageway surface cracking, special consideration should be given to treatment of flexible surfacing layers above Base Blocks and Cover Plates Type A.

Example (i)

D = Wearing Course + Base Course Surfacing

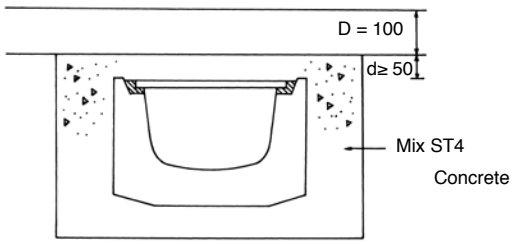


Fig. 17 Base Block and Cover Plate Type A

Where the surfacing is less than 100mm or where Blocks are to be laid in an existing carriageway, additional drawings may be required showing vertical staggers at the course interfaces so that the tops of the main trench sides are not less than 100mm from the final carriageway surface. These will vary with the number and thickness of each course as well as the total cover above the Units.

Two typical examples are as shown in fig. 18 and 19.

Example (ii)

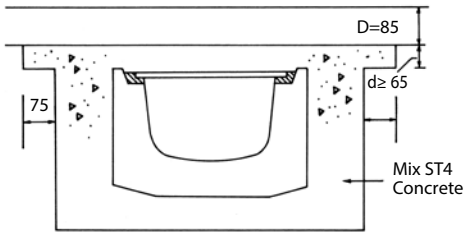


Fig. 18 Base Block and Cover Plate detail where D<100mm

Example (iii)

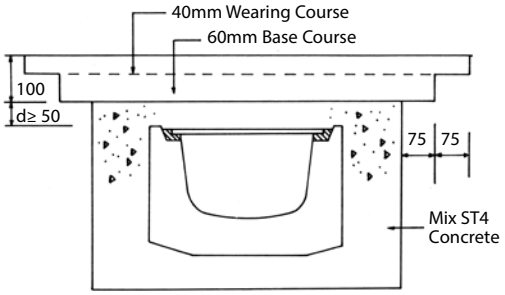


Fig 19 Base Block and Cover Plate detail where D=0 (existing c/way)

8. Adjacent carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed. Base Units, Outfalls, Junctions or Bends not covered by fully bedded Top Units, Cover Plates or covers and frames, shall be adequately supported against loadings imposed by construction traffic.

Construction

9. Where flexible surfacing is laid greater than 15mm above the bottom of the drainage aperture, it shall be cut and shaped after rolling when partially cooled at each Top Unit, to form a smooth chamfer. A special steel cutting tool is available from Marshalls.

10. On completion of the works, the Beany Block System shall be cleaned out by high pressure water jetting (100-150 bar at 200 l/min minimum) and left free from obstructions and all Outfalls and Silt Traps shall be emptied. Top Unit drainage apertures shall be covered by timber boards or other approved method, during jetting operations. The cleaning process shall be repeated where necessary after the completion of any remedial works.

11. When used in conjunction with the Manual of Contract Documents for Highway Works, reference should be made to Appendix 5/5.

    For works not carried out under the above specification, it may be necessary to clarify cement mortar in accordance with BS EN 998-2 and concrete mix ST1, ST4 and grade C25/30 as specified in BS 8500-2.

12. Conventional gully gratings should have a maximum overall depth of 140mm to allow bedding over Base Units (as in Access Cover Type 2, Standard Detail Sheet).

Mini Beany®

Mini Beany, Conservation, Bedford

Conservation Silver Grey

Standard Grey

Mini Beany®

Combined Kerb and Drainage System

Mini Beany is a low to medium capacity combined kerb and drainage system which evolved from the successful Beany range. The robust concrete construction makes this the ideal choice for areas of heavy or abnormally heavy wheel loads. Available in a choice of top finishes to complement a wide range of projects, from urban to rural.

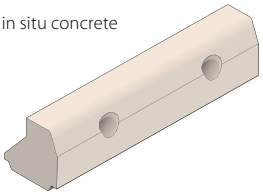
NBSPlus
Q10 190

Mini Beany®

Combined Kerb and Drainage System

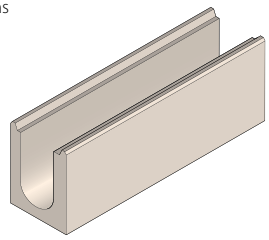
Mini Beany® Top Blocks

- Mini Beany carries the British Standard Kitemark
- Top Blocks available in 500mm & 1000mm lengths
- 500mm long radius top blocks are available
- Half battered profile suitable for use with tarmac, in situ concrete and concrete block paving
- Reduces mechanical lifts per metre from 2 to 1 for top unit.



Mini Beany® Pressed Base

- Increased strength of channel bases, resulting in improved installation with no requirement for front haunching, just bedding and backing concrete
- Available in 1000mm lengths in four invert depths
- 500mm long radius bases are available
- Fully compatible with Traffic drain and the current range of trapped outfalls and ancillary items
- Quicker to install with significant savings on installation.

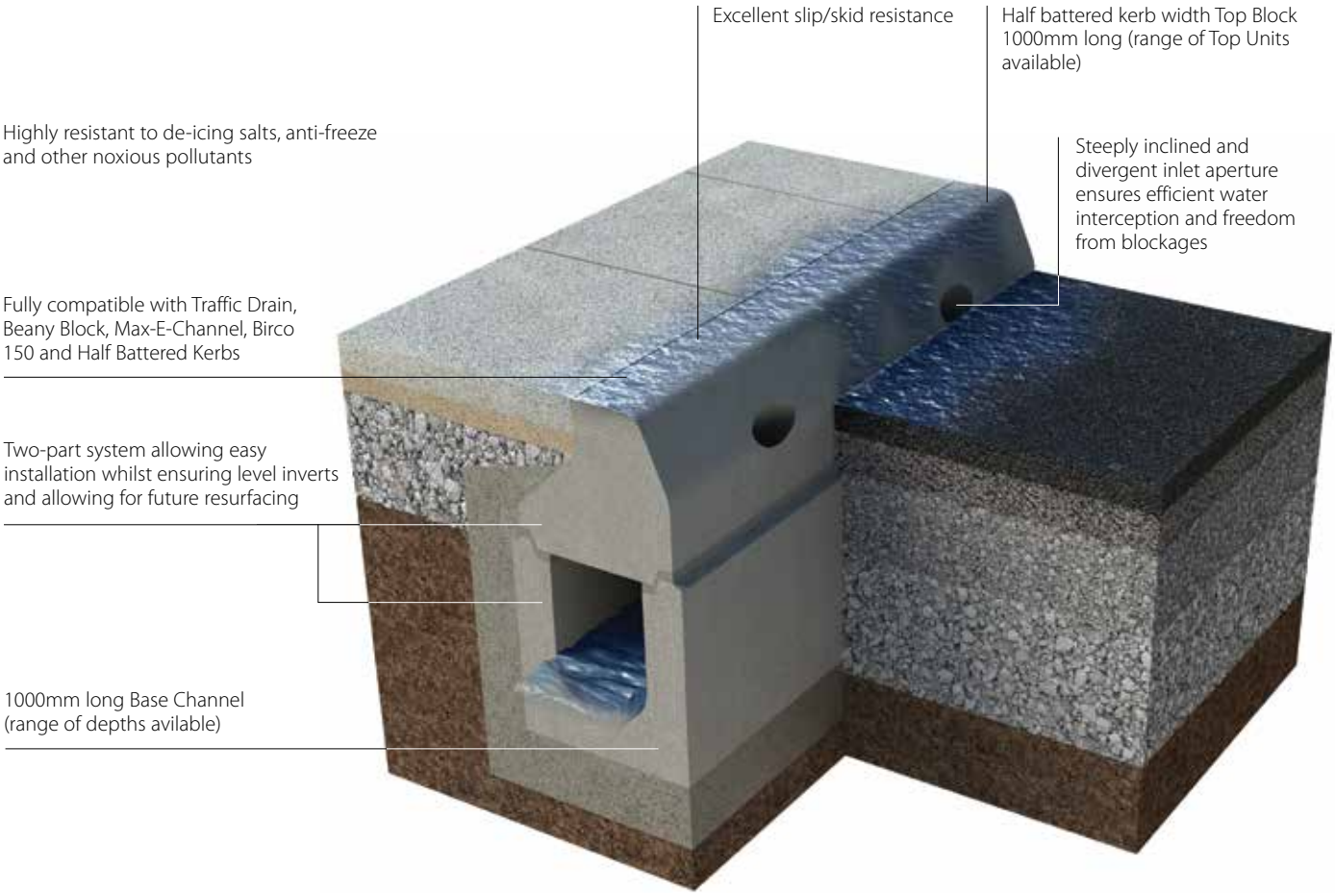


Special Finishes

Conservation Mini Beany

A silver-grey coarse textured finish top unit, manufactured with granite aggregate, complements perfectly areas of high architectural, historical and scenic value. This product profile complements Conservation Kerb 205 x 255mm. Marshalls Silver Grey Conservation Paving, Kerb and Edging along with Mistral Concrete Block Paving and Conservation Setts, are ideally suited to complement this surface finish.

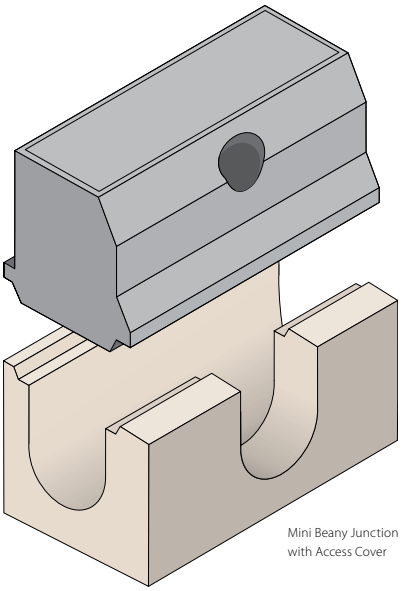
Conservation Mini Beany (205 x 255mm) is available with coarse texture to two faces and is available from stock.



Engineering Benefits

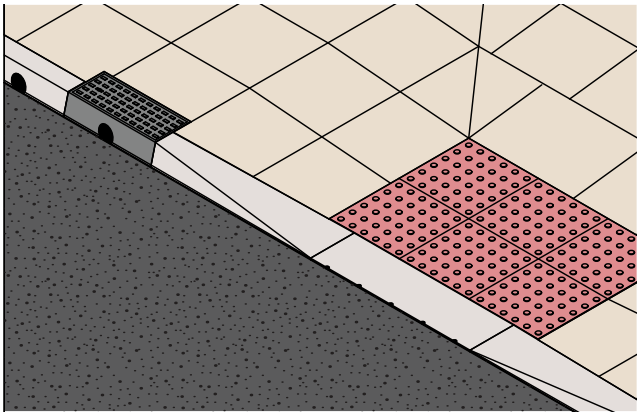
Mini Beany Versatility
Mini Beany is totally compatible with the rest of the Marshalls range of commercial linear drainage systems.

The addition of traffic drain further extends the use of the Mini Beany system, allowing for flows at locations such as across junctions, entrances or at nosing – in fact anywhere that requires vehicle access.



Mini Beany Junction with Access Cover

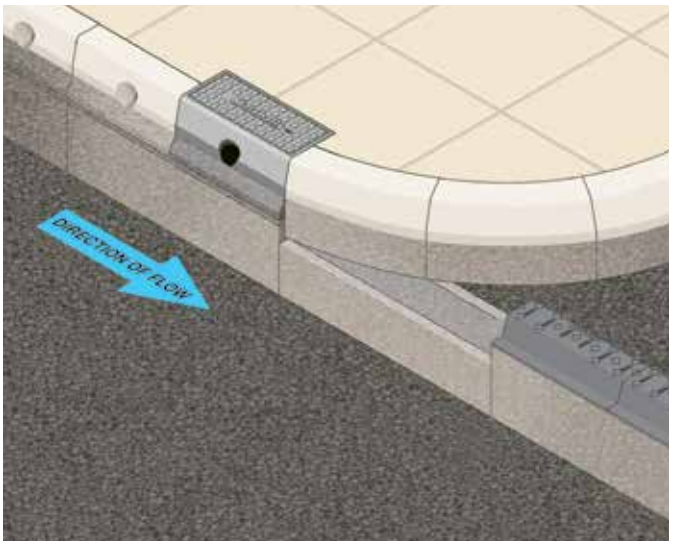
Mini Beany Drop Crossing Detail
Mini Beany drop crossing detail now has centre stones with inlet holes to allow drainage at drop crossing applications, with options for a 6-25mm upstand.



Mini Beany Drop Crossing Detail

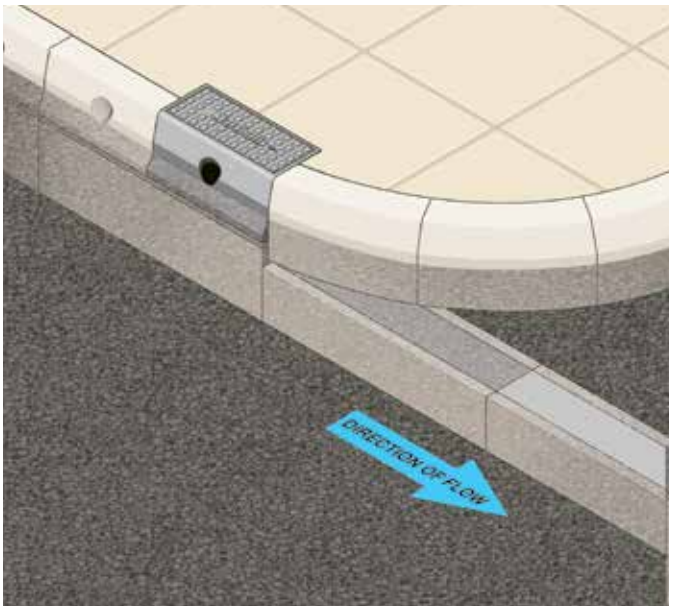
Mini Beany Junction Detail
The T Junction unit is used where there is a requirement to form a T junction with the base channels.

Mini Beany to Traffic Drain
Mini Beany can be used with Traffic Drain where the drainage run continues but the kerb line finishes. A smooth channel invert ensures uninterrupted flow.



Mini Beany to Traffic Drain

Mini Beany to Cover Plate
The system has been specifically designed so where base units and cover plates are used to carry flows under carriageways or vehicular crossings, a minimum of 150mm of road material can be laid above the units to prevent damage and reflective carriageway surface cracking.



Mini Beany to Cover Plate

Cost Advantages

Mini Beany is ideal where specific problems would arise with conventional drainage methods for example:

- Where there is insufficient fall to the outfall point.
- Where, in flat areas, either numerous, closely spaced gullies or false falls would be required in the carriageway.
- Where long gully connections would be needed.
- Where surface water drainage pipes would conflict with service mains and cables.
- Where ponding would occur at low points.
- Where traffic safety and control measures would be required when widening existing carriageway.

Mini Beany is likely to be more economical than conventional kerb/point drainage where carriageways have crossfall, few vehicular crossings or where a surface water drain would be required for highway drainage purposes. Cost savings have been significant on highway and non-highway schemes incorporating lengths of the Mini Beany System. For comparison purposes, conventional methods should include the following as appropriate:

- Surface water drain (including reinstatement).
- Gullies.
- Gully connections.
- Manholes.
- Kerbs.
- Channel Blocks.
- Extra 200mm width of footway plus a small amount of carriageway.
- Service diversions.
- Traffic safety and control (existing carriageways).

Construction Savings

- Mini Beany System combines water interception and transportation in one system. This minimises or eliminates the need for carrier drains, gullies and manholes, reducing construction costs and saving time.
- Simple two-part system – straightforward to design and detail, reducing design times and cost. Easy to set out and straightforward to install.
- The overall construction period can be reduced as carriageway materials may be laid in a continuous sequence. Unlike laying conventional drainage, excavations are kept to a minimum without exposing the formation and sub-base surfaces to possible periods of adverse weather.
- Underground cables and services can be avoided so contractual/ insurance claims are likely to be much less than when laying conventional drainage.

Low Maintenance

- Mini Beany will require periodic inspection and emptying of Silt Traps, Outfalls and Catchpits. The number of Silt Traps and Outfalls are likely to be fewer than in a conventional drainage systems*. If a blockage does occur, it can easily be located and rectified by rodding or jetting from an access point or through a top block aperture adjacent to the blockage.

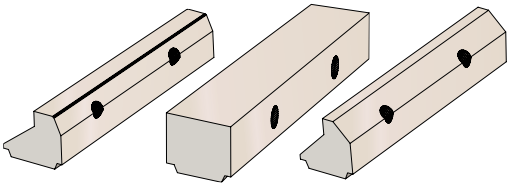
**It is reccommended to have an access point at the head of the run and every 50m and a Silt Trap every 100m*

Conservation Mini Beany

- A silver grey coarse textured finish top unit, manufactured with granite aggregate, complements perfectly areas of high architectural, historical and scenic value. This product complements Marshalls Silver Grey Conservation Paving Kerb and Edging along with Mistral Concrete Block Paving and Conservation Setts. Beany Block and Mono Beany is also available in Conservation.
- Conservation Mini Beany is available with coarse texture to 2 or 3 faces and manufactured to order for an agreed quantity.

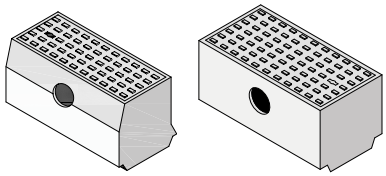
Components

TOP COMPONENTS



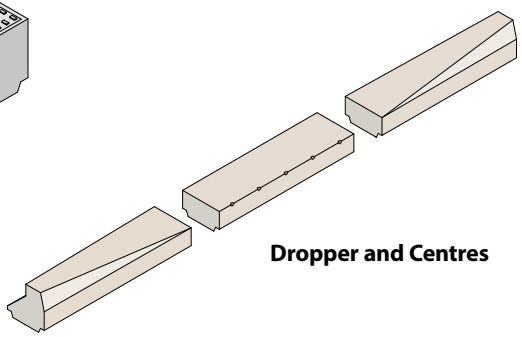
Top Blocks

Half Battered, 45º Splayed, and Conservation Bullnose Tops in 500mm & 1000mm lengths.



Access Cover and Frames

Half Battered, Conservation Bullnose Access Covers (nearside or offside hinged) 500mm in length. All now lockable for improved security.

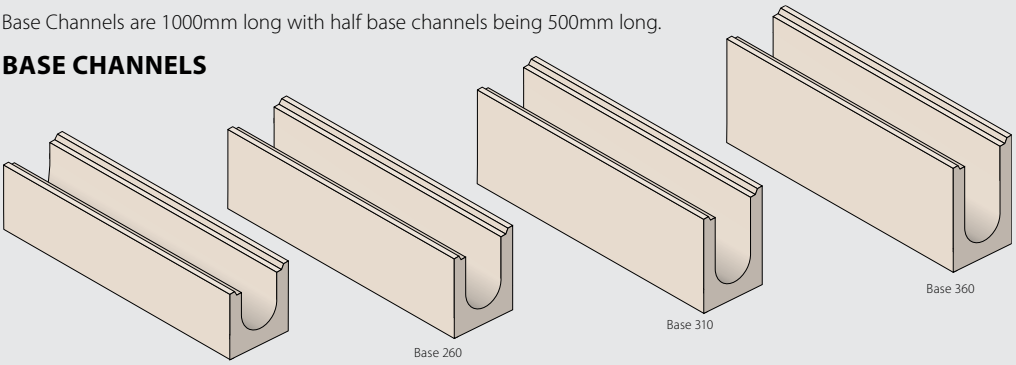


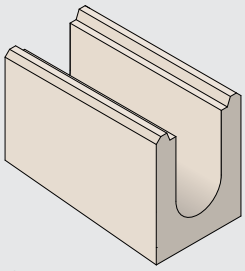
Dropper and Centres

BASE COMPONENTS

Base Channels are 1000mm long with half base channels being 500mm long.

BASE CHANNELS





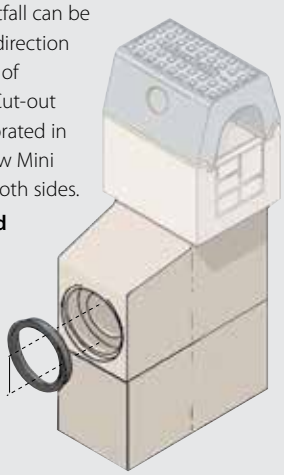
Base Transitions
210-260, 260-310, 310-360

OUTFALLS

High Capacity Outfall

Comprising a two section concrete trapped Outfall, Silt Box and cast iron Beany Access Cover. Outlet for 225mm or 150mm diameter pipework with universal seals. The bottom two sections of the outfall can be orientated in any direction allowing flexibility of pipework layout. Cut-out panels are incorporated in the Silt Box to allow Mini Beany runs from both sides.

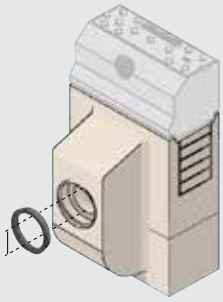
Note: Silt Box and Beany cast iron Access Cover and Frame available separately.



Inline Side Outlet Outfall

Comprising a two section concrete trapped Outfall, with cast iron Mini Beany Access Cover and Frame. Side outlet for 150mm diameter pipework with universal seal. Cut-out panels to allow Mini Beany Runs from both sides.

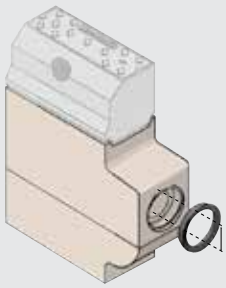
Note: Cast iron Access Cover and Frame available separately.



Inline End Outlet Outfall

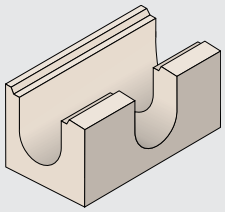
Comprising a two section concrete trapped Outfall, with cast iron Mini Beany Access Cover and Frame. End outlet for 150mm diameter pipework with universal seal. Cut-out panel to allow Mini Beany run from one side only.

Note: Cast iron Access Cover and Frame available separately.



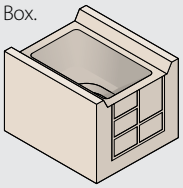
Mini Beany T Junction

Available in all 4 base channel depths. 500mm in length.



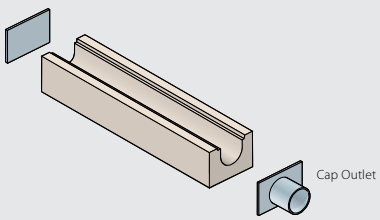
Silt Box

Transition between Mini Beany and Beany Block or Max-E-Channel systems. If required, it can also be used at the location of silt traps in the Mini Beany run. It has cut-out panels to allow for Mini Beany runs from two sides, or, Mini Beany and Beany Block from each side. There is a hole in the base of the Silt Box.



Base End Caps And Cap Outlets

Base end caps and cap outlets are available for 210, 260, 310 and 360 base units. The galvanised steel plates act as permanent formwork to a concrete surround. This is an optional detail to the use of engineering bricks.



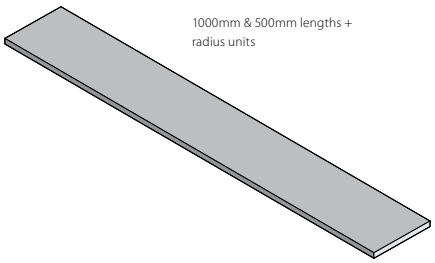
RADIUS BLOCKS

Top Components	Radius	Unit Reference
	Greater than 56m	1000mm
	30.1 - 56 External	500mm
	30.1 - 56 Internal	500mm
	30.0 - 10.0 External	30/10 External
	30.0 - 10.0 Internal	30/10 Internal
	9.9 - 6.0 External	9/6 External
	9.9 - 6.0 Internal	9/6 Internal
	45° Bend External	45° External
	45° Bend Internal	45° Internal

Base Components	Radius	Unit Reference
	Greater than 56m	1000mm
	30.1 - 56 External or Internal	500mm
	30.0 - 10.0 External or Internal	30/10
	9.9 - 6.0 External or Internal	9/6
	45° Bend External or Internal	45° Bend

Cover Plates

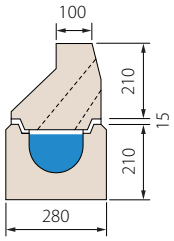
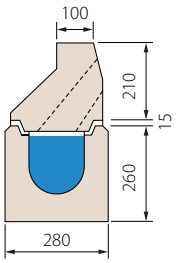
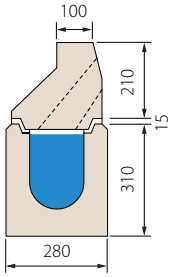
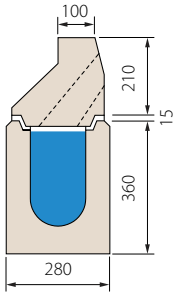
Galvanised steel Cover Plates for use with Mini Beany Base Units where a Top Unit is not required, such as drop crossings.



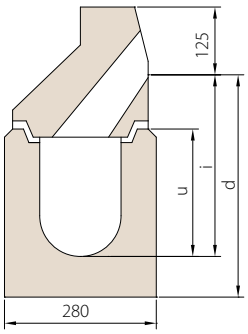
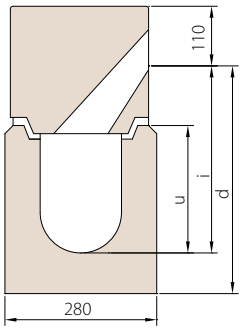
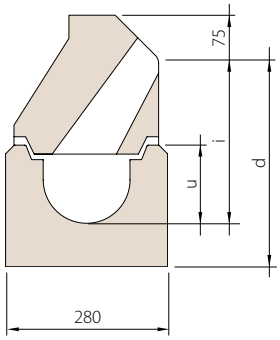
1000mm & 500mm lengths + radius units

Hydraulic Data

FLOW CAPACITY

Mini Beany with 210 Base Unit	Mini Beany with 260 Base Unit	Mini Beany with 310 Base Unit	Mini Beany with 360 Base Unit
			
			
Equivalent Pipe Diameter (mm) 140	Equivalent Pipe Diameter (mm) 170	Equivalent Pipe Diameter (mm) 190	Equivalent Pipe Diameter (mm) 210

Note: 1. Flow figures, l/s, are derived from spatially varied flow work carried out by HR Wallingford

	Mini Beany Half Battered			Conservation			Mini Beany 45 Splayed		
									
ref.	d	i	u	d	i	u	d	i	u
Base 210	310	235	135	320	245	135	360	285	135
Base 260	360	285	185	370	295	185	410	335	185
Base 310	410	335	235	420	345	235	460	385	235
Base 360	460	385	285	470	395	285	510	435	285

Hydraulic Data

The Mini Beany hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using spatially variable flow design principles.

Base 210

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	6	0.38	7	0.44	7	0.44	8	0.50	8	0.50	9	0.56	9	0.56	13	0.81
20	6	0.38	7	0.44	7	0.44	8	0.50	8	0.50	10	0.63	11	0.69	14	0.88
30	5	0.31	7	0.44	8	0.50	8	0.50	9	0.56	10	0.63	12	0.75	14	0.88
40	5	0.31	6	0.38	8	0.50	8	0.50	9	0.56	11	0.69	13	0.81	15	0.94
50	5	0.31	6	0.38	8	0.50	9	0.56	9	0.56	11	0.69	13	0.81	15	0.94
75	4	0.25	6	0.38	8	0.50	9	0.56	10	0.63	13	0.81	14	0.88	17	1.06
100	3	0.19	6	0.38	8	0.50	9	0.56	11	0.69	14	0.88	17	1.06	19	1.19

Base 260

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	10	0.42	11	0.46	12	0.50	13	0.54	14	0.58	15	0.63	17	0.71	22	0.92
20	9	0.38	11	0.46	12	0.50	13	0.54	14	0.58	16	0.67	18	0.75	22	0.92
30	9	0.38	11	0.46	12	0.50	13	0.54	14	0.58	16	0.67	18	0.75	24	1.00
40	9	0.38	11	0.46	13	0.54	13	0.54	14	0.58	17	0.71	19	0.79	24	1.00
50	8	0.33	11	0.46	13	0.54	13	0.54	15	0.63	17	0.71	20	0.83	25	1.04
75	8	0.33	10	0.42	13	0.54	14	0.58	16	0.67	19	0.79	22	0.92	26	1.08
100	7	0.29	10	0.42	14	0.58	14	0.58	16	0.67	21	0.88	26	1.08	29	1.21
150	5	0.21	9	0.38	15	0.63	15	0.63	18	0.75	24	1.00	27	1.13	31	1.29

Base 310

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	13	0.42	16	0.52	17	0.55	18	0.58	18	0.58	20	0.65	24	0.77	30	0.97
20	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	21	0.68	25	0.81	30	0.97
30	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	21	0.68	25	0.81	32	1.03
40	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	22	0.71	26	0.84	32	1.03
50	12	0.39	15	0.48	17	0.55	18	0.58	20	0.65	23	0.74	27	0.87	33	1.06
75	11	0.35	15	0.48	17	0.55	19	0.61	21	0.68	25	0.81	28	0.90	34	1.10
100	10	0.32	14	0.45	17	0.55	19	0.61	22	0.71	26	0.84	30	0.97	36	1.16
150	9	0.29	14	0.45	18	0.58	20	0.65	23	0.74	30	0.97	34	1.01	39	1.26
200	7	0.23	13	0.42	18	0.58	21	0.68	25	0.81	33	1.06	37	1.19	43	1.39

Base 360

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	18	0.46	21	0.54	23	0.59	24	0.62	25	0.64	28	0.72	33	0.85	40	1.03
50	17	0.44	20	0.51	23	0.59	24	0.62	26	0.67	30	0.77	35	0.90	42	1.08
75	16	0.41	20	0.51	23	0.59	25	0.64	27	0.69	32	0.82	36	0.92	44	1.13
100	15	0.38	19	0.49	23	0.59	25	0.64	28	0.72	34	0.87	38	0.97	46	1.18
125	14	0.36	19	0.49	23	0.59	25	0.64	29	0.74	35	0.90	40	1.03	48	1.23
150	13	0.33	19	0.49	24	0.62	26	0.67	30	0.77	37	0.95	42	1.08	50	1.28
175	12	0.31	18	0.46	24	0.62	26	0.67	31	0.79	39	1.00	44	1.13	52	1.33
200	11	0.28	18	0.46	24	0.62	27	0.69	32	0.82	41	1.05	46	1.18	54	1.38
225	10	0.26	18	0.46	24	0.62	27	0.69	32	0.82	43	1.10	48	1.23	55	1.41
250	9	0.23	17	0.44	24	0.62	28	0.72	33	0.85	45	1.15	50	1.28	57	1.46
275	8	0.21	17	0.44	25	0.64	28	0.72	34	0.87	47	1.21	51	1.31	59	1.51

Theoretical Outfall Capacities

Outfall Type	Outlet Pipe Diameter (mm)	l/s	m/s
Mini Beany High Capacity Outfall	150	40	3.67
Mini Beany High Capacity Outfall	225	91	3.75
Mini Beany Inline End Outlet Outfall	150	29	2.67
Mini Beany Inline Side Outlet Outfall	150	29	2.67

Mini Beany Component Codes

A Top Blocks

Top Blocks	Length (mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code
HB Standard Grey	1000	250	240	95	**DR672010**
HB Standard Grey	500	250	240	48	**DR672020**
45° SP Standard Grey	1000	250	240	98	**DR672040**
45° SP Standard Grey	500	250	240	49	DR672050
Bull Nose Conservation	1000	250	240	139	DR931210
Bull Nose Conservation	500	250	240	69.5	DR931211

***Special finishes may be available upon request**

A1 Dropped Crossing Accessories

Dropped Crossing Accessories	Length (mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code
Drop Kerb LH	1000	250	240/135	82	**DR689920**
Drop Kerb RH	1000	250	240/135	82	**DR689930**
Centre Stone	1000	250	135	70	**DR689940**
Conservation Centre Stone	1000	250	135	70	DR931450
Conservation Drop Kerb LH	1000	250	240/135	82	DR931400
Conservation Drop Kerb RH	1000	250	240/135	82	DR931401

B Base Channels

Base Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
210 Channel	1000	280	150	210	135	102	**DR696010**
260 Channel	1000	280	150	260	185	109	**DR697010**
310 Channel	1000	280	150	310	235	122	**DR698010**
360 Channel	1000	280	150	360	285	144	**DR699010**
210 Channel	500	280	150	210	135	51	**DR696020**
260 Channel	500	280	150	260	185	55	**DR697020**
310 Channel	500	280	150	310	235	61	DR698020
360 Channel	500	280	150	360	285	77	DR699020

B1 Radial Top

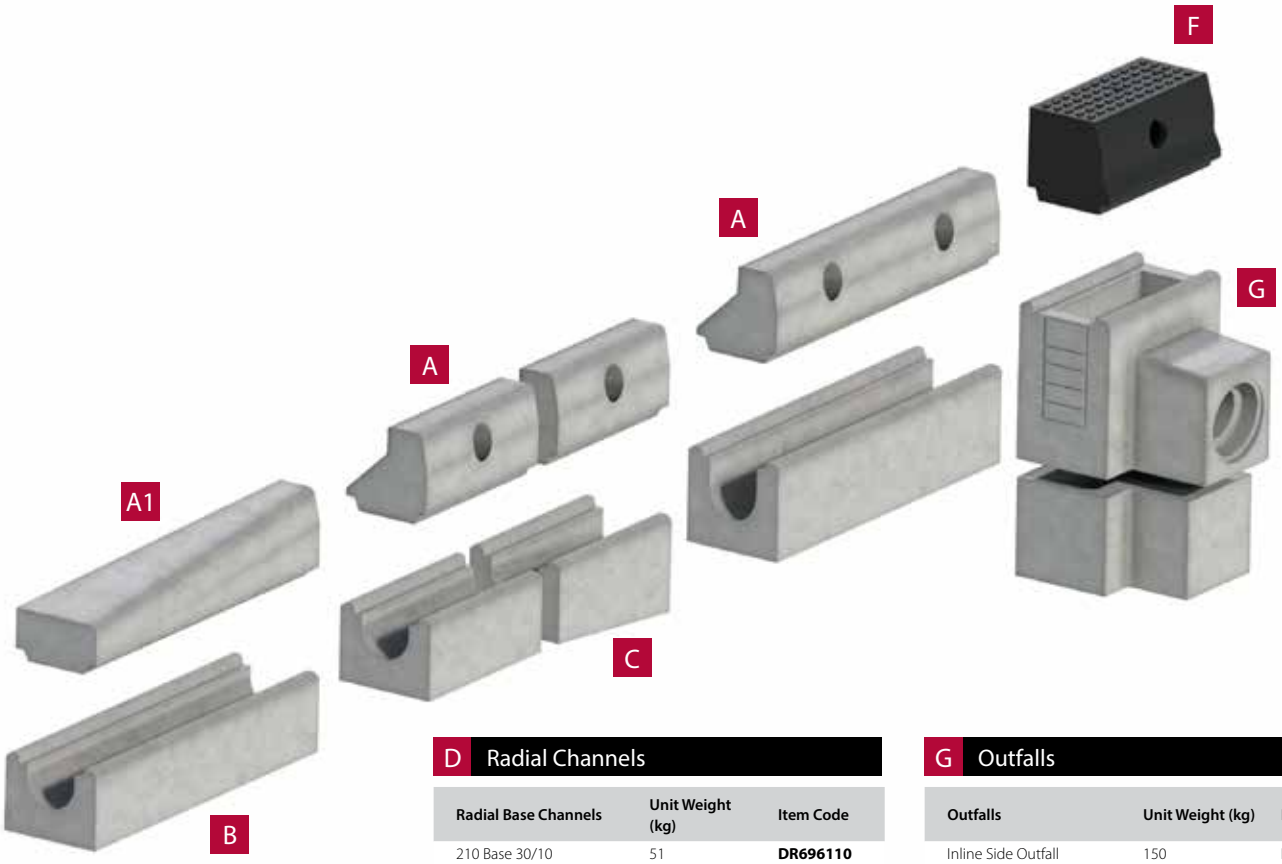
Radial Tops	Unit Weight (kg)	Item Code
HB Cut 30/10 Ext Rad	44	**DR672310**
HB Cut 30/10 Int Rad	44	DR672311
HB Cut 9/6 Ext Rad	44	DR672320
HB Cut 9/6 Int Rad	44	DR672321
HB 9/6 Ext Cons Tex	35	DR931620
BN 9/6 Int Cons Tex	35	DR931230
BN 30/10 Ex Cons Tex	35	DR931215
BN 9/6 Ext Cons Tex	35	DR931225
BN 30/10 Int Cons Tex	35	DR931220
BN 9/6 Int Cons Tex	35	DR931230

C Transition Channels

Transition Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/ Downstream	Invert Depth (mm) Upsteam/Downstream	Unit Weight (kg)	Item Code
210 - 260	500	280	150	210/260	135/185	54	DR696330
260 - 310	500	280	150	260/310	185/235	61	DR697330
310 - 360	500	280	150	310/360	235/285	77	DR698330

More radius and corner units can be made available upon request

Mini Beany with reference numbers indicated in **bold** black are available ex-stock.
Mini Beany with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requrements.



D Radial Channels

Radial Base Channels	Unit Weight (kg)	Item Code
210 Base 30/10	51	**DR696110**
210 Base 9/6	51	DR696120
260 Base 30/10	55	**DR697110**
260 Base 9/6	55	DR697120
310 Base 30/10	61	DR698110
310 Base 9/6	61	DR698120
360 Base 30/10	77	DR699110
360 Base 9/6	77	DR699120

E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
210 End Cap	1	**DR696310**
260 End Cap	1	**DR697310**
310 End Cap	1	**DR698310**
360 End Cap	1	**DR699310**
210 Cap Outlet	2	DR696320
260 Cap Outlet	2	DR697320
310 Cap Outlet	2	DR698320
360 Cap Outlet	2	DR699320

F Access Covers

Access Covers	Unit Weight (kg)	Item Code
45 SP Near Side Access Cover	40	**DR691015**
45 SP Offside Access Cover	40	**DR691025**
HB Universal Access Cover	40	DR691022
Bull Nose Near Side Access Cover	40	**DR691027**

G Outfalls

Outfalls	Unit Weight (kg)	Item Code
Inline Side Outfall	150	**DR689000**
Inline End Outfall	142	DR689010
Silt Box	72	**DR689910**

H Cover Plates

Cover Plates	Unit Weight (kg)	Item Code
Cover Plate 500 mm	12	DR691030
Cover Plate 1000 mm	6	**DR691040**
Cover Plate 30/10	6	DR691050
Cover Plate 9/6	6	DR691060

I Cable Duct Blocks

Cable Duct Blocks	Unit Weight (kg)	Item Code
HB Cable Duct Block	3	DR689900
45° SP Cable Duct Block	3	DR689905

Standard Details

Drawing 1 of 6

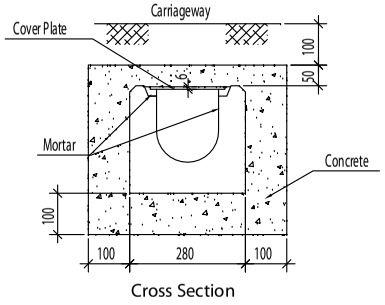
Mini Beany Splayed Top Block With Base 210, 260, 310 or 360

Base Unit	A HB (mm)	A SP (mm)	A BN (mm)	B HB (mm)	B SP (mm)	B BN (mm)	C HB (mm)	C SP (mm)	C BN (mm)	D HB (mm)	D SP (mm)	D BN (mm)
Base 210	210	210	210	235	285	245	435	435	430	410	460	420
Base 260	260	260	260	285	335	295	485	485	480	460	510	470
Base 310	310	310	310	335	385	345	535	535	530	510	560	520
Base 360	360	360	360	385	435	395	585	585	580	560	610	570

Top Block/Base Channel Joint Detail

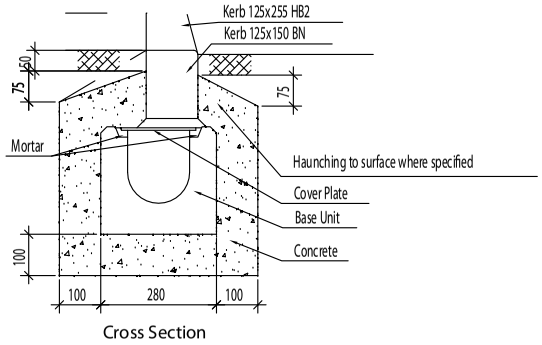
Mini Beany Half Battered Top Block With Base 210, 260, 310 or 360

Mini Beany Bullnosed Top Block With Base 210, 260, 310 or 360



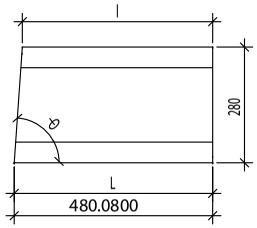
Cross Section

Base Unit & Cover Plate

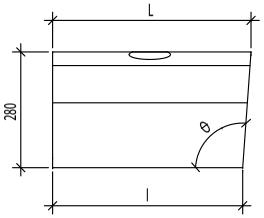


Cross Section

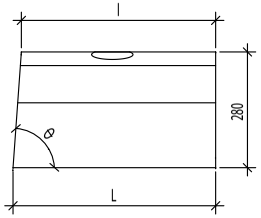
Base Unit & Cover Plate



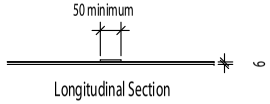
Base Units 210, 260, 310, 360
(External or Internal Radius)



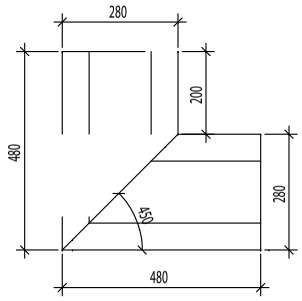
Top Unit
(External Radius)



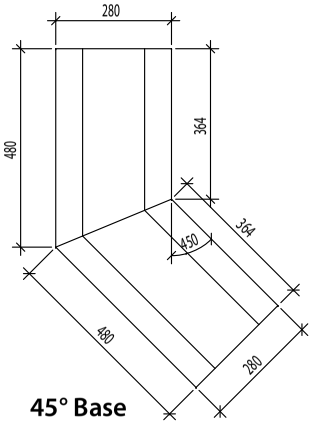
Top Unit
(Internal Radius)



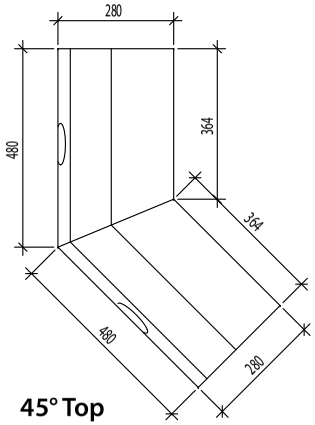
Cover Plate & Jointing Tape



90° Base



45° Base



45° Top
(External Shown)

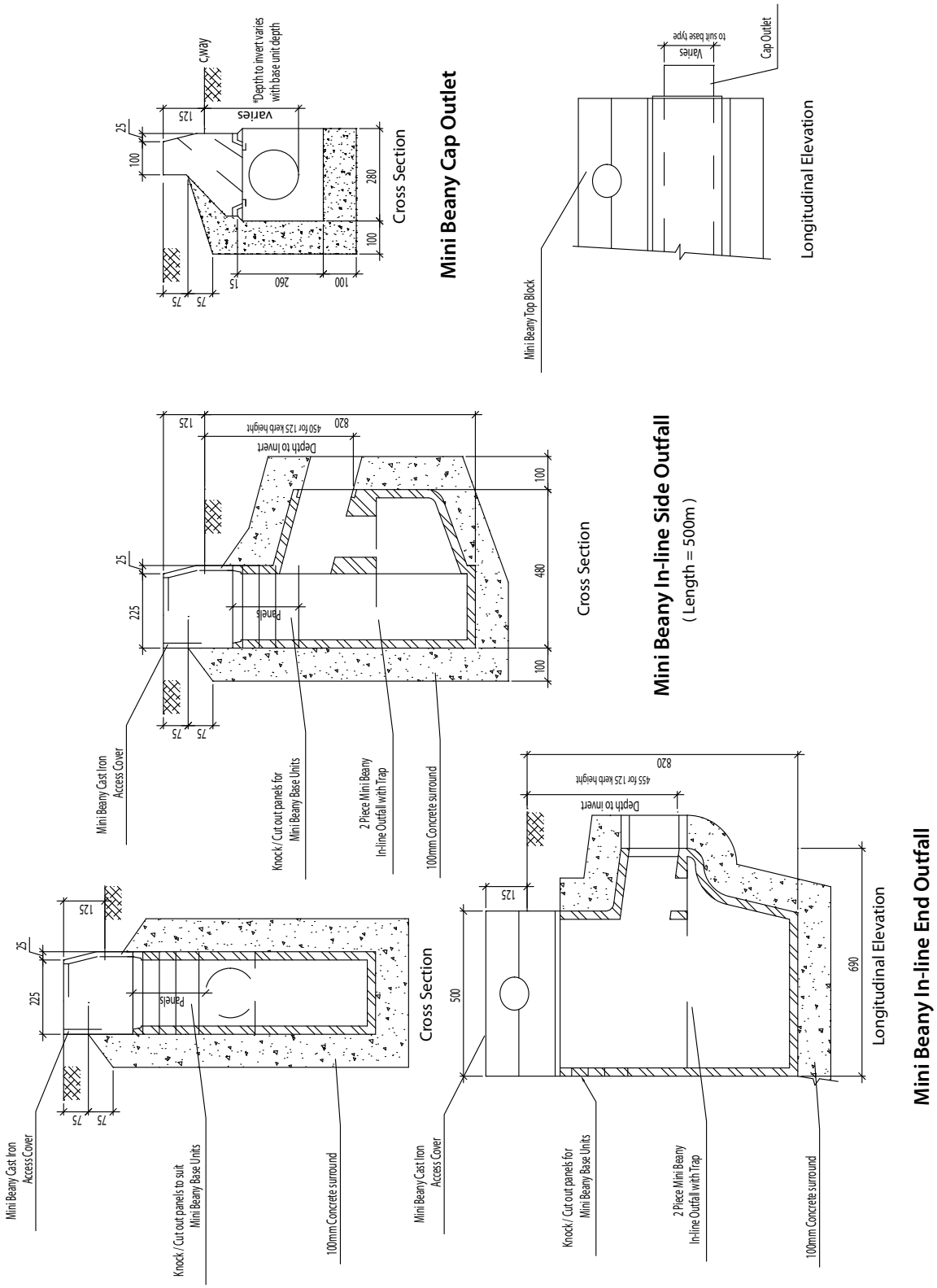
Type of Block	Radius	L	l	θ
30/10 (External & Internal Radius) All base units	30.00m-10.00m	480	470	88°
9/6 (External & Internal Radius) All base units	9.90m-6.00m	480	460	86°
30/10 (External Radius) Top Unit	30.00m-10.00m	480	472	92°
9/6 (External Radius) Top Unit	9.90m-6.00m	480	460	94°
30/10 (Internal Radius) Top Unit	30.00m-10.00m	480	470	88°
9/6 (Internal Radius) Top Unit	9.90m-6.00m	480	460	86°

Cover Plate Dimensions

-Straight : 500 x 185 x 6 & 1000 x 185 x 6
-30/10, 9/6 & 90° supplied to match respective bases
-all 6.0 mm thick

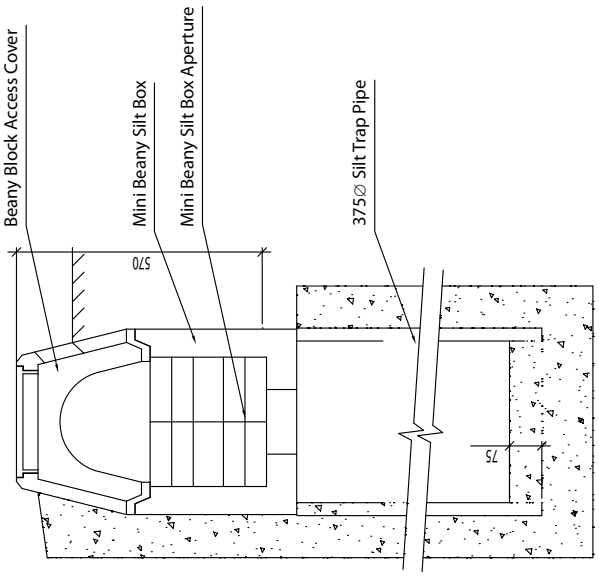
Standard Details

Drawing 3 of 6



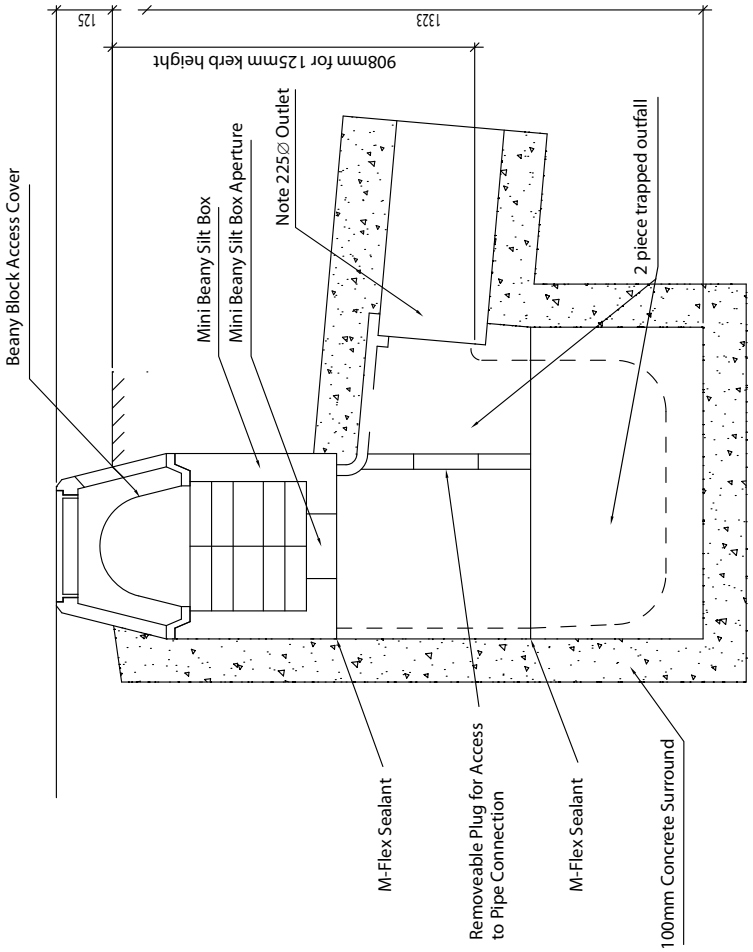
Standard Details

Drawing 4 of 6



Cross Section

Mini Beany Silt Trap Assembly



Cross Section

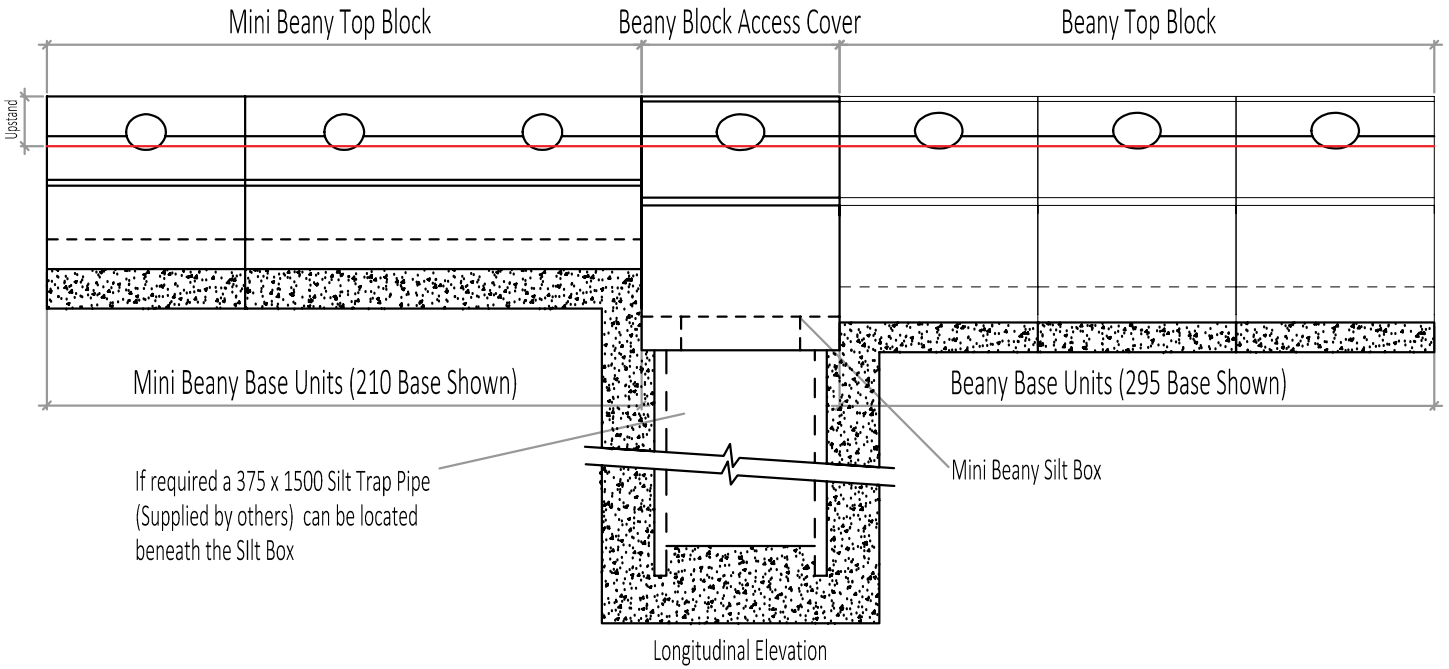
Mini Beany Trapped Gully

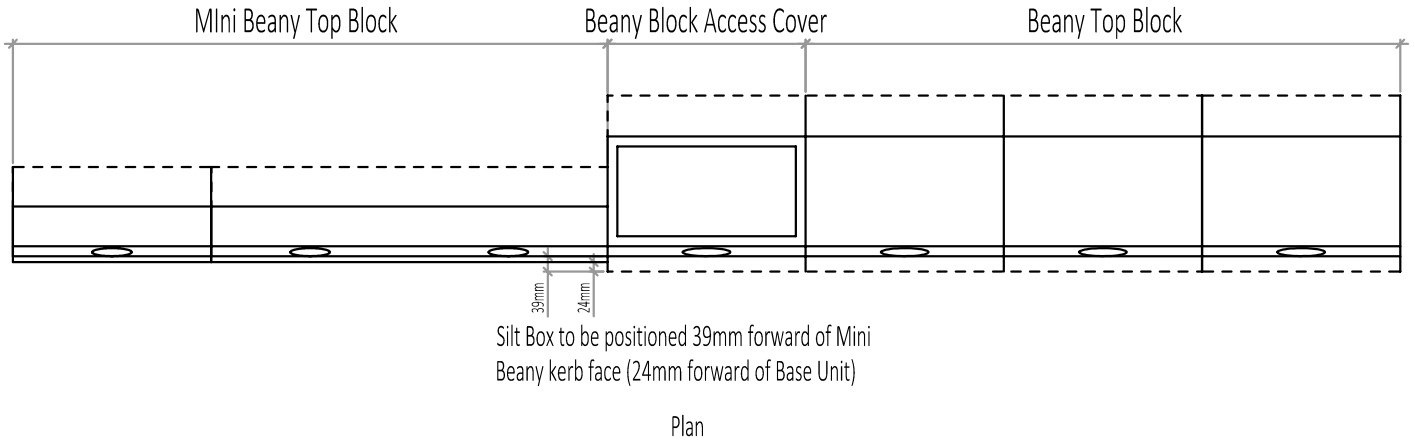
Standard Details

Drawing 5 of 6

Base Depths	
Base Depth A	Base Depth B
260	210
310	260
360	310

Mini Beany Vehicle Crossing Transition





Mini Beany to Beany - On-line Block Transition

Standard Details

Notes For Mini Beany

Drawings 1 to 6

1. Mortars shall be;

i) A Mortar class 12 cement mortar to BS EN 998-2 for bedding the Top Blocks

ii) Marshalls' M-Flex for bedding Silt Boxes onto the Beany Trapped Gully Unit

iii) Marshalls' M-Flex for bedding the sections of the Marshalls' Trapped Gully Unit sections

2. Concrete bed, haunch and surround shall be;

i) A mix ST1 concrete to BS 8500-1&2 and BS EN 206-1 for Base Units used in the normal kerb application

ii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Base Units used within the carriageway (i.e. where Base Units are used with cover plates and are trafficked)

iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Beany Trapped Gully, Silt Traps, Catch Pits and outfall details

iv) The specification for carrier pipe concrete surround is by others

3. Marshalls' vertical joint sealant, M-Seal, shall be applied to all Base Units.

4. Mini Beany Access Covers and Frames are hinged and handed to the direction of the traffic, specified "nearside" and "offside".

5. Movement joint details that fully isolate the Mini Beany whilst maintaining restraint shall be provided adjacent to all concrete slabs, even when the slab is covered by other materials.

6. For Mini Beany with cover plate applications, a minimum of 50mm of concrete cover above the cover plate will be required.

7. All dimensions are in millimetres.

Specification

Introduction

The following specification covers the complete Mini Beany system including ancillary fittings and is compatible with the Standard Detail Sheets.

Where the Manual of Contract Documents for Highway Works is used, information for 'Appendix 5/5: Combined Drainage and Kerb systems' is available on request.

Mini Beany

1. The combined kerb and drainage system shall be Mini Beany, manufactured in pre-cast concrete, with the exception of certain fitments which are manufactured in cast iron as supplied by Marshalls, Halifax HX5 9HT in accordance with Standard Detail Sheets.

2. The combined kerb and drainage shall consist of a two part system consisting of top blocks with a ***straight backed half battered/straight backed 45º splayed*/conservation BN profile*** together with constant depth base units that are ***210/260/310/360**** deep. The overall width of the system shall be not less than 280mm.

3. All components of the Mini Beany system shall comply with the British Standard BS EN1433:2002, load classification E600 and the following:

   (i) The water inlet aperture shall increase in size towards the inside of the unit with a minimum divergence angle of 5°

   (ii) The angle of incline of the water inlet aperture shall be at least 30° to the horizontal

   (iii) Water inlet apertures shall be wholly within individual units and not within 100mm of the end of each unit

   (iv) When installed, the depth of construction from the top of the base channels to the drained area surface shall be not less than 100mm

   (v) The Top Block shall have an Unpolished Skid Resistance Value (USRV) in excess of 70 when tested in accordance with BS 7263:Part 3

   (vi) The system shall have a minimum of 12,850mm^2/m water inlet aperture area

4. The combined kerb and drainage system comprising straight top and base units, splay cut top and base units for radius use, straight and radius cover plates, outfalls, silt traps, junctions, access covers, end caps, cap outlets and sealant shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturers instructions and Standard Details.

Note: * delete as required

Construction

Introduction
Installation of the Mini Beany Combined Kerb and Drainage System should be carried out in accordance with the Specification and Standard Detail Sheets. The following method of installation is recommended.

Excavation
Sufficient material should be excavated to accommodate Top Block and Base Units, concrete bedding and haunching, any 'soft spots' or poorly compacted formation should be made good.

Where Base Units and Cover Plates are to be installed beneath new pavements, the pavements shall be completed to top of roadbase level for flexible construction, or to top of sub-base level for rigid construction, before excavation for the Units commences.

Setting Out
Setting out pins should be accurately located, with a string line level with the top front corners of the Base Units. Line and level will depend on the kerb upstand. Pins can be located to the rear of the Units to avoid having to lift the Units over the string line.

Plenty of setting out pins should be inserted where Mini Beany is laid on horizontal curves (e.g. every 5m for radius of 30m) and the appropriate 'splay' Units used for radii of 30m or less.

The various radius units are:-

Type of Unit	Radii	L (mm)	I (mm)
50/30.1 (External & Internal Radius) All base units	50.0m to 30.0m	500	500
30/10 (External & Internal Radius) All base units	29.9m to 10.0m	480	470
9/6 (External & Internal Radius) All base units	9.9m to 6.0m	480	460
50/30.11 (External Radius) Top Block	50.0m to 30.0m	500	500
30/10 (External Radius) Top Blocks	29.9m to 10.0m	480	470
9/6 (External Radius) Top Blocks	9.9m to 6.0m	480	460
30/10 (Internal Radius) Top Blocks	29.9m to 10.0m	480	470
9/6 (Internal Radius) Top Blocks	9.9m to 6.0m	480	460

Radius For Zero Gap	
Product Type	**Radius (m)**
30/10	15.2
9/6	7.6

Radius Units
The theoretical maximum gap between adjacent Top Block corners when laid to horizontal curves is 4mm .

Top Blocks and 480mm long Base Units are available for either external or internal horizontal curves.

In practice, gaps between Base Units may be slightly greater due to laying tolerances and application of vertical joint sealant.

The approximate number of radius Top Blocks and Base Units required for a quarter circle (external radius) is 3.21 x horizontal radius e.g. for a 15m radius, 48 No.

Base Units
Base Units shall be laid to correspond to carriageway channel levels, or where beneath the carriageway, be laid to a straight grade. Starting at the Outfall, i.e. working uphill, the Units should be bedded on to a freshly mixed foundation of the appropriate grade and thickness of concrete (refer to Standard Detail Sheet).
Concrete bed, haunch and surround shall be:

i) A mix ST1 concrete to BS 8500-1&2 and BS EN 206-1 for Base Units used in the normal kerb application

ii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Base units used within the carriageway (i.e. where Base units are used with cover plates and are trafficked)

iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Beany Trapped Gully, Silt Traps, Catch Pits and outfall details

iv) The specification for carrier pipe concrete surround is by others

Alternatively, the Units may be bedded on to a layer of cement mortar 10-40mm thick on a previously prepared concrete foundation.

The joint sealant is applied during installation of the base units, prior to installation of the top blocks. Sufficient M-Seal joint sealant should be trowel applied to one end face of the bases. Surplus sealant shall be removed from the inner surface of the Units.

1 drum of M-Seal should be sufficient for the following length of Mini Beany:

M-Seal Requirement	
Base Type	**Coverage (m/18l)**
210	240
260	185
310	150
360	125

Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter. Cutting of Base Junctions or Outfall Units is not recommended.

At the termination of any Mini Beany runs, not located at outfalls, the base units shall be closed using galvanised steel end caps as detailed in the Standard Detail Sheets.

Top Blocks
The string line should be set to the level of the top corner of Units.

Again, starting at the Outfall, the Units should be set directly onto a liberal quantity of stiff, cement mortar to completely fill the whole of the joint. Cement mortar shall be Class 12 in accordance with BS EN 998-2. These should be tamped into position close to previously laid Units and the alignment checked. The levels should be checked using the string line and a spirit level. In addition, the general alignment should be checked from all directions as each Block is laid. Surplus mortar shall be removed from the units as work proceeds.

Top Blocks shall be close jointed with adjacent top and front faces corresponding and any Unit deviating by more than 3mm in 3m from line and level shall be made good by lifting and relaying.

Construction

The inside and outside of the joints between Base and Top Units should be pointed and cleaned out with a brush or rag as work proceeds.

Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units, other than cast iron or steel, shall be carried out with a concrete saw or disc cutter.

Cover Plates

Cover Plates should be bedded on cement mortar to the specified thickness, pointed inside and outside of the joints with the inside of the Base Units being cleaned out as work proceeds. The Cover Plates should be close jointed and the joints sealed with 50mm wide M-Tape. Cover Plates shall be suitably protected before and during installation in order that the protective coating is not damaged.

Where cutting is necessary, one or two plates shall be cut so that no single plate is less than 250mm. Cut or damaged plates shall be renovated using Defcon Z or similar approved in accordance with BS 729: 1971 (1986).

Top Units

1. In order to obtain a 'good line', it is very important to lay the Top Units on the specified thickness of compacted mortar using the string line and Base Units as a guide. Too thin a layer of mortar will not allow sufficient sideways movement of the units to achieve an acceptable alignment.

2. It is not necessary for Top and Base Unit vertical joints to line up although there will be more tolerance for adjustment of the Tops, if the joints are close together on curves of 10m radius or less.

3. Where Mini Beany is laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the units and haunching adjacent to the slab joints and also longitudinal movement joints between the haunching and the slabs. Where necessary, Top Unit drainage openings shall be protected against the ingress of material during concreting operations by covering with Waterproof Cloth Tape.

4. Outfalls, Silt Traps and Access Covers shall be constructed in accordance with the Standard Detail Sheet using the appropriate type of Base Unit. Units shall be bedded on sufficient M-Flex sealant over a gully pot, Outfall Unit or vertical pipe, to make a watertight joint. Where necessary in situ smooth concrete benching shall be shaped to the full depth of the Base Unit. In Silt Traps, the pipe shall be bedded into mix ST4 concrete which shall be fully compacted to make a watertight seal.

5. Cable Duct Blocks shall be bedded on cement mortar in accordance with the Standard Detail Sheet.

6. In situ concrete haunching or surround should not be placed until the installed blocks have been inspected and approved by the Engineer. The haunching/surrounding should be carried out as one operation to complete lines of Top and Base Units/Cover Plates in accordance with the Standard Detail Sheet. The top of the concrete surround for Base Units and Cover Plates under new carriageways shall be finished level with the top of the roadbase for flexible construction or top of sub-base level for rigid construction. Construction plant or vehicles crossing the Units shall be suitable in relation to thickness of concrete cover so that damage is not caused to the Units, Cover Plates, concrete bedding or haunching.

7. Adjacent carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed. Base Units, Outfalls, Junctions or Bends not covered by fully bedded Top Units, Cover Plates or covers and frames, shall be adequately supported against loadings imposed by construction traffic.

8. Where flexible surfacing is laid greater than 15mm above the bottom of the drainage aperture, it shall be cut and shaped after rolling when partially cooled at each Top Unit, to form a smooth chamfer.

9. On completion of the works, the Mini Beany System shall be cleaned out by high pressure water jetting (100-150 bar at 200 l/min minimum) and left free from obstructions and all Outfalls and Silt Traps shall be emptied. Top Unit drainage apertures shall be covered by timber boards or other approved method, during jetting operations. The cleaning process shall be repeated where necessary after the completion of any remedial works.

10. When used in conjunction with the Manual of Contract Documents for Highway Works, reference should be made to Appendix 5/5.

    For works not carried out under the above specification, it may be necessary to clarify cement mortar in accordance with BS EN 998-2 and concrete ST1, ST4 and grade C25/30 as specified in BS 8500-1 & 2 and BS EN 206-1.

11. Installation operations should be discontinued if weather conditions are such that the performance of the Mini Beany may be jeopardised.

    Installation should not be undertaken when the temperature is below 3°C on a falling thermometer and below 1°C on a rising thermometer.

12. All necessary Personal Protective Equipment (PPE) should be worn on site, as the site rules dictate. Goggles, ear protection, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

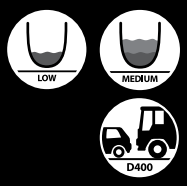
Mono Beany®

Mono Beany, A21, East Sussex

Conservation Silver Grey

Standard Grey

Mono Beany®



One Piece Combined Kerb and Drainage System

An innovative, concrete single piece combined kerb and drainage solution. Mono Beany is a low to medium capacity system which combines strength and aesthetics through Marshalls' high strength M-Tech concrete. Available in two depths and in both Half Battered and 45˚Splayed profiles with a range of accessories to provide a comprehensive drainage system which carries the BSI Kitemark.

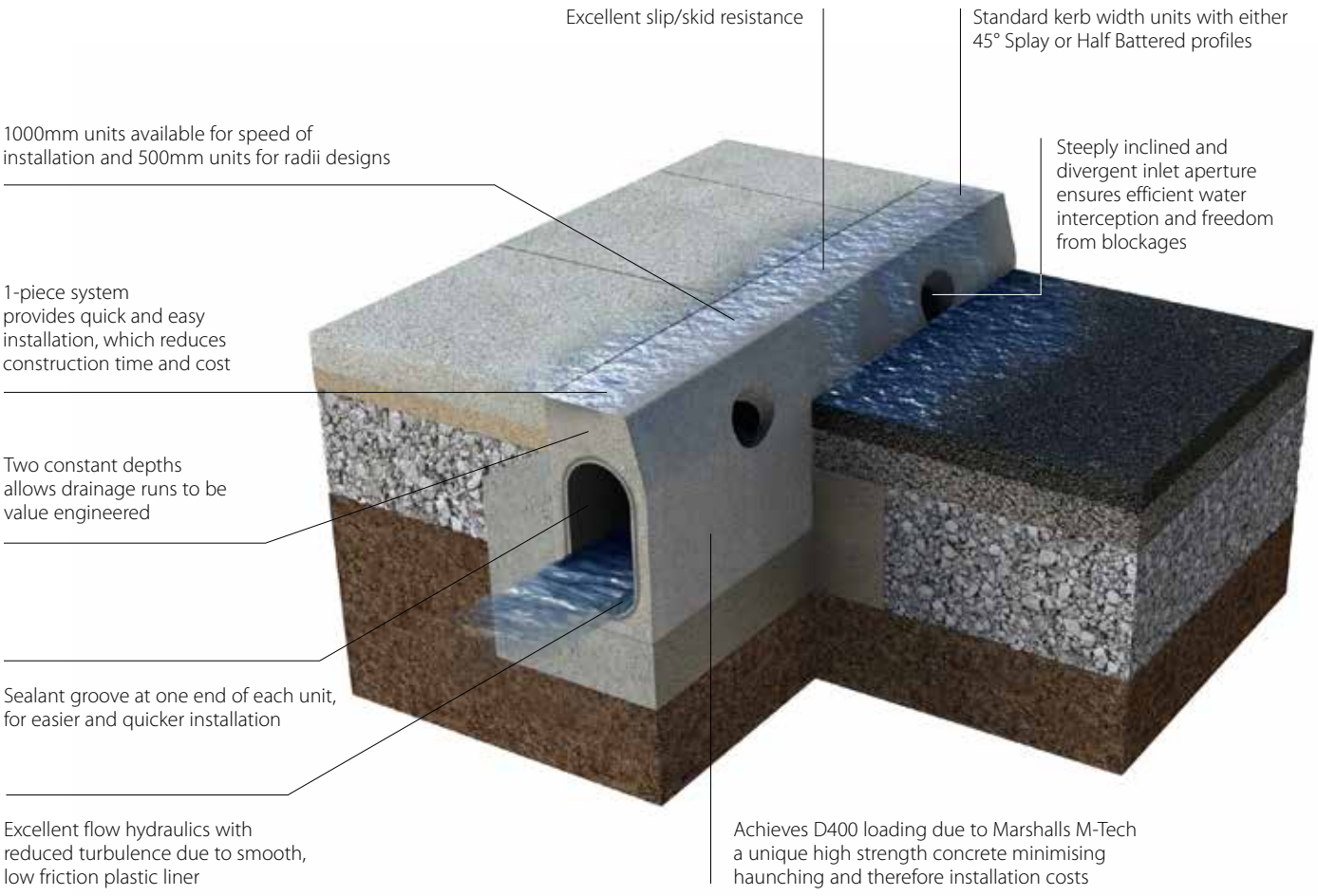
NSSPlus
Q10 190

Mono Beany®

One Piece Conbined kerb and Drainage System

Mono Beany®

- The growing demand for more cost-effective and less complicated drainage systems has led to modern linear drainage becoming the preferred choice amongst specifiers and contractors.
- Marshalls Mono Beany demonstrates our commitment to this growing market.
- Mono Beany is an extension of our original Beany Block, and alongside Mini Beany this new addition not only complements but completes our comprehensive Beany range of water management solutions.
- Manufactured from Marshalls M-Tec concrete, Mono Beany provides increased strength with less material.
- Mono Beany offers versatility, available in both Half Battered and Splayed profiles, in 500mm and 1000mm lengths with two invert depths and a full suite of problem solving accessories.
- Mono Beany achieves a load classification of D400 making it suitable for a number of trafficking applications including major and minor carriageways, car parks and commercial and urban scapes.
- Installation costs are further reduced and speeds increased due to only a single mechanical lift being required per meter.
- This one piece system is simple and straight forward to design and easy to set out and install. Cost effective and flexible with excellent surface drainage efficiency specifically designed for low to medium flow capacity. Inlet apertures are 500mm apart, reducing running or fast flowing water on the carriageway and eliminating ponding.
- Mono Beany carries the British Standard Kitemark, is certified to BS EN:1433 and is CE approved.



Cost Advantages

Mono Beany is ideal where specific problems would arise with conventional drainage methods for example:

- Where there is insufficient fall to the outfall point.
- Where, in flat areas, either numerous, closely spaced gullies or false falls would be required in the carriageway.
- Where long gully connections would be needed.
- Where surface water drainage pipes would conflict with service mains and cables.
- Where ponding would occur at low points.
- Where traffic safety and control measures would be required when widening existing carriageway.

Mono Beany is likely to be more economical than conventional kerb/point drainage where carriageways have crossfall, few vehicular crossings or where a surface water drain would be required for highway drainage purposes. Cost savings have been significant on highway and non-highway schemes incorporating lengths of the Beany Block system. For comparison purposes, conventional methods should include the following as appropriate:

- Surface water drain (including reinstatement).
- Gullies.
- Gully connections.
- Manholes.
- Kerbs.
- Channel Blocks.
- Extra 200mm width of footway plus a small amount of carriageway.
- Service diversions.
- Traffic safety and control (existing carriageways).

Construction Savings

- Mono Beany System combines water interception and transportation in one system. This minimises or eliminates the need for carrier drains, gullies and manholes, reducing construction costs and saving time.
- Simple one-piece system – straightforward to design and detail, reducing design times and cost. Easy to set out and straightforward to install.
- The overall construction period can be reduced as carriageway materials may be laid in a continuous sequence. Unlike laying conventional drainage, excavations are kept to a minimum without exposing the formation and sub-base surfaces to possible periods of adverse weather.
- Underground cables and services can be avoided so contractual/ insurance claims are likely to be much less than when laying conventional drainage.

Low Maintenance

- Mono Beany will require periodic inspection and emptying of Silt Traps, Outfalls and Catchpits. The number of Silt Traps and Outfalls are likely to be fewer than in a conventional drainage systems*. If a blockage does occur, it can easily be located and rectified by rodding or jetting from an access point or through a top block aperture adjacent to the blockage.

**It is reccommended to have an access point at the head of the run and every 50m and a Silt Trap every 100m*

Conservation Mono Beany

- A silver grey coarse textured finish top unit, manufactured with granite aggregate, complements perfectly areas of high architectural, historical and scenic value. This product complements Marshalls Silver Grey Conservation Paving Kerb and Edging along with Mistral Concrete Block Paving and Conservation Setts. Beany Block and Mini Beany is also available in Conservation.
- Conservation Mono Beany is available with coarse texture to 2 or 3 faces and manufactured to order for an agreed quantity.

Components

HALF BATTERED

Half Battered 321 1000mm

Half Battered 321 500mm

Half Battered 502 1000mm

Half Battered 502 500mm

45° SPLAYED

45° Splayed 321 1000mm

45° Splayed 321 500mm

45° Splayed 502 1000mm

45° Splayed 502 500mm

ACCESSORIES

Centre Stone 321 1000mm

Centre Stone 502 1000mm

Dropper 321

Dropper 502

*Half Battered Access Cover with Rodding Box for 321 System

*45° Splayed Access Cover with Rodding Box for 321 System

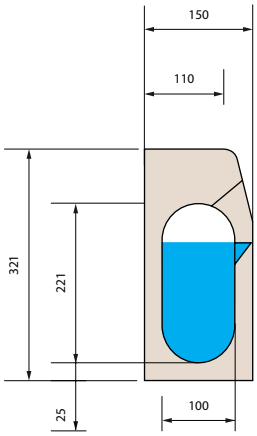
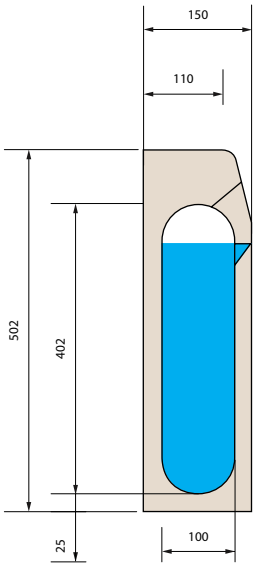
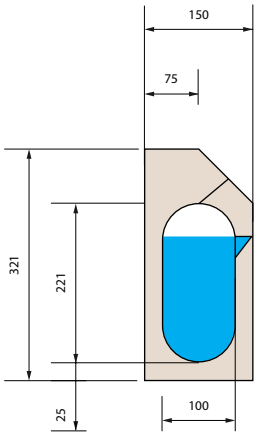
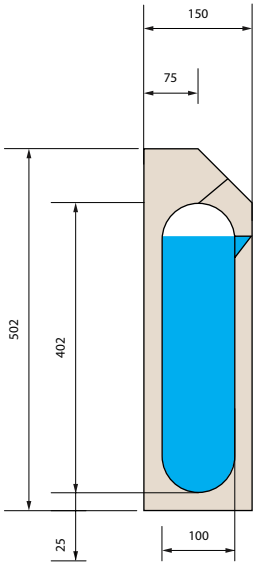
*Half Battered Access Cover with Rodding Box for 502 System

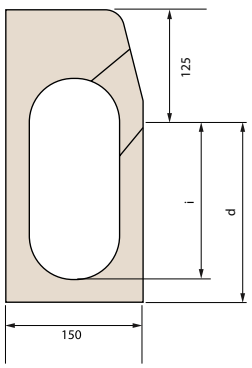
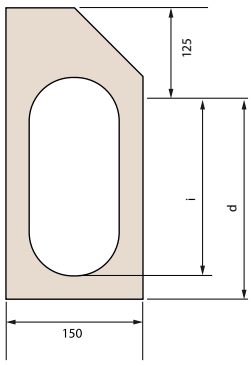
*45° Splayed Access Cover with Rodding Box for 502 System

*Access Cover with Rodding Box. Comprising a two section concrete and cast iron Rodding Box and Access Cover. Cut-out panels to allow Mono Beany runs from both sides

Hydraulic Data

FLOW CAPACITY

Mono Beany 321 Half Battered	Mono Beany 502 Half Battered	Mono Beany 321 Splayed	Mono Beany 502 Splayed
			
			
Equivalent Pipe Diameter (mm) 165	Equivalent Pipe Diameter (mm) 215	Equivalent Pipe Diameter (mm) 165	Equivalent Pipe Diameter (mm) 215

Mono Beany Half Battered	Mono Beany Splayed
	

ref.	d	i	d	i
321 Unit	196	171	221	196
502 Unit	377	352	402	377

Hydraulic Data

The Mono Beany hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using Colebrook White design principles.

Mono Beany

Channel Type	321		321 Centre Stone		502		502 Centre Stone	
Gradient '1 in'	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	79	4.29	32	3.61	169	4.75	116	4.52
20	54	2.96	22	2.49	117	3.29	80	3.13
30	44	2.38	18	2.00	94	2.65	64	2.52
40	37	2.04	15	1.71	81	2.27	55	2.16
50	33	1.81	13	1.52	71	2.01	49	1.91
75	26	1.45	10	1.22	57	1.62	39	1.53
100	22	1.24	9	1.04	49	1.38	33	1.31
150	18	0.99	7	0.83	39	1.11	27	1.05
200	15	0.85	6	0.71	33	0.95	23	0.90
300	12	0.68	5	0.57	27	0.76	18	0.72
400	10	0.58	4	0.48	23	0.65	15	0.61
500	9	0.51	3	0.43	20	0.57	13	0.54
750	7	0.41	3	0.34	16	0.46	11	0.43
1000	6	0.35	2	0.29	13	0.39	9	0.37
1500	5	0.28	2	0.23	11	0.31	7	0.29
2000	4	0.24	1	0.19	9	0.26	6	0.25

Outfall Capacities

Outfall Type	Outlet Pipe Diameter (mm)	l/s	m/s
Mono Beany inline Side Outfall	150	29	2.6

RADIUS BLOCKS

Radius	Unit Reference
≤4.99	Cut on site or extended radius
5m - 9.99m	9/5 Radius Unit
10m - 20m	20/10 Radius Unit
20.01 - 40m	0.5m Unit

Mono Beany Component Codes

A Constant Depth System

Constant Depth Channels	Length (mm)	Width (mm)	Height (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code Standard Grey	Item Code Conservation
Half Battered	1000	150	321	171	69	**DR663030**	DR666030
	500	150	321	171	34.5	**DR663035**	DR666035
	1000	150	502	352	91	**DR663040**	DR666040
	500	150	502	352	45.5	DR663045	DR666045
45° Splayed	1000	150	321	196	64	**DR663120**	DR666630
	500	150	321	196	32	**DR663125**	DR666635
	1000	150	502	377	86	**DR663130**	DR666640
	500	150	502	377	43	DR663135	DR666645

B Transition Channels

Transition Channels		Length (mm)	Width (mm)	Height (mm)	Invert Depth (mm) Upstream/Downstream	Unit Weight (kg)	Item Code
Half Battered	502 - 321 Transition RH	1000	150	502	352/171	107	DR663320
	502 - 321 Transition LH	1000	150	502	352/171	107	DR663321
45° Splayed	502 - 321 Transition RH	1000	150	502	377/196	107	DR663325
	502 - 321 Transition LH	1000	150	502	377/196	107	DR663326

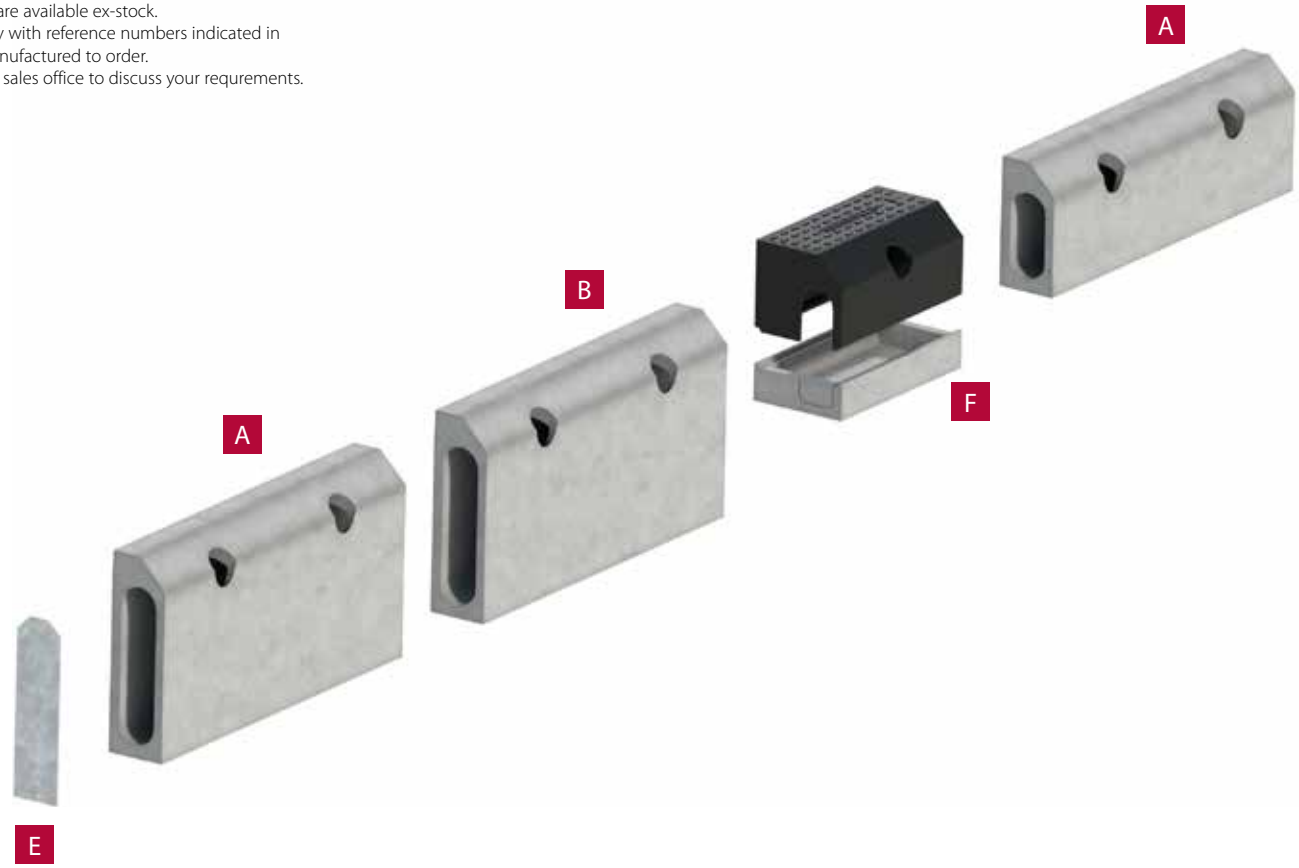
E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
End Cap for 321 System	1	**DR664235**
End Cap for 502 System	1	**DR664240**
Cap Outlet for 321 System	1	DR664225
Cap Outlet for 502 System	1	DR664230

F Outfalls & Accessories

Outfalls & Accessories	Unit Weight (kg)	Item Code
Inline Slide Outfall	80	**DR664180**
Half Battered Access Cover	40	**DR664010**
45° Splayed Access Cover	40	**DR664020**
Rodding Box for 321 System	20	**DR664185**
Rodding Box for 502 System	30	**DR664190**

Mono Beany with reference numbers indicated in **bold** black are available ex-stock.
Mono Beany with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requrements.



C Dropped Crossing Accessories

Road Crossing Accessories		Length (mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code Standard Grey	Item Code Conservation
Half Battered	Centre Stone 321	1000	150	202	40	**DR663110**	DR666530
	Centre Stone 502	1000	150	383	50	DR663115	
	Right Hand 321	1000	150	202/321	50	**DR663090**	DR666520
	Right Hand 502	1000	150	383/502	60	DR663095	
	Left Hand 321	1000	150	202/321	50	**DR663100**	DR666510
	Left Hand 502	1000	150	383/502	60	DR663105	
45° Splayed	Centre Stone 321	1000	150	252	40	**DR663310**	DR666730
	Centre Stone 502	1000	150	433	50	DR663315	
	Right Hand 321	1000	150	252/321	50	**DR663290**	DR666720
	Right Hand 502	1000	150	433/502	60	DR663295	
	Left Hand 321	1000	150	252/321	50	**DR663300**	DR666710
	Left Hand 502	1000	150	433/502	60	DR663305	

G Cable Ducts

Cable Ducts		Unit Weight (kg)	Item Code
Half Battered	321 Cable Duct		DR664250
	502 Cable Duct		DR664255
45° Splayed	321 Cable Duct		DR664260
	502 Cable Duct		DR664265

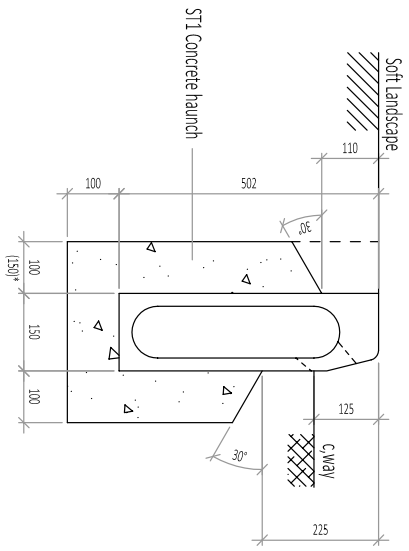
D Radial Channels

Radial Channels		Length (mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code
Half Battered	5/9 Internal Radius 321	490	150	321	20	DR663050
	5/9 Internal Radius 502	490	150	502	30	DR663060
	5/9 External Radius 321	490	150	321	20	DR663070
	5/9 External Radius 502	490	150	502	30	DR663080
	20/10 Internal Radius 321	490	150	321	20	DR663055
	20/10 Internal Radius 502	490	150	502	30	DR663065
	20/10 External Radius 321	490	150	321	20	DR663075
	20/10 External Radius 502	490	150	502	30	DR663085
45° Splayed	5/9 Internal Radius 321	490	150	321	20	DR663140
	5/9 Internal Radius 502	490	150	502	30	DR663150
	5/9 External Radius 321	490	150	321	20	DR663160
	5/9 External Radius 502	490	150	502	30	DR663170
	20/10 Internal Radius 321	490	150	321	20	DR663145
	20/10 Internal Radius 502	490	150	502	30	DR663155
	20/10 External Radius 321	490	150	321	20	DR663165
	20/10 External Radius 502	490	150	502	30	DR663175

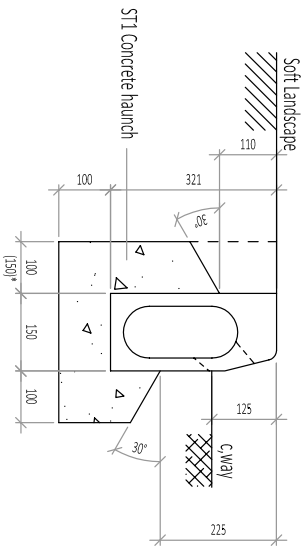
Standard Details

Drawing 1 of 9*

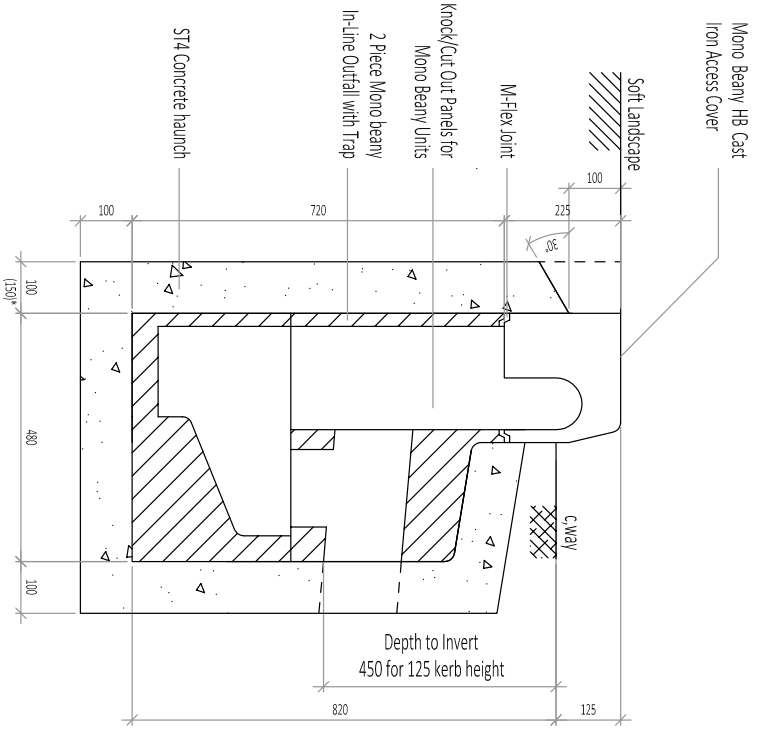
HB Mono Beany 502 Installation
Mo002



HB Mono Beany 321 Installation
Mo001



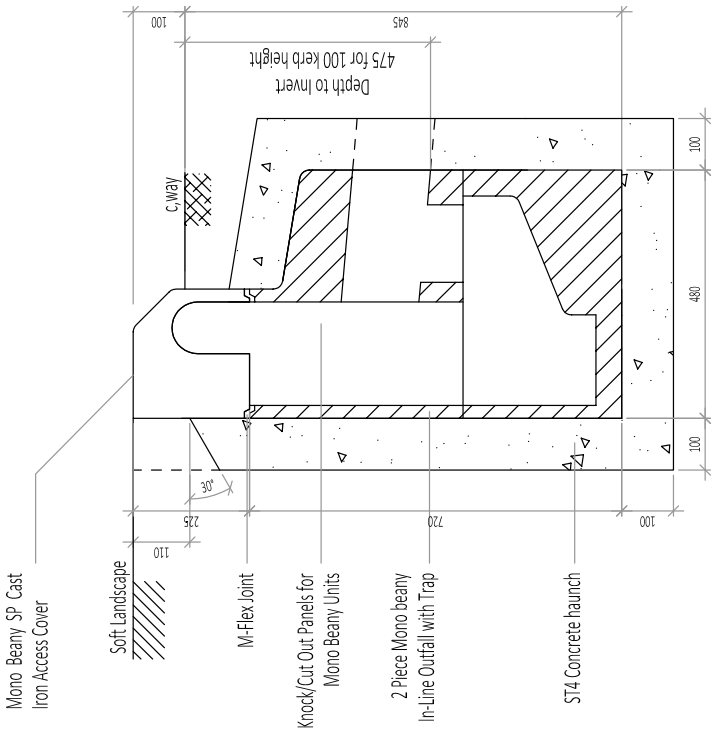
HB Mono Beany Access Cover
and Side Outfall
Mo005



*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

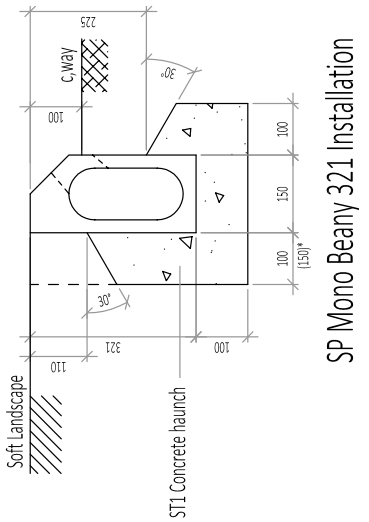
Standard Details

Drawing 2 of 9*



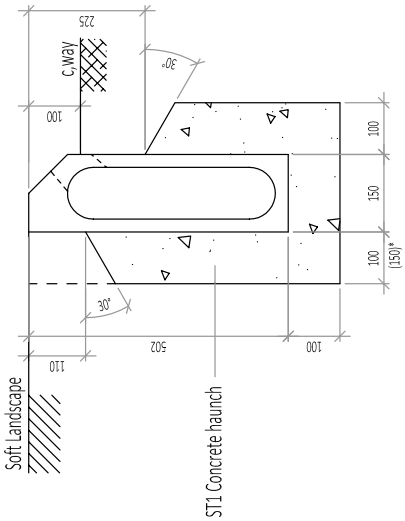
SP Mono Beany Access Cover and Side Outfall

Mo010



SP Mono Beany 321 Installation

Mo003



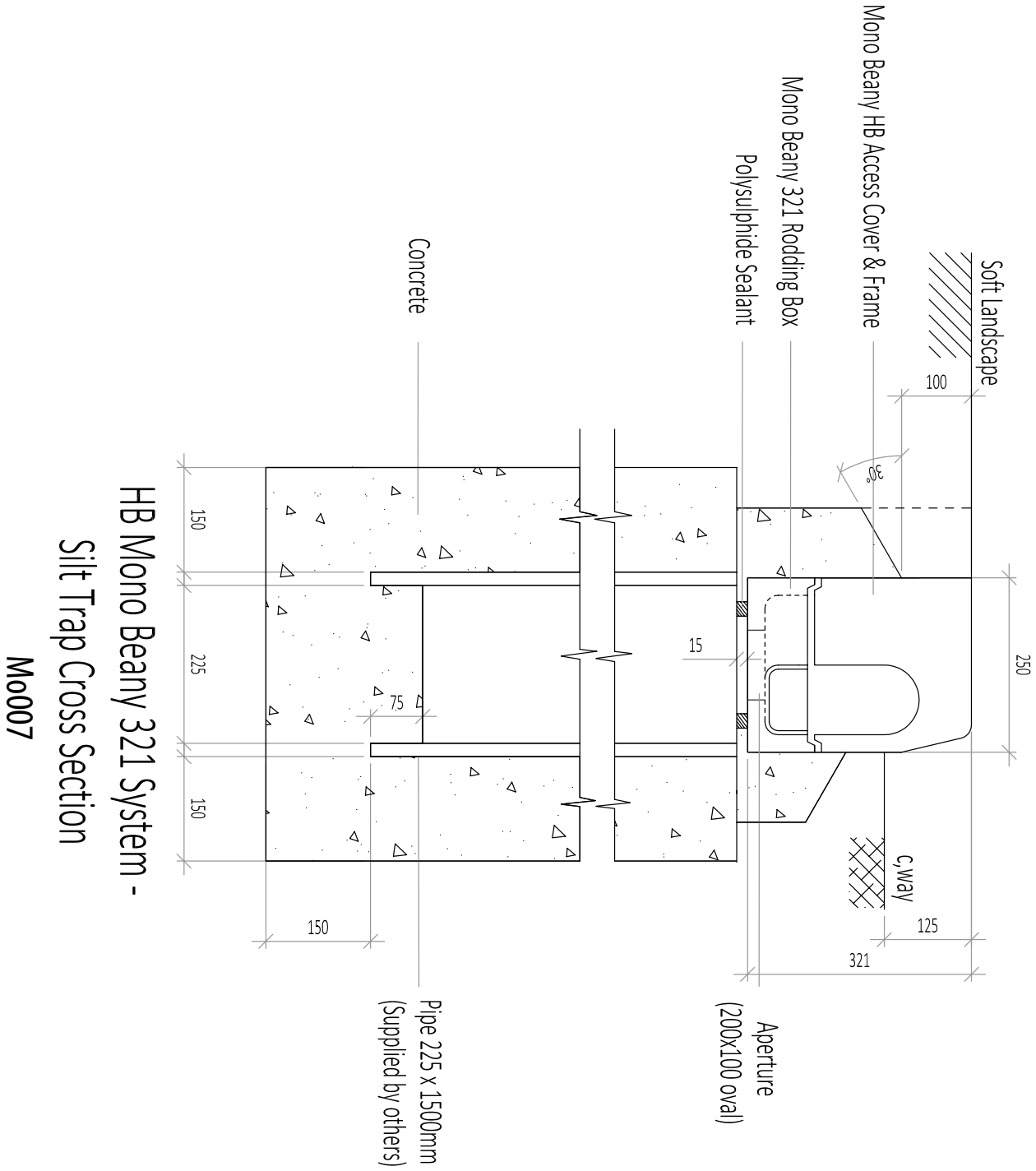
SP Mono Beany 502 Installation

Mo004

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

Drawing 3 of 9*

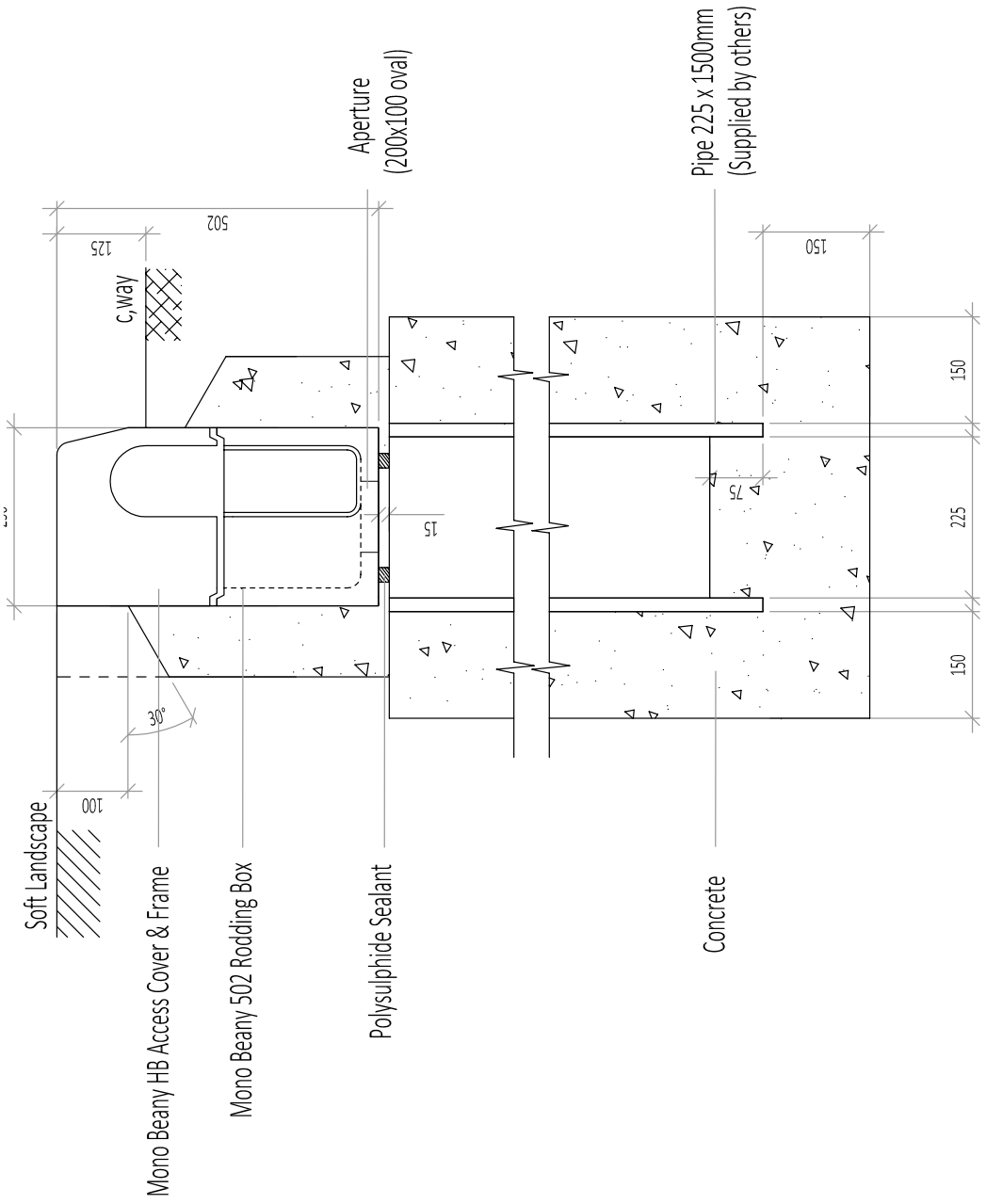


HB Mono Beany 321 System -
Silt Trap Cross Section
Mo007

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

Drawing 4 of 9*

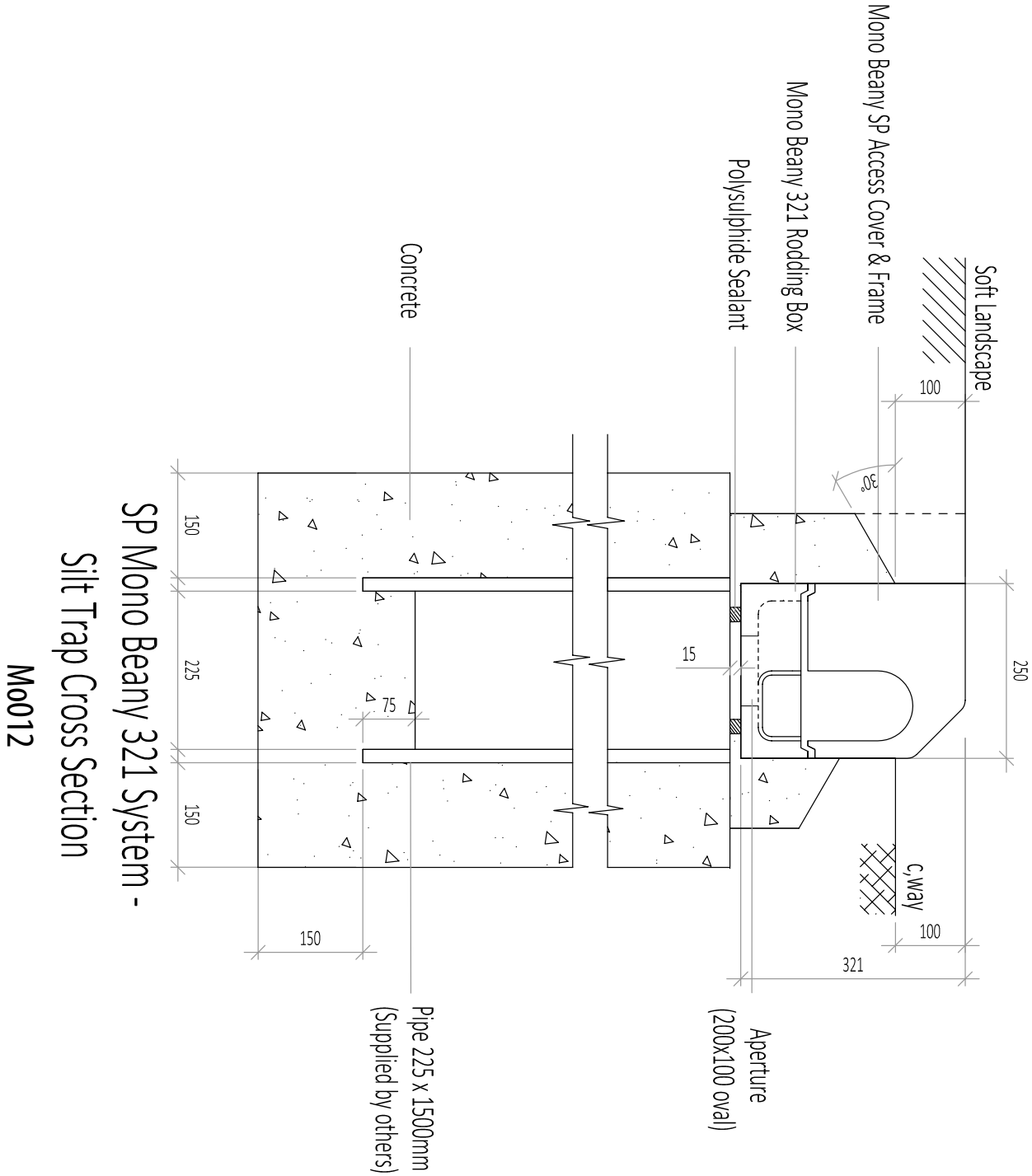


HB Mono Beany 502 System -
Silt Trap Cross Section
Mo009

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

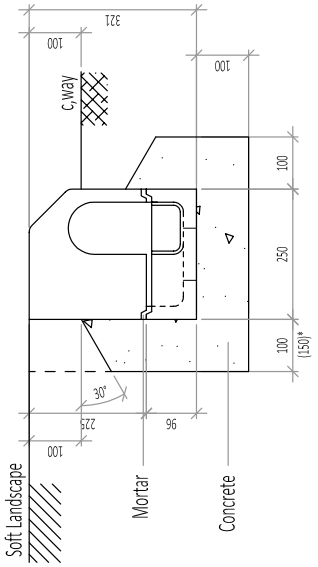
Drawing 5 of 9*



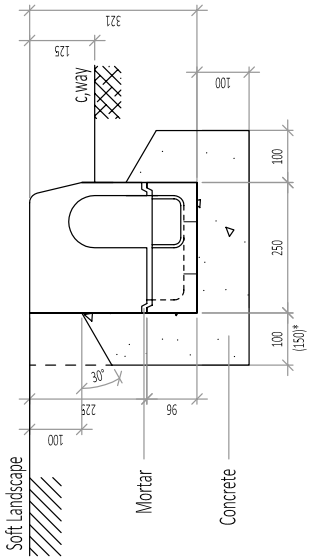
*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

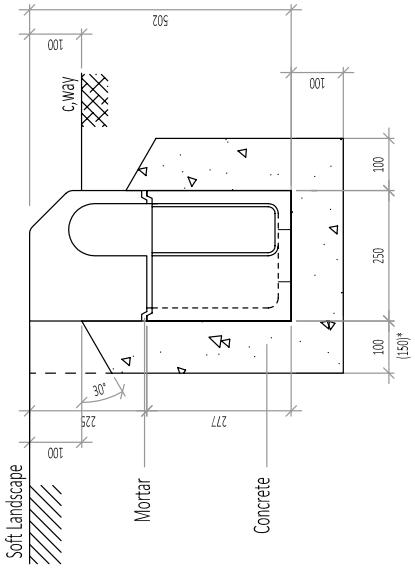
Drawing 6 of 9*



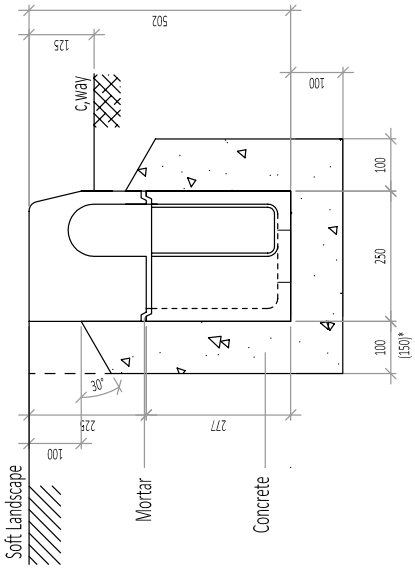
SP Mono Beany 321 Rodding Box
& Access Cover Installation
Mo011



HB Mono Beany 321 Rodding Box
& Access Cover Installation
Mo006



SP Mono Beany 502 Rodding Box
& Access Cover Installation
Mo013

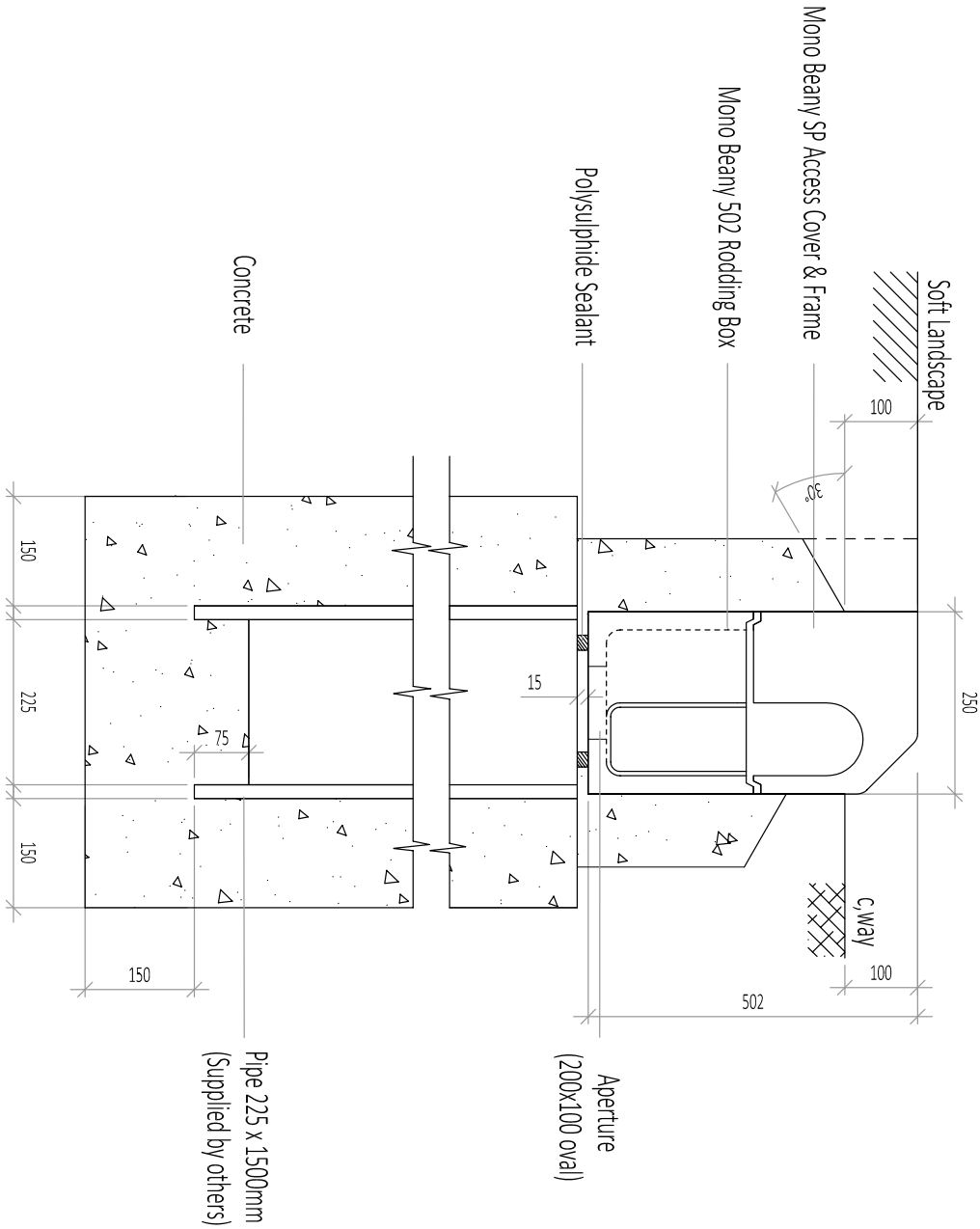


HB Mono Beany 502 Rodding Box
& Access Cover Installation
Mo008

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

Drawing 7 of 9*

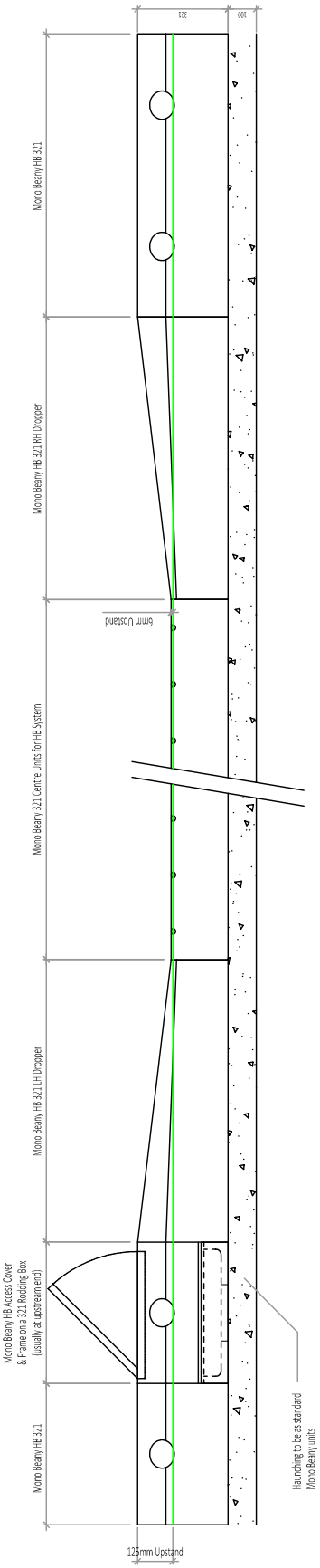


SP Mono Beany 502 System -
Silt Trap Cross Section
Mo014

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

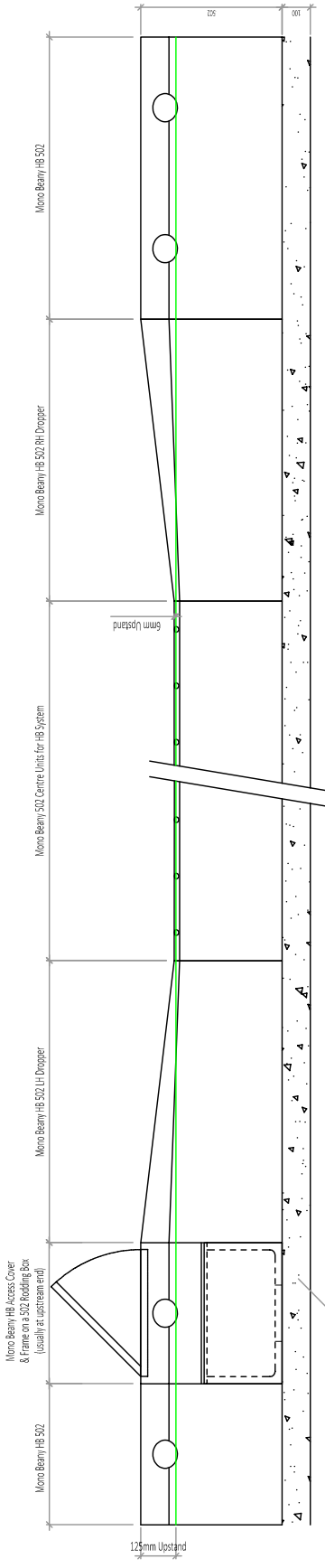
Standard Details

Drawing 8 of 9*



HB Mono Beany 321 Crossing Detail - Elevation

Mo015



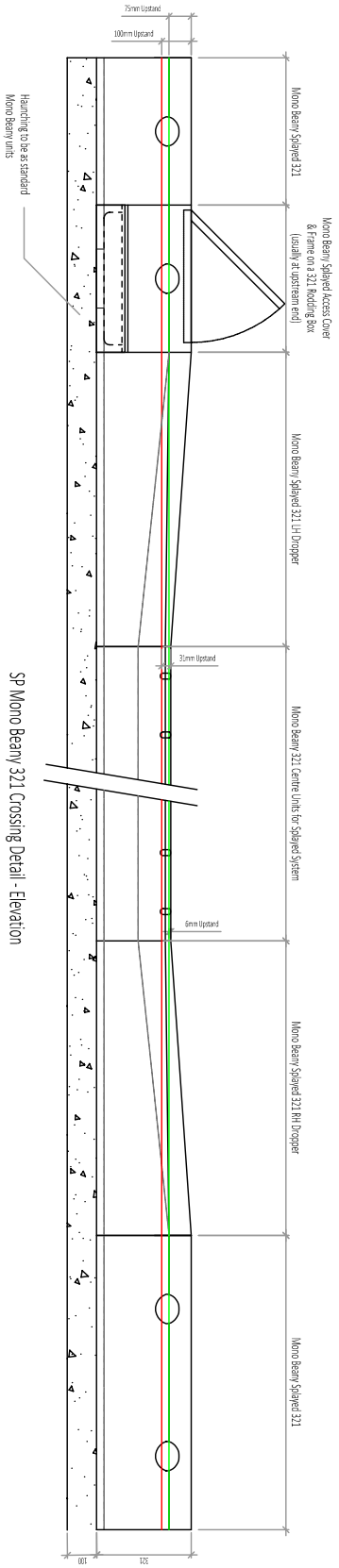
HB Mono Beany 502 Crossing Detail - Elevation

Mo016

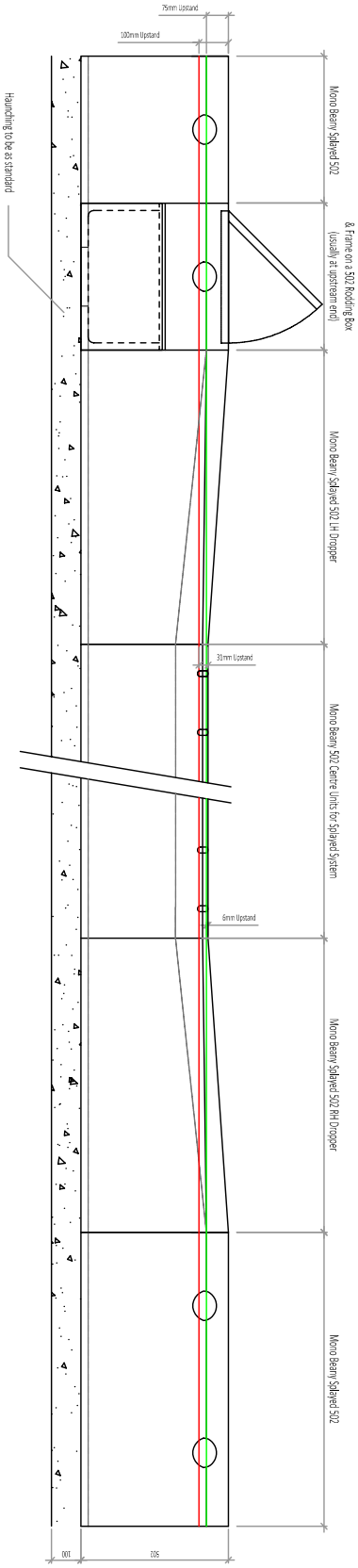
*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

Drawing 9 of 9*



SP Mono Beamy 321 Crossing Detail - Elevation
Mo017



SP Mono Beamy 502 Crossing Detail - Elevation
Mo018

*Units located in areas subject to a frequent number of high speed and/or heavy good vehicle impacts, (i.e. junctions, round abouts and lay bys) shall have a full height rear launch

Standard Details

Notes For Mono Beany

Drawings 1 to 9

1. Mortars shall be;

i. A Mortar class 12 cement mortar to BS EN 998-2 for general bedding and levelling

ii. Marshalls' M-Flex for bedding Mono Beany access covers onto silt boxes

iii. Marshalls' M-Flex for bedding the sections of the Marshalls' Trapped Gully Unit sections

2. Concrete bed, haunch and surround shall be;

i. A concrete mix ST1 to BS 8500-1&2 and BS EN 206-1 for Base Units used in the normal kerb application

ii. A concrete mix ST1 to BS 8500-1&2 and BS EN 206-1 for Beany Trapped Gully, Silt Traps, Catch Pits, end cap and outfall details

iii. Rear haunch shall be full height when used in areas subject to frequent high impact and/or heavy goods vehicular impact (i.e., junctions, roundabouts or layby's) or in areas of soft landscaping to the rear.

3. Marshalls' vertical joint sealant, M-Seal, shall be applied to all vertical faces to achieve a watertight seal.

4. Mono Beany Access Covers and Frames are hinged and handed to the direction of the traffic, specified "nearside" and "offside".

5. Movement joint details that fully isolate the Mono Beany whilst maintaining restraint shall be provided adjacent to all concrete slabs, even when the slab is covered by other materials.

6. All dimensions are in millimetres

Specification

Introduction

The following specification covers the complete Mono Beany system including ancillary fittings and is compatible with the Standard Detail Sheets. Where the Manual of Contract Documents for Highway Works is used, information for 'Appendix 5/5: Combined Drainage and Kerb systems' is available on request.

Mono Beany Combined Kerb and Drain Linear Drainage system

1. The combined kerb and drainage system shall be Marshalls Mono Beany©, manufactured in pre-cast concrete, with the exception of certain ancillary items which are manufactured in cast iron as supplied by Marshalls, Halifax HX5 9HT in accordance with Standard Detail Sheets.

2. The combined kerb and drainage shall consist of a one part system of constant depth blocks

a. Units shall be a maximum of 321/502*mm deep, 150mm wide and 1000mm long.

b. Units laid to radii of less than 40m shall utilise 500mm units and for radii of less than 30m purpose made radial blocks as appropriate

c. Kerb upstand shall be 125/75*mm (HB/SP*)

d. Kerb profile to be Half Battered / 45° Splay*

e. The unit shall be formed in pre-cast concrete with an integral plastic internal lining.

3. All components of the Mono Beany system shall comply with the British Standard BS EN1433:2002, load classification D400 and the following:

a. All units shall be 3rd party accredited with the Kite Mark.

b. The water inlet aperture shall increase in size towards the inside of the unit with a minimum divergence angle of 5°

c. The angle of incline of the water inlet aperture shall be at least 30° to the horizontal

d. Water inlet apertures shall be wholly within individual units and not within 100mm of the end of each unit

e. When installed, the depth of construction from the top of the base channels to the drained area surface shall be not less than 125mm

f. The system shall have a minimum of 12,850mm^2/m water inlet aperture area

4. The combined kerb linear drainage shall be installed to line and level indicated in the contract and in accordance with manufacturer's instructions and standard details.

5. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or as detailed in the contract / WRc Sewers for Adoption; 7th Edition : 2012 / BS EN 752:2008 / BS 8000: Part 14:1989*

Note: * delete as required

Construction

Excavation

1. Sufficient material should be excavated to accommodate the Units, concrete bedding and haunching.

2. Any 'soft spots' or poorly compacted formation should be made good.

Setting Out

1. Setting out pins should be accurately located to the correct line and level with a string line level placed to the rear of the kerb.

2. Sufficient setting out pins should be inserted where Mono Beany Units are laid on horizontal curves

Outfalls

1. Mono Beany Outfalls should be installed first.

2. Sufficient material should be excavated to accommodate the Trapped Mono Beany Gulley

3. 125mm of ST4 mix (BS 8500-1&2) concrete of the appropriate mix is placed in the bottom of the excavation

4. The bottom section of the two part Mono Beany Outfall is lowered into position

5. Sufficient M-Flex sealant is gunned onto the top horizontal surface of the bottom section of the two part Beany Outfall so as to provide a seal between the top and bottom sections

6. The bedding concrete should be laid and brought up flush to the top of the Mono Beany Outfall.

7. The Cast iron Access Cover & Frame Units should be set directly onto a liberal quantity of stiff, cement mortar to completely fill the whole of the joint.

Mono Beany Unit Installation

1. Bedding concrete (ST1 to BS 8500-1&2) of the appropriate thickness and depth shall be laid

2. Mono Beany Units shall be laid onto the freshly mixed bedding concrete, starting at the outfall, i.e. working uphill

3. Alternatively, the Mono Beany Units may be bedded on to a layer of 10 to 40mm cement mortar (M12 mortar to BS EN 998-2) on a previously prepared concrete foundation.

4. Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length and no cuts shall be within 50mm of the inlet aperture. No cutting shall impair the stability of the Unit.

5. All cutting and trimming of the Units shall be carried out with an appropriate cutting tool.

Mono Beany Joint Sealant

1. Sufficient Marshalls' M-Flex sealant should be gunned into the sealant groove at either end of the unit.

Mono Beany End Caps

1. Where the Mono Beany run does not terminate at an outfall, the base unit shall be sealed using the Mono Beany End Cap.

2. The End Cap shall be securely placed against the vertical end of the base unit and haunched with fresh concrete (ST1 mix to BS 8500-1&2).

Pavement Installation

1. Where Mono Beany is laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the units and haunching adjacent to the slab joints and also longitudinal movement joints between the haunching and the slabs.

2. Where necessary, the Unit drainage openings shall be protected against the ingress of material during concreting operations by covering with Waterproof Cloth Tape.

3. Where Mono Beany is installed in areas of soft landscaping or areas subject to frequent high impact and/or heavy goods vehicular impact (i.e., junctions, roundabouts or layby's) Marshalls recommend a full height rear haunch

Health & Safety

4. All necessary Personal Protective Equipment (PPE) should be worn on site, as site rules stipulate. Goggles, ear defenders, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

5. COSHH - All relevant health and safety information, including COSHH data sheets, can be obtained from Marshalls Advisory Services, or the Marshalls Design Team on 0845 3020606.

Client:
Highways England

Contractor:
Costain

Engineer:
Mouchel (Manchester)

Marshalls products used:
- 15,000 linear metres of Mono Beany
- Bespoke transition unit

Mono Beany

Case Study - M1

Marshalls supplied 15,000 linear metres of Mono Beany one-piece combined kerb and drainage to the new M1 smart motorway scheme.

Challenge

The road network is a crucial part of our national transport system and failures to improve these networks increases cost, hinders employment opportunities and makes it harder to do business.

Congestion is already a serious problem on the M1 between junctions 28 and 31 which carries around 95,000 vehicles per day.

The challenge was to install new infrastructure, including drainage attenuation, with minimal disruption and to select a suitable product engineered to help contractors meet deadlines. This would ensure the M1 was open and running to its full capacity within the project timescales. The client also needed to keep within budget and didn't want to pay for a costly over-engineered system.

Solution

Marshalls was chosen to supply linear drainage to the project. Mono Beany is Marshalls' first one-piece combined kerb and drainage system made with ultra-tough M-Tech concrete which has been proven to significantly reduce installation time.

This innovative product is available in two depths which both have a recycled inner plastic core to provide hydraulic flow benefits at low and medium capacities. Each one metre unit can carry up to 40 tonnes (Class D400) when trafficked. The inlet apertures are divergent and angled at 45° to prevent blockages and maximise drainage efficiency. These features ensure surface water is cleared rapidly and internal flow is smooth and efficient.

The hydraulic capacity requirements varied along the run and therefore a mix of Mono Beany 321 and 502 units were required as this was deemed more cost-effective. Marshalls also used its expertise to develop a new transition unit to complete the M1 scheme as part of the Highways Agency's focus on innovation. This was developed in order to create a smooth hydraulic transition from a 502 to a 321 Mono Beany unit, which reduced the hydraulic capacity, while coming within budget.

Benefit

Costain initially anticipated it would lay 240 metres of Mono Beany per day, however using the revolutionary, easy-to-install Mono Beany system the installation time was considerably reduced, with 340 metres installed per day to the scheme.

Malcolm Bell, Construction Manager from Costain said: ***"Due to how quickly we were able to install the innovative Mono Beany system there was an increased demand on deliveries to site. Marshalls offered a reliable and guaranteed supply throughout the project, delivering three to four loads per week direct-to-site, often delivering two loads per day. This helped to ensure we met our completion deadlines and kept works disruption to a minimum.***

"Working with Marshalls also offered Costain a dedicated and knowledgeable design team to meet our requirements for this scheme.

"These are all important factors when tasked with installing over nine miles of drainage to a major strategic route connecting people, communities and businesses."

In the longer term this scheme will help relieve congestion and smooth traffic flow along this stretch of the M1, improving safety and journey times for commuters. These benefits will also support economic development in the region.

Responding to the recent announcement by Highways England that there will be a £1.5bn investment in smart motorway schemes Marshalls Drainage Trading Director said: "Marshalls is already engaged in a number of smart motorway schemes as part of this investment, offering design expertise on a wide range of suitable products.

"As the UK's leading supplier of hard landscaping materials, we are committed to developing effective water management and linear drainage solutions to meet the needs of contractors.

"Having already supplied Junctions 28-31 of the M1, we are poised for further involvement to improve the road network and have the capacity and capability to deal with further orders."

Bridge Beany®

Cast Iron

Bridge Beany®

Combined Kerb and Drainage System

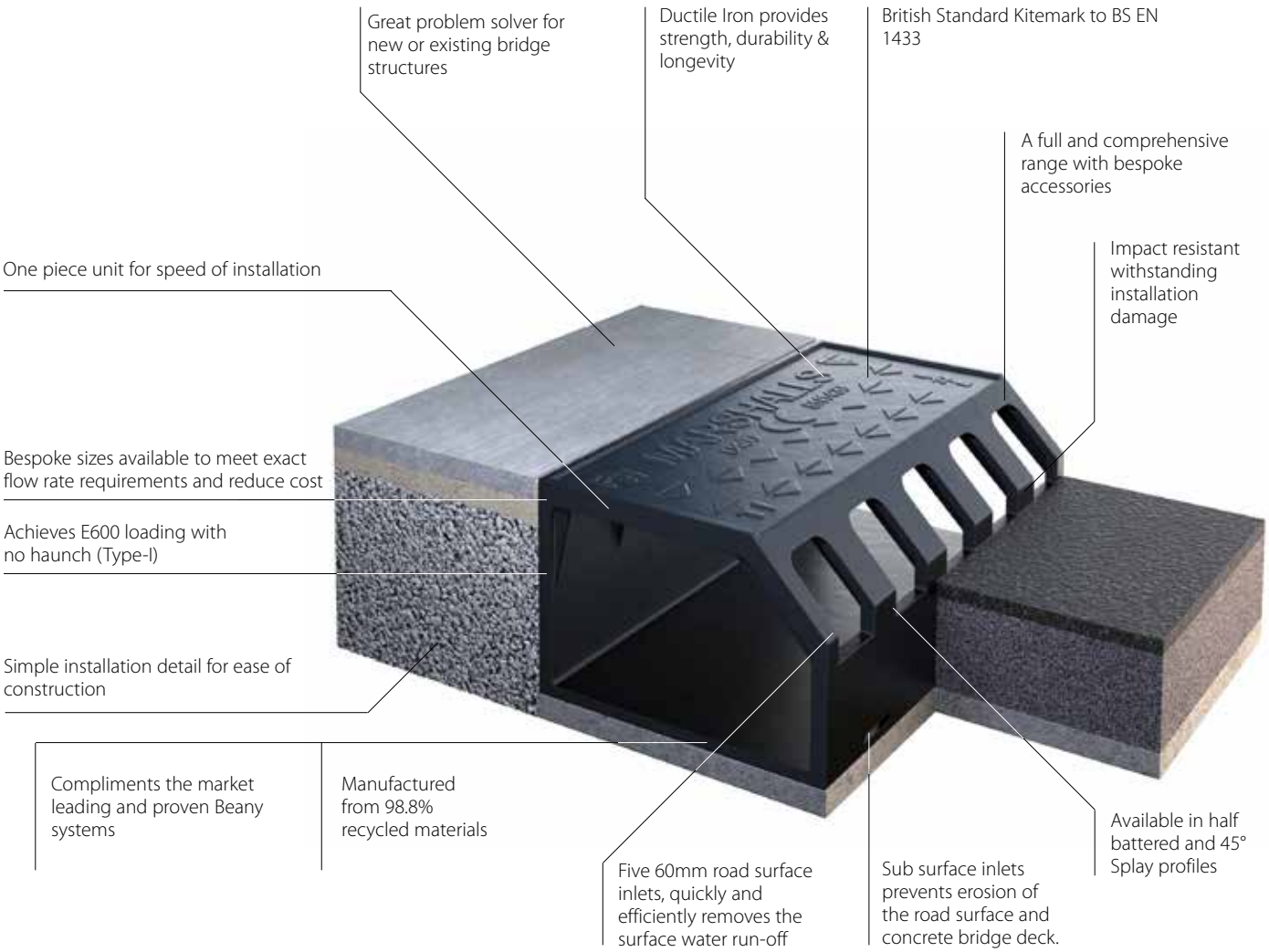
Providing a flexible, yet high performance solution, Marshalls' exclusive Bridge Beany Drainage System is the only Type-I E600 available on the market.

A cost effective option for a variety of schemes, Marshalls Bridge Beany offers a tailored, value-engineered solution that can be used either as a standalone product or in conjunction with other products in the award-winning Beany range.

NSSPlus
Q10 190

Bridge Beany®

Combined Kerb and Drainage System



- Bridge beany is the markets only Type-I E600 bridge drainage system. This Kitemark proven system provides an E600 loading classification without any haunching providing a flexible and cost-effective solution for bridge deck drainage requirements.
- The product is compatible with Marshalls market leading Beany, Mini Beany, and Mono Beany systems, further extending the use of this product on highways and carriageways providing a total solution.

The System

- Bridge Beany is manufactured as a one piece solution with five apertures along the face of each 500mm unit maximising inlet capacity. The Ductile Iron properties of the units guarantees an E600 rated bridge deck drainage system strong enough to withstand loadings imposed by both road and construction traffic when installed.

Versatile

- Whether it be a new or existing bridge structure the simplistic design of Bridge Beany provides features which give it significant engineering benefits over alternative systems.
- The flexibility of bespoke units and accessories coupled with Marshalls hydraulic and product design service, delivers a tailored value engineered solution that provides excellent surface drainage efficiency meeting exact flow rate and design requirements.

Cost Advantages

High Capacity Performance

- Bridge Beany is available as a 450mm wide unit to compensate for the restricted construction depth, whilst proving extra capacity.
- Each unit has five 60mm inlets spaced at 40mm intervals to maximize inlet capacity in periods of heavy rainfall, ensuring surface water is quickly and efficiently removed.

Construction Saving

- The Bridge Beany System combines water interception and transportation in one system. This eliminates the need for drilling the bridge deck to accommodate gullies and the connection of sub-surface and suspended carrier pipes reducing construction costs and savings time.
- Simple one part system – straight forward to design and detail, reducing design times and cost. Easy to set out and easy to install.
- The overall construction period can be reduced as carriage way materials may be laid in a continuous sequence. Unlike laying conventional drainage, excavations are kept to a minimum without exposing the formation and sub-base surfaces to possible periods of adverse weather
- Underground cables and services can be avoided so contractual/ insurance claims are likely to be much less than when laying conventional drainage.
- Bridge Beany is certified to E600 loading as a Type-I system. A type-I system can be laid in conjunction with standard parapet and surfacing material eliminating the time and material cost of a concrete haunch.

Low Maintenance

- If a blockage does occur, it can be easily located and rectified by rodding or jetting from an access point or through an aperture adjacent to the blockage as appose to maintaining carrier pipes that are set within the sub-base or suspended below the bridge.
- The one piece design ensures units lock into the construction of the concrete bridge deck and road surface reducing or eliminating the risk of units becoming lose or going missing, reducing replacement maintenance costs.
- Bridge Beany is manufactured in ductile iron enabling the units to be uplifted and re-laid after necessary maintenance on the road or bridge structure.

Engineering Benefits

Manufacture

The system's main components are manufactured from ductile iron with a bitumen coating applied.

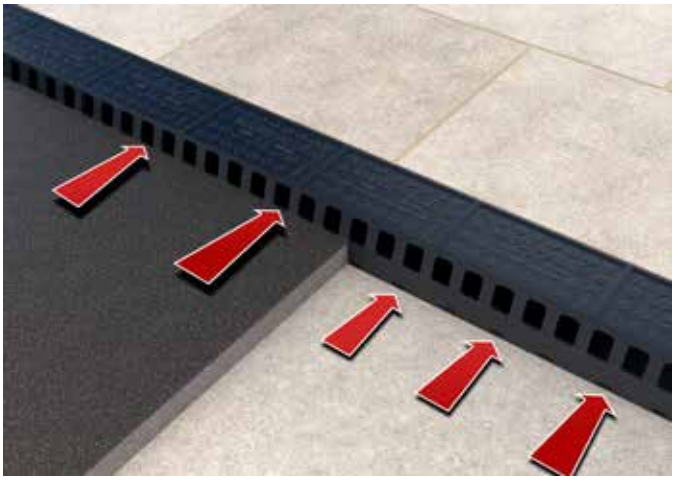
The high inherent strength and durability of ductile iron means the Bridge Beany System can:

- Allow complete compaction of surfacing materials adjacent to the channel during construction without damage.
- Be up-lifted and re-laid without effecting the performance of the units when road works needs to be carried out on the bridge structure.
- Provide flexibility of bespoke units enabling a solution to suit a wide range of capacity requirements minimizing outfalls.

Water Inlet Aperture

Each Bridge Beany unit has a series of road surface and sub-surface inlets to maximize the inlet capacity and efficiency of the system, reducing the risk for traffic is adverse weather.

- The three Sub-surface inlets on each unit reduces the pressure created by the sub-surface water, preventing erosion of the road surface and concrete bridge deck.
- Each 500mm unit has five 60mm road surface inlets to quickly and efficiently remove the surface water run-off reducing the amount of water absorbed into the road sub-base.
- Located 40mm apart on each unit to give maximum strength preventing resistance against roads imposed by overriding heavy vehicles.



Type-I System

Bridge Beany is the markets only kitemarked Type-I E600 system that can withstand a loading of 66 tonnes as a freestanding until with no haunching material.

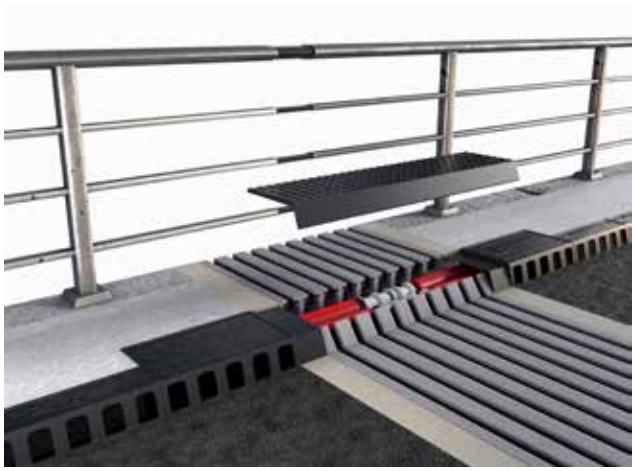
- Bridge Beany requires no concrete haunch resulting in a saving of approx. 250kg per linear meter reducing the overall weight on the bridge structure.
- Bridge Beany will perform to E600 without being reliant on the installation surround.

Expansion Joint Solutions

The expansion joint on a bridge often proves to be the most problematic area for both Contractors and Designers. Allowing for movement whilst keeping the joint dry is of primary importance on any bridge.

The Bridge Beany system offers several types of expansion joints ranging from a small single pipe to a large capacity unit that enable the designer or contractor to cross an existing or new expansion joint.

The expansion units can allow horizontal, vertical, axial and lateral movement of the joint whilst meeting the same performance requirements as the standard bridge drainage units.



Pinch Point Units

Bridge Beany pinch point units are designed for additional strength for heavily trafficked junctions, road abouts and areas subject to HGV traffic

Components

HALF BATTERED

Half Battered
500 x 450 x 125

Half Battered
500 x 350 x 125

Half Battered
500 x 275 x 125

Half Battered
500 x 175 x 125

Half Battered
500 x 150 x 125

45° SPLAYED

45° Splayed
500 x 450 x 100

45° Splayed
500 x 350 x 100

45° Splayed
500 x 275 x 100

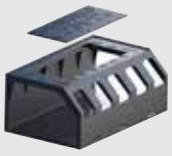
45° Splayed
500 x 175 x 100

45° Splayed
500 x 150 x 100

ACCESSORIES

Rodding & Outlet Units

- The access lid is lockable for improved security
- Compatible with the standard units regardless of size or profile
- Removable lid provides large access opening for the emptying of silt traps and outfall sumps using traditional equipment
- Special lids can be designed for all access requirements
- Outlet unit can be configured to meet individual requirements; size, exit angle or position (base, rear and end)



Rodding Unit

Base Outlet Unit

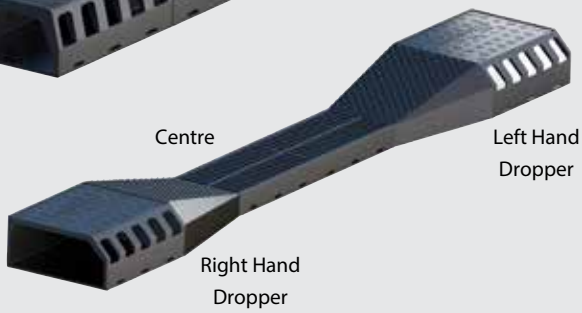
Transition Units

- Designed to allow smooth transition from one unit height to width to another or the Beany systems
- Provides uninterrupted flow between the units minimizing impact on the hydraulic performance

Transition Unit

Droppers And Flush Units

- Droppers are available in left or right hand units
- Uninterrupted flow across a pedestrian crossing or road junctions
- Flush units are available with solid or heelsure slots



Centre

Left Hand Dropper

Right Hand Dropper

End Units

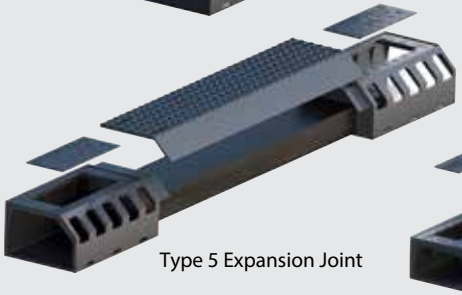
- Available right and left hand units
- Forms the transition to normal half battered kerbs at pedestrian or vehicular crossings

Left Hand End Unit

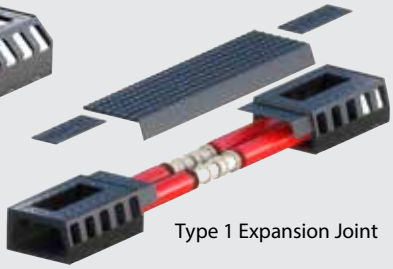
Right Hand End Unit

Expansions Units

- Available as a type 1 or type 5 expansion joint
- Each unit is bespoke to enable the system to cross an existing or new expansion joint.
- Designed to allow horizontal, vertical, axial and lateral movement of the joint



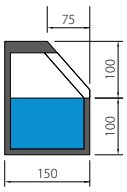
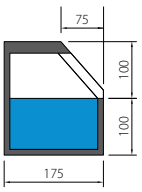
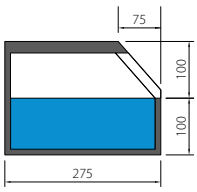
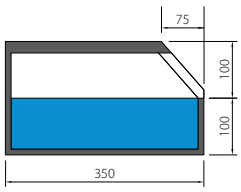
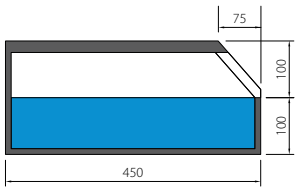
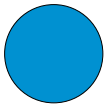
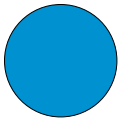
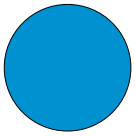
Type 5 Expansion Joint

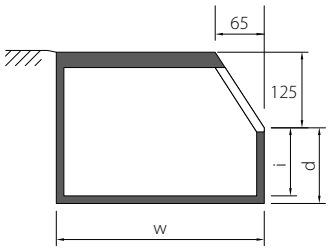
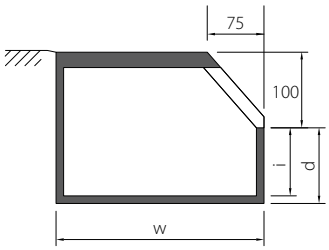


Type 1 Expansion Joint

Hydraulic Data

FLOW CAPACITY

Bridge Beany 150 x 100	Bridge Beany 175 x 100	Bridge Beany 275 x 100	Bridge Beany 350 x 100	Bridge Beany 450 x 100
				
				
Equivalent Pipe Diameter (mm) 125	Equivalent Pipe Diameter (mm) 135	Equivalent Pipe Diameter (mm) 175	Equivalent Pipe Diameter (mm) 200	Equivalent Pipe Diameter (mm) 225

	Bridge Beany Half Battered			Bridge Beany Splayed		
						
ref.	w	i	d	w	i	d
150	150	90 (65/115)*	100 (75/125)*	150	90 (65/115)*	100 (75/125)*
175	175	90 (65/115)*	100 (75/125)*	175	90 (65/115)*	100 (75/125)*
275	275	90 (65/115)*	100 (75/125)*	275	90 (65/115)*	100 (75/125)*
350	350	90 (65/115)*	100 (75/125)*	350	90 (65/115)*	100 (75/125)*
450	450	90 (65/115)*	100 (75/125)*	450	90 (65/115)*	100 (75/125)*

Hydraulic Data

The Bridge Beany hydraulic data stated in the following tables is for the standard range only and comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the HR Wallingford method.

If a bespoke system is required, specific hydraulic flow calculations to meet the exact bridge deck requirements can be provided free of charge.

Half Battered

450 Half Battered

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	16.00	0.40	23.10	0.57	29.10	0.72	31.90	0.79	36.40	0.90	45.70	1.13	51.50	1.27	61.10	1.51
100	9.30	0.23	20.40	0.50	30.40	0.75	35.30	0.87	43.00	1.06	60.00	1.46	65.00	1.60	74.60	1.84
150	2.60	0.06	17.70	0.44	31.80	0.78	38.70	0.95	49.60	1.22	72.60	1.79	78.50	1.94	88.00	2.17
200	2.10	0.05	15.10	0.04	33.10	0.82	42.00	1.04	56.20	1.39	86.10	2.12	92.00	2.27	101.50	2.50

350 Half Battered

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	11.60	0.37	16.70	0.53	21.00	0.67	23.10	0.74	26.30	0.84	33.00	1.06	37.20	1.19	44.10	1.41
100	6.70	0.22	14.80	0.47	22.00	0.70	25.50	0.82	31.10	0.99	42.70	1.37	46.90	1.15	53.80	1.72
150	1.90	0.01	12.80	0.41	23.00	0.73	27.90	0.89	35.80	1.15	52.40	1.69	56.70	1.81	63.60	2.03
200			10.90	0.35	24.00	0.77	30.40	0.97	40.60	1.30	62.20	1.99	66.40	2.12	73.30	2.35

275 Half Battered

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	8.40	0.35	12.20	0.50	15.30	0.63	16.80	0.69	19.20	0.79	24.00	0.99	27.10	1.12	32.20	1.32
100	4.90	0.20	10.80	0.44	16.00	0.66	18.60	0.77	22.70	0.93	31.10	1.28	34.20	1.41	39.30	1.62
150	1.40	0.06	9.30	0.38	16.70	0.69	20.40	0.84	26.10	1.08	38.20	1.58	41.30	1.70	46.30	1.91
200			7.90	0.33	17.40	0.72	22.10	0.91	29.60	1.22	45.30	1.87	48.40	1.99	53.40	2.20

175 Half Battered

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	4.60	0.31	6.70	0.44	8.40	0.56	9.20	0.61	10.50	0.70	13.10	0.88	14.80	0.99	17.60	1.17
100	2.70	0.18	5.90	0.39	8.80	0.58	10.20	0.68	12.40	0.83	17.00	1.14	18.70	1.25	21.50	1.43
150	0.70	0.05	5.10	0.34	9.10	0.61	11.10	0.74	14.30	0.95	20.90	1.40	22.60	1.51	25.30	1.69
200			4.30	0.29	9.50	0.64	12.10	0.81	16.20	1.08	24.80	1.65	26.50	1.77	29.20	1.95

150 Half Battered

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	2.90	0.28	4.20	0.41	5.30	0.51	5.80	0.56	6.60	0.64	8.30	0.80	9.30	0.90	11.00	1.07
100	1.70	0.16	3.70	0.36	5.50	0.53	6.40	0.62	7.80	0.75	10.70	1.04	11.80	1.14	13.50	1.31
150	0.50	0.05	3.20	0.31	5.70	0.56	7.00	0.68	9.00	0.87	13.10	1.27	14.20	1.37	15.90	1.54
200	0.50	0.05	2.70	0.26	6.00	0.58	7.60	0.74	10.20	0.98	15.60	1.51	16.60	1.61	18.40	1.78

Hydraulic Data

45° Splayed

450 Splayed																
Gradient	**Zero**		**1 in 1000**		**1 in 500**		**1 in 400**		**1 in 300**		**1 in 200**		**1 in 100**		**1 in 50**	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	16.00	0.40	23.10	0.57	29.10	0.72	31.90	0.79	36.40	0.90	45.70	1.13	51.50	1.27	61.10	1.51
100	9.30	0.23	20.40	0.50	30.40	0.75	35.30	0.87	43.00	1.06	60.00	1.46	65.00	1.60	74.60	1.84
150	2.60	0.06	17.70	0.44	31.80	0.78	38.70	0.95	49.60	1.22	72.60	1.79	78.50	1.94	88.00	2.17
200	2.10	0.05	15.10	0.04	33.10	0.82	42.00	1.04	56.20	1.39	86.10	2.12	92.00	2.27	101.50	2.50

350 Splayed																
Gradient	**Zero**		**1 in 1000**		**1 in 500**		**1 in 400**		**1 in 300**		**1 in 200**		**1 in 100**		**1 in 50**	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	11.60	0.37	16.70	0.53	21.00	0.67	23.10	0.74	26.30	0.84	33.00	1.06	37.20	1.19	44.10	1.41
100	6.70	0.22	14.80	0.47	22.00	0.70	25.50	0.82	31.10	0.99	42.70	1.37	46.90	1.15	53.80	1.72
150	1.90	0.01	12.80	0.41	23.00	0.73	27.90	0.89	35.80	1.15	52.40	1.69	56.70	1.81	63.60	2.03
200			10.90	0.35	24.00	0.77	30.40	0.97	40.60	1.30	62.20	1.99	66.40	2.12	73.30	2.35

275 Splayed																
Gradient	**Zero**		**1 in 1000**		**1 in 500**		**1 in 400**		**1 in 300**		**1 in 200**		**1 in 100**		**1 in 50**	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	8.40	0.35	12.20	0.50	15.30	0.63	16.80	0.69	19.20	0.79	24.00	0.99	27.10	1.12	32.20	1.32
100	4.90	0.20	10.80	0.44	16.00	0.66	18.60	0.77	22.70	0.93	31.10	1.28	34.20	1.41	39.30	1.62
150	1.40	0.06	9.30	0.38	16.70	0.69	20.40	0.84	26.10	1.08	38.20	1.58	41.30	1.70	46.30	1.91
200			7.90	0.33	17.40	0.72	22.10	0.91	29.60	1.22	45.30	1.87	48.40	1.99	53.40	2.20

175 Splayed																
Gradient	**Zero**		**1 in 1000**		**1 in 500**		**1 in 400**		**1 in 300**		**1 in 200**		**1 in 100**		**1 in 50**	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	4.60	0.31	6.70	0.44	8.40	0.56	9.20	0.61	10.50	0.70	13.10	0.88	14.80	0.99	17.60	1.17
100	2.70	0.18	5.90	0.39	8.80	0.58	10.20	0.68	12.40	0.83	17.00	1.14	18.70	1.25	21.50	1.43
150	0.70	0.05	5.10	0.34	9.10	0.61	11.10	0.74	14.30	0.95	20.90	1.40	22.60	1.51	25.30	1.69
200			4.30	0.29	9.50	0.64	12.10	0.81	16.20	1.08	24.80	1.65	26.50	1.77	29.20	1.95

150 Splayed																
Gradient	**Zero**		**1 in 1000**		**1 in 500**		**1 in 400**		**1 in 300**		**1 in 200**		**1 in 100**		**1 in 50**	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	2.90	0.28	4.20	0.41	5.30	0.51	5.80	0.56	6.60	0.64	8.30	0.80	9.30	0.90	11.00	1.07
100	1.70	0.16	3.70	0.36	5.50	0.53	6.40	0.62	7.80	0.75	10.70	1.04	11.80	1.14	13.50	1.31
150	0.50	0.05	3.20	0.31	5.70	0.56	7.00	0.68	9.00	0.87	13.10	1.27	14.20	1.37	15.90	1.54
200	0.50	0.05	2.70	0.26	6.00	0.58	7.60	0.74	10.20	0.98	15.60	1.51	16.60	1.61	18.40	1.78

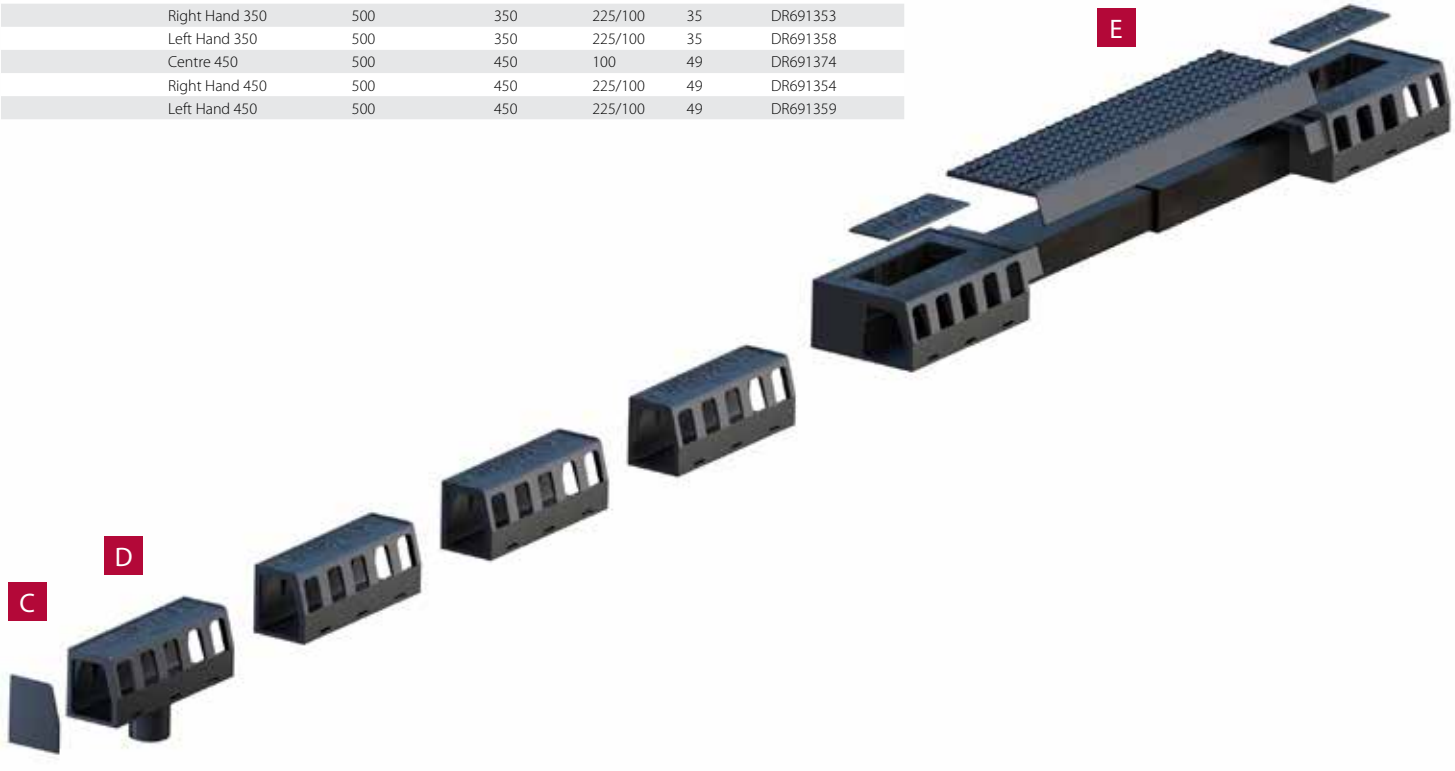
Bridge Beany Component Codes

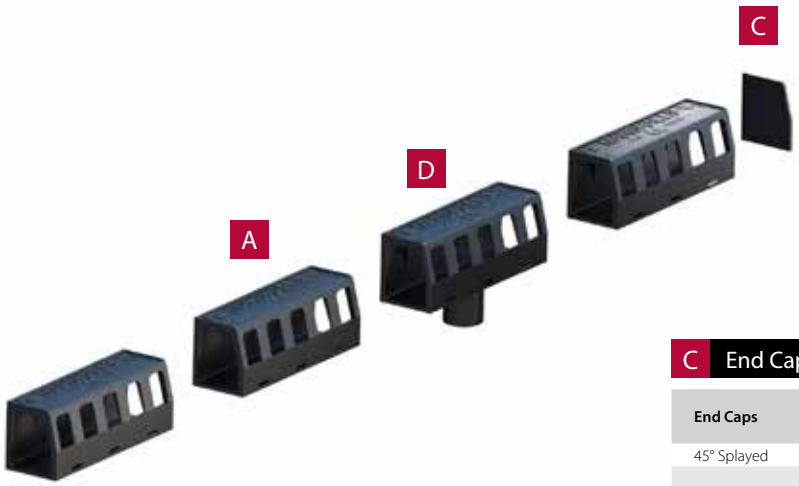
A Constant Depth Channel

Constant Depth Channel	Length (mm)	Width (mm)	Wier Height (mm)	Height (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
45° Splayed	500	150	100	200	186	14	DR691201
	500	175	100	200	186	17	DR691202
	500	275	100	200	186	26	DR691203
	500	350	100	200	186	35	DR691204
	500	450	100	200	186	49	DR691205
Half Battered	500	150	125	225	211	14	DR691290
	500	175	125	225	211	17	DR691291
	500	275	125	225	211	26	DR691292
	500	350	125	225	211	35	DR691293
	500	450	125	225	211	49	DR691294

B Dropped Crossing Accessories

Road Crossing Accessories		Length(mm)	Width (mm)	Height (mm)	Unit Weight (kg)	Item Code
45° Splayed	Centre 150	500	150	100	14	DR691280
	Right Hand 150	500	150	200/100	14	DR691260
	Left Hand 150	500	150	200/100	14	DR691265
	Centre 175	500	175	100	17	DR691281
	Right Hand 175	500	175	200/100	17	DR691261
	Left Hand 175	500	175	200/100	17	DR691266
	Centre 275	500	275	100	26	DR691282
	Right Hand 275	500	275	200/100	26	DR691262
	Left Hand 275	500	275	200/100	26	DR691267
	Centre 350	500	350	100	35	DR691283
	Right Hand 350	500	350	200/100	35	DR691263
	Left Hand 350	500	350	200/100	35	DR691268
	Centre 450	500	450	100	49	DR691284
	Right Hand 450	500	450	200/100	49	DR691264
	Left Hand 450	500	450	200/100	49	DR691269
Half Battered	Centre 150	500	150	100	14	DR691370
	Right Hand 150	500	150	225/100	14	DR691350
	Left Hand 150	500	150	225/100	14	DR691355
	Centre 175	500	175	100	17	DR691371
	Right Hand 175	500	175	225/100	17	DR691351
	Left Hand 175	500	175	225/100	17	DR691356
	Centre 275	500	275	100	26	DR691372
	Right Hand 275	500	275	225/100	26	DR691352
	Left Hand 275	500	275	225/100	26	DR691357
	Centre 350	500	350	100	35	DR691373
	Right Hand 350	500	350	225/100	35	DR691353
	Left Hand 350	500	350	225/100	35	DR691358
	Centre 450	500	450	100	49	DR691374
	Right Hand 450	500	450	225/100	49	DR691354
	Left Hand 450	500	450	225/100	49	DR691359





C End Caps

End Caps		Unit Weight (kg)	Item Code
45° Splayed	End Cap 150	5	DR691210
	End Cap 175	5	DR691211
	End Cap 275	10	DR691212
	End Cap 350	10	DR691213
	End Cap 450	15	DR691214
Half Battered	End Cap 150	5	DR691300
	End Cap 175	5	DR691301
	End Cap 275	10	DR691302
	End Cap 350	10	DR691303
	End Cap 450	15	DR691304

E Expansion Joints

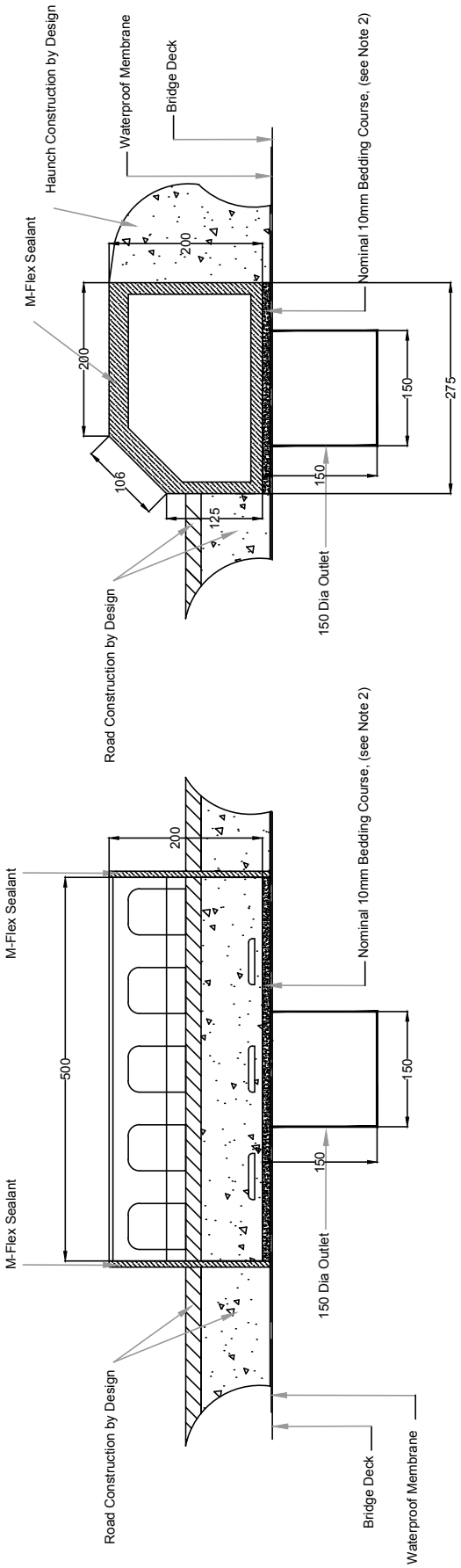
Expansion Joints		Unit Weight (kg)	Item Code
45° Splayed	Type 1 Expansion Joint 150	100	DR691240
	Type 1 Expansion Joint 175	100	DR691241
	Type 1 Expansion Joint 275	150	DR691242
	Type 1 Expansion Joint 350	200	DR691243
	Type 1 Expansion Joint 450	250	DR691244
	Type 5 Expansion Joint 150	200	DR691245
	Type 5 Expansion Joint 175	300	DR691246
	Type 5 Expansion Joint 275	400	DR691247
	Type 5 Expansion Joint 350	500	DR691248
	Type 5 Expansion Joint 450	600	DR691249
Half Battered	Type 1 Expansion Joint 150	100	DR691330
	Type 1 Expansion Joint 175	100	DR691331
	Type 1 Expansion Joint 275	150	DR691332
	Type 1 Expansion Joint 350	200	DR691333
	Type 1 Expansion Joint 450	250	DR691334
	Type 5 Expansion Joint 150	200	DR691335
	Type 5 Expansion Joint 175	300	DR691336
	Type 5 Expansion Joint 275	400	DR691337
	Type 5 Expansion Joint 350	500	DR691338
	Type 5 Expansion Joint 450	600	DR691339

D Outfalls & Rodding Units

Outfalls & Rodding Units		Unit Weight (kg)	Item Code
45° Splayed	Outfall 150	18	DR691230
	Outfall 175	21	DR691231
	Outfall 275	30	DR691232
	Outfall 350	39	DR691233
	Outfall 450	54	DR691234
	Rodding Unit 150	14	DR691220
	Rodding Unit 175	17	DR691221
	Rodding Unit 275	26	DR691222
	Rodding Unit 350	35	DR691223
	Rodding Unit 450	49	DR691224
Half Battered	Outfall 150	18	DR691320
	Outfall 175	21	DR691321
	Outfall 275	30	DR691322
	Outfall 350	39	DR691323
	Outfall 450	54	DR691324
	Rodding Unit 150	14	DR691310
	Rodding Unit 175	17	DR691311
	Rodding Unit 275	26	DR691312
	Rodding Unit 350	35	DR691313
	Rodding Unit 450	49	DR691314

Standard Details

Drawing 1 of 1



Standard Details

Notes For Bridge Beany

Drawings 1 to 1

1. All dimensions are in millimetres

2. Mortar shall be Class 12 to BS EN 988-2:2003

3. Concrete shall be of a minimum compressive strength of designation ST1 in normal kerb applications.

4. Cementitious based bedding material shall contain a waterproofing additive.

5. The channel unit shall be ductile iron (S.G.) manufactured to EN-GJS-450-10.

6. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes which may differ from customer requirements and site conditions and should be checked and accepted by the Engineer for project use.

Specification

Introduction

The following specification covers the complete Bridge Beany linear drainage system including ancillary fittings and is compatible with the standard detail drawings.

Where the Manual of Contract Drawings for Highways Works is used, refer to 'Appendix 5/5: Linear Channels'.

Bridge Beany

1. The linear drainage system shall be Bridge Beany supplied by Marshalls plc. All channel materials and ancillary products detailed in this specification shall be supplied by Marshalls.

2. All components of the system shall be type tested and be fully compliant with the requirements of BS EN 1433:2002: Drainage channels for vehicular and pedestrian areas – Classification, design and testing requirements, marking and evaluation of conformity' when installed as per manufacturers recommendations.

3. The linear drainage system shall be a one piece unit manufactured in a single material (Ductile Iron) with the exception of certain ancillary products as supplied by the manufacturers in accordance with standard details.

4. The linear drainage channel:-

   a. Kerb profile shall be ***Half Battered (HB) / 45° Splay (SP)****.

   b. Units shall be a maximum of 200mm deep and ***150/175/275/350/450**** mm wide. Units laid to radii of less than 50m shall utilise purpose made radial blocks as appropriate.

   c. Kerb upstand shall be ***125/100/75**** mm.

   d. The weir height shall be ***125/100/75**** mm.

   e. Shall be of a constant depth between ancillaries or access points

   f. The units shall be Type 'I' (unhaunched) and meet a minimum of load class of E600 when tested in accordance with BSEN 1433.

   g. All units shall be 3rd party accredited with the Kite Mark complete with manufacturers identifying marks.

   h. The weir height of the water inlet aperture shall be ***125/100/75**** mm ***(HB/SP*)***.

   i. The water inlet apertures shall be of equal size and shape with a total of 5 apertures per 500mm unit.

   j. The combined area of the inlet apertures shall be ≥ the cross section area of the internal channel unit.

   k. Water inlet apertures shall be wholly contained within individual units

Specification

l. The internal cross sectional area shall be a minimum ***9100/10700/17500/22600/29300 mm²***.

m. Water shall exit the channel units via an outfall with an outlet of ***150/225**** mm nominal bore located in the ***base/rear/side**** of the drainage outfall unit.

n. The location of outfalls and silt traps shall be as detailed in contract documents.

5. Channel unit shall be bedded on a nominal ***10/20**** mm bed to allow for adjustment to line and level.

6. Bedding mortar shall be Marshalls M-Bond or mortar designation (i) complying with Class M12 in accordance with BS EN 998-2.

7. Bedding concrete shall be designation ST1 in normal kerb applications.

8. Cementitious based bedding material shall contain a waterproofing additive.

9. Bridge Beany expansion joints shall be ***Type 1 / Type 5**** to compliment the requirements of the proprietary expansion joint manufacturer.

10. The primary material of the channel unit system shall be ductile iron (S.G.) manufactured to minimum standard EN-GJS-450-10.

11. The unit shall consist of material which is 100% recyclable.

12. The unit shall be fire resistant.

13. The unit shall be UV resistant.

14. The linear drainage shall be installed to line and level indicated in the contract and in accordance with manufacturer's instructions and standard details.

15. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or as detailed in the contract / WRc Sewers for Adoption; ***7th Edition : 2012 / BS EN 752:2008 / BS 8000: Part 14:1989****

Note: * delete as required

Construction

Introduction

Installation of the Bridge Beany combined kerb and drainage system should be carried out in accordance with the specification and standard detail drawings.

The following method of installation is recommended by Marshalls and it is based on conventional UK best practice construction techniques, installation and testing trials and if applicable, installation shall comply with the recommendations in the Construction Phase Plan as defined by the 'Construction (Design and Management) Regulations 2015'.

Should your application differ from standard installation guidance you should consult with your Engineer or Marshalls Technical Advice Team.

Excavation

Excavation is not normally required for Bridge deck units on new installations but the following advice should be taken on refurbishment or retro-fit projects.

Sufficient material should be excavated to accommodate the channel unit, levelling bed, and working areas. Place excavation support as required depending on channel size, native ground conditions and method of working. Any 'soft spots', poorly compacted formation or defective bridge deck structure should be made good.

Setting Out

Setting out pins should be accurately located in accordance with the contract drawings, with a string line level with the top and rear of the channel units. Pins should be located to avoid having to lift the channel units over the string line. The slots should be set so as to follow the longfall and crossfall of the final surface as required by the contract drawings.

Alternatively, a theodolite or similar electronic surveying equipment may be used. It is not recommended that line and level is set using internal channel faces.

Line and level should be checked at regular intervals and channels adjusted as required

Outfalls

Outfalls are preformed units and are laid in the same manner as standard kerb channel units. 125, 175 & 250 channels are supplied with a 150 mm nominal bore (NB) bottom outlet and 350 & 450 channels are supplied with a 225 mm NB bottom outlet as standard. Rear, end and other NB outlets and be supplied on request.

Outfalls should be laid first and positioned as per the contract drawings or at the appropriate orifice on the bridge structure.

Construction

Outfalls do not require bedding or haunching to achieve an E600 load class but should be bedded on a nominal 10 to 20 mm bed to allow for adjustment to line and level.

Bedding mortar shall be a 2 part epoxy type mortar such as Marshalls M-Bond or mortar designation (i) complying with class M12 in accordance with BS EN 998-2.

Bedding concrete shall be of a minimum compressive strength designation ST1 in normal kerb applications.

Cementitious based bedding material shall contain a waterproofing additive.

Care should be taken to not damage any waterproof membrane system during installation.

Channel Units
Channel units do not require bedding or haunching to achieve an E600 load class but should be bedded on a nominal 10 to 20 mm bed to allow for adjustment to line and level.

Bedding mortar shall be a 2 part epoxy type mortar such as Marshalls M-Bond or mortar designation (i) complying with class M12 in accordance with BS EN 998-2.

Bedding concrete shall be of a minimum compressive strength designation ST1 in normal kerb applications.

Cementitious based bedding material shall contain a waterproofing additive.

Care should be taken to not damage any waterproof membrane system during installation.

Starting at the outfall chamber, i.e. working uphill, Marshalls recommend the following installation technique:-

Place the bedding to the correct line and level allowing the channel units to be placed on to the upper surface.

Units should be placed using mechanical lifting apparatus such as a scissor or magnetic lifter and final adjustment can be made using a rubber mallet or similar tool.

To maintain water tightness, channels shall be sealed at each joint using Marshall's M-Flex. A nominal 10 mm bead shall be applied to one vertical face and placed adjacent to the next unit and pushed 'home' to complete the joint.

Where a channel run does not terminate at an outfall, the unit shall be sealed using the Bridge Beany End Cap which should be securely placed against the vertical end of the unit and sealed with Marshalls M-Flex.

Marshalls recommend the use of full channels and do not recommend cutting or alteration of channels and designs are be produced to accommodate full lengths with ancillaries.

Line and level should be check as required during installation.

Bridge Expansion Joints and Sealing of Gaps
Expansion joint units are installed in the same manner as outfall units.

Type 1 Expansion Joints
Install and fix the downstream and upstream unit either side of the joint. The end spigots should be facing each other and pointing at the joint.

Place the jubilee clips loosely over the ends of the flexible pipe and place each end of the pipe over a spigot stub. Trim or cut the connecting pipe to suit. Tighten the jubilee clip to ensure a good fit and ensure water tightness.

Place any waterproofing or joint material as required by the specification or expansion joint supplier ensuring that the pipe retains the ability to expand and contract.

Place the cover plate between the two expansion joint units in the recess area ensuring the slots in the plate align with the fixing points on the units. Secure the 'fixed' end of the plate with M10 bolts and lightly tighten the 'sliding' end of the plate. The plate should be sufficiently secure to avoid vertical or lateral movement by hand pressure but allow free movement under expansion and contraction of the bridge deck sections.

Type 5 Expansion Joints
Install and fix the downstream expansion joint unit.

Attach the rectangular bridging channel to the side of the upstream unit using M10 bolts.

Insert the free end of the rectangular channel on the upstream unit in to the downstream expansion joint unit and install and fix in place the upstream expansion joint unit. The rectangular bridging channel does not require any other method of fixing or securing.

Place any waterproofing or joint material as required by the specification or expansion joint supplier ensuring that the bridging channel retains the ability to 'slip' and move freely and to expand and contract without damage.

Place the cover plate between the two expansion joint units in the recess area ensuring the slots in the plate align with the fixing points on the units.

Construction

Secure the fixed end of the plate with M10 bolts and lightly tighten the 'sliding' end of the plate. The plate should be sufficiently secure to avoid vertical or lateral movement by hand pressure but allow free movement under expansion and contraction of the bridge deck sections.

Site Storage, Handling and Placing

Marshalls recommend that units are stored in their original packaging until required to help reduce the risk of damage and to help with movement around site.

It is the site contractor's responsibility to ensure that units are stored on solid level ground and in a clean and protected area away from potential site damage. Care should be taken when removing units from secure packaging and pallets and units should not be stacked more than one pallet high. Units shall not be stored close to sources of heat such as engine exhaust outlets or hot works areas such as welding and cutting.

Should the units be put in long term storage Marshalls recommend that the units are covered to protect mating surfaces and slot opening from dirt and debris until such time that they are required. Additional protection may be required to prevent accidental damage.

Marshalls advise that all drainage components should be installed by a safe method of working. The use of mechanical handling equipment such as magnetic or scissor lifters have proven to be of benefit and will eliminate manual handling. Marshall's do not recommend manual handling.

Commissioning

Whilst the channel units are strong enough to receive traffic as soon as installed, Marshalls do not recommend you load or traffic over the channel until the unit has been surrounded or 'bound' by the finished pavement to avoid the units been moved out of alignment and/or breaking the waterproof seal between units.

Particular care should be taken during the construction phase when conditions may be more onerous due to construction plant and machinery movements and/or incomplete construction.

As soon as then channel units are fully installed and the outfalls are connected, the Bridge deck units can be used straight away.

Where necessary, the drainage channel inlets shall be protected against the ingress of construction material during subsequent construction operations by covering with waterproof cloth tape.

Notes

1. Marshalls recommended that channels are not cut to length on site, drainage runs will be calculated and supplied to multiples of whole units with ancillaries.

2. Outfalls, access chambers and silt traps shall be constructed in accordance with the Standard Details. Access chambers should be located at no more than 50m centres in long runs.

3. Access chamber covers are secured with M10 retaining screws.

4. All necessary Personal Protective Equipment (PPE) should be worn on site, as site rules stipulate. Goggles, ear defenders, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

5. COSHH - All relevant health and safety information, including COSHH data sheets, can be obtained from Marshalls Advisory Services, or the Marshalls Design Team on 0845 3020606.

Max-E Channel

Max-E Channel, Bedford

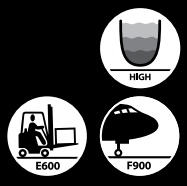
Conservation Silver Grey

Standard Grey & Reinforced Standard Grey

Cast Iron

Max-E Channel

Concrete Drainage System



Max-E Channel is a high capacity system that complements the Beany range to ensure continuity between kerb and top units. The range of different concrete top units offered in a variety of colours and finishes complements any aesthetic. A cast iron top option completes the range and provides a solution for the highest loading classification. Max-E Channel is fully compatible with the full range of Beany junctions, outfalls and other ancillary units.

NBSPlus

Q10 170

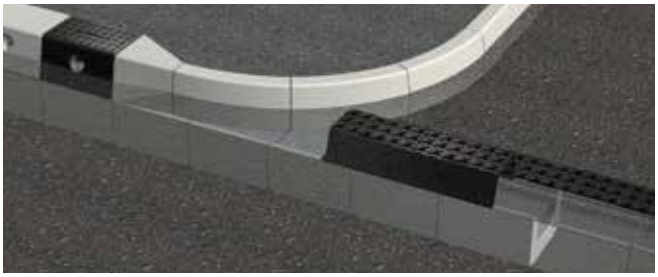
Max-E Channel

Concrete Drainage System

- Max-E-Channel utilises the same base units as the Beany Block system combining with Max-E-Channel top units to form a linear drainage system which is laid level with the pavement surface. This high flow capacity system offers the choice of top units of various materials and load classifications.
- Max-E-Channel top units come in the following materials:
  – Hydraulically pressed concrete
  – Hydraulically pressed reinforced concrete
  – Fabricated galvanised steel
  – Cast iron
- The appropriate top unit is then bedded onto any of the 4 Beany base units being 205mm, 295mm, 365mm and 630mm
- This forms a robust linear drainage system suitable for draining large paved surfaces varying from pedestrian precincts to heavy duty industrial areas and highways.

Versatile

- The various Top Units are easily interchangeable, ensuring easy transition from one type to another where performance requirements vary within the same scheme.
- As expected Max-E-Channel integrates with the Beany Block Top Units creating a unique system capable of providing continuous drainage of the carriageway at road and vehicular crossings.



Beany to Max-E-Channel (cast iron with holes)

- The introduction of the inlaid Top Units offers all the advantages of this high capacity system yet creates a discrete surface to be incorporated into the most aesthetic of landscape schemes.
- Concrete Top Units are available as standard in a natural pimple finish although other aesthetically pleasing units are also available.

Load Classifications

- The Max-E-Channel System is strength tested in accordance with BS EN 1433:2002 to the following classes:

Reinforced Concrete	E600
Cast Iron	F900

Access Cover and Frame

A heavy duty cover frame is available for use with Outfalls and Silt Traps to allow for inspection and maintenance.

Max-E-Channel is a high capacity system able to store storm water. Where limitations are placed on outfall capacities, Max-E-Channel can help eliminate the need for storage reservoirs or balancing ponds

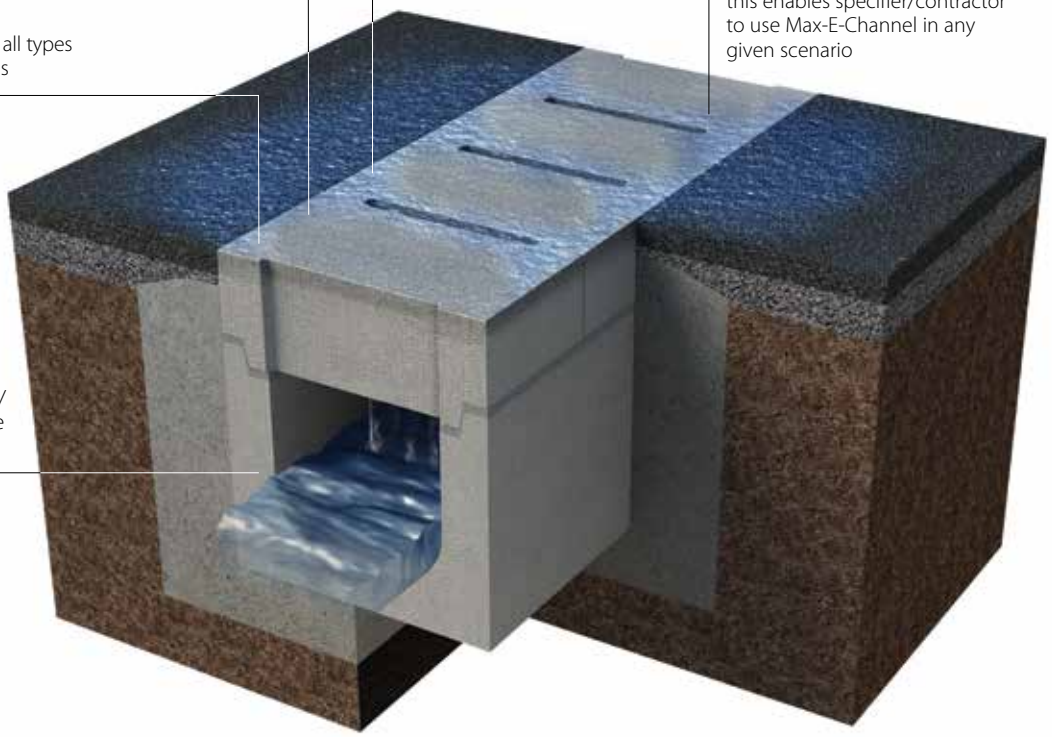
Max-E-Channel System is proven on all types of highway and hard landscape areas

The high inherent strength and durability of the system can:

- Allow complete compaction of surfacing materials adjacent to the channel during construction
- Withstand de-icing salts and freeze/thaw effects reducing maintenance and increasing service life

As Max-E-Channel is compatible with Beany Block, it can be used where continuous drainage of the carriageway is required at vehicular or road crossings

Range of Top Units can be selected in all loading classes, this enables specifier/contractor to use Max-E-Channel in any given scenario



Special Finishes

Conservation and Granite Max-E-Channel

Max-E Channel units are available in the majority of our granite paving ranges or Marshalls concrete Silver-grey to complement areas of high architectural, historical and scenic value. This product complements Marshalls Silver Grey Conservation and granite Paving Kerb and Edging along with Mistral Concrete Block Paving and Conservation Setts.

Textured Max-E-Channel

An exposed aggregate textured finish on the visible faces of the top units is available providing high aesthetic qualities where the granite aggregate finish is not required.

Components

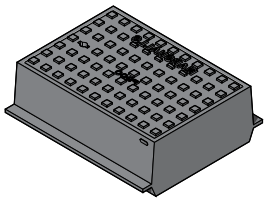
TOP COMPONENTS

Reinforced Concrete E600

- 250mm long hydraulically pressed reinforced concrete.
- Standard natural pimple faced concrete.
- Load classification E600.

Cast Iron F900

- 500mm long cast iron units.
- Ideal for locations subject to fast moving traffic.
- Load classification F900.



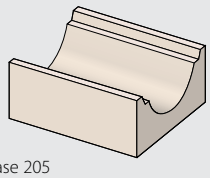
Max-E-Channel Access Cover

- Cast Iron Access Covers and Frames are available for use at outfalls, silt traps and access points.
- A full depth unit compatible with all top units.
- End hinged for ease of access and security.
- Large access opening for the easy emptying of silt traps and outfall sumps.
- Refer to Marshalls Drainage Design Guide for design advice and detailing.
- Load classification F900.

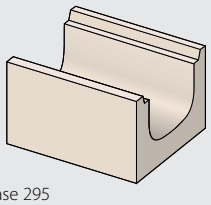
BASE COMPONENTS

All Base Units, Ancillary Items and Transition Units are 500mm long

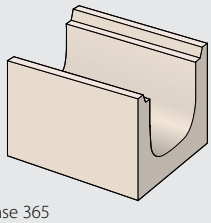
Base Units



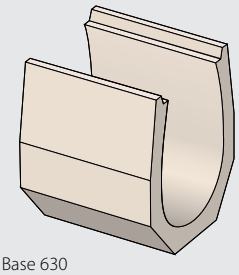
Base 205



Base 295

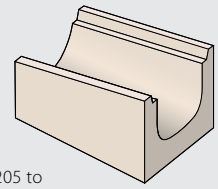


Base 365

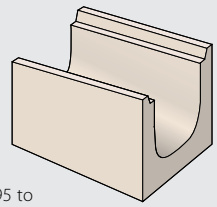


Base 630

Transition Units

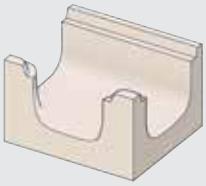


205 to
295 Transition

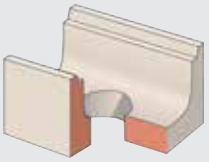


295 to
365 Transition

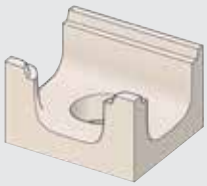
Ancillary Items



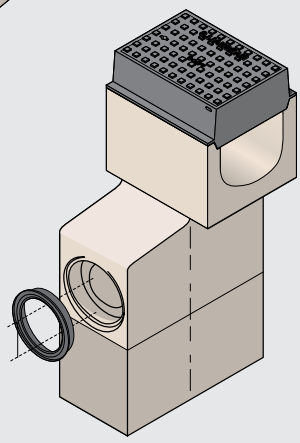
Junction
For base 205 & 295



Outfall (shown sectioned for illustrative purposes)
For bases 205, 295 and 365



Junction/Outfall
For bases 205 and 295

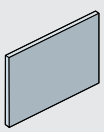


Gully Outfall

A trapped outfall is available to suit either 150mm or 225mm diameter outfall pipe.
Note: Gully Outfall does not include base outfall or access cover and frame.

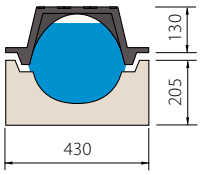
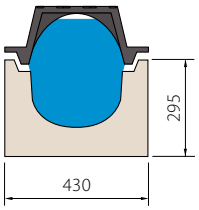
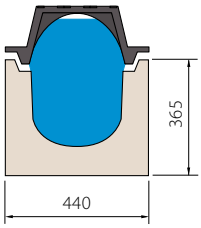
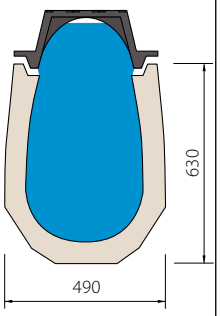
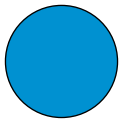
Base End Caps

Base End Caps are available for 205, 295 and 365 base units. The galvanised steel plates act as permanent formwork to a concrete surround. This is an optional detail to the use of engineering bricks, see the Drainage Design Guide.

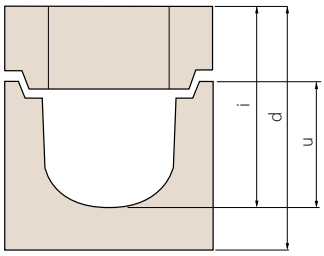


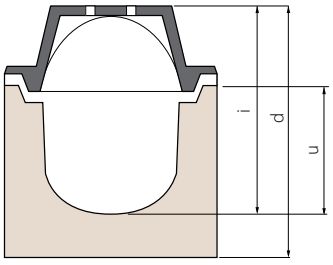
Hydraulic Data

FLOW CAPACITY

Max-E-Channel Cast Iron Top with 205 Base Unit	Max-E-Channel Cast Iron Top with 295 Base Unit	Max-E-Channel Cast Iron Top with 365 Base Unit	Max-E-Channel Cast Iron Top with 630 Base Unit
			
			
Equivalent Pipe Diameter (mm) 225	Equivalent Pipe Diameter (mm) 300	Equivalent Pipe Diameter (mm) 350	Equivalent Pipe Diameter (mm) 475

MAX- E CHANNEL (Concrete or Cast Iron Gratings)





ref.	d	i	u
Base 205	350	280	135
Base 295	440	350	205
Base 365	510	420	275
Base 630	775	700	555

All dimensions measured from grating surface, pavement should be 5mm above this level.

Hydraulic Data

The Max-E-Channel hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using spatially variable flow design principles.

Max-E-Channel With Cast Iron Top Units

Base 205

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	18	0.45	21	0.53	23	0.58	24	0.60	26	0.65	29	0.73	34	0.85	42	1.05
50	17	0.43	21	0.53	24	0.60	25	0.63	27	0.68	32	0.80	37	0.93	45	1.13
75	15	0.38	20	0.50	24	0.60	26	0.65	29	0.73	34	0.85	39	0.98	47	1.18
100	14	0.35	20	0.50	24	0.60	26	0.65	30	0.75	37	0.93	42	1.05	50	1.25
125	13	0.33	19	0.48	24	0.60	27	0.68	31	0.78	39	0.98	44	1.10	52	1.30
150	12	0.30	19	0.48	25	0.63	28	0.70	32	0.80	42	1.05	47	1.18	55	1.38
175	10	0.25	18	0.45	25	0.63	28	0.70	33	0.83	44	1.10	49	1.23	57	1.43
200	9	0.23	18	0.45	25	0.63	29	0.73	35	0.85	47	1.18	52	1.30	60	1.50

Base 295

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	32	0.50	38	0.59	42	0.66	44	0.69	46	0.72	52	0.81	61	0.95	75	1.17
50	31	0.48	37	0.58	42	0.66	45	0.70	48	0.75	55	0.86	64	1.00	78	1.22
75	30	0.47	36	0.56	43	0.67	46	0.72	50	0.78	58	0.91	67	1.05	81	1.27
100	29	0.45	36	0.56	43	0.67	46	0.72	52	0.81	62	0.97	71	1.11	85	1.33
125	27	0.42	35	0.55	43	0.67	47	0.73	54	0.84	66	1.03	74	1.16	88	1.38
150	25	0.39	35	0.55	44	0.69	48	0.75	55	0.86	69	1.08	77	1.20	92	1.44
175	23	0.36	34	0.53	44	0.69	49	0.77	57	0.89	72	1.13	80	1.25	94	1.47
200	21	0.33	33	0.52	44	0.69	50	0.78	58	0.91	76	1.19	84	1.31	98	1.53
225	19	0.30	33	0.52	45	0.70	51	0.80	59	0.92	78	1.22	89	1.39	101	1.58
250	17	0.27	32	0.50	45	0.70	51	0.80	61	0.95	82	1.28	91	1.42	105	1.64
275	16	0.25	31	0.48	45	0.70	52	0.81	63	0.98	85	1.33	94	1.47	109	1.70

Base 365

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	46	0.55	54	0.64	59	0.70	61	0.73	65	0.77	72	0.86	84	1.00	104	1.24
50	44	0.52	53	0.63	59	0.70	62	0.74	67	0.80	76	0.90	88	1.05	108	1.29
75	42	0.50	52	0.62	60	0.71	63	0.75	69	0.82	80	0.95	92	1.10	112	1.33
100	40	0.48	51	0.61	60	0.71	64	0.76	70	0.83	84	1.00	95	1.13	116	1.38
125	39	0.46	51	0.61	60	0.71	65	0.77	72	0.86	88	1.05	99	1.18	120	1.43
150	37	0.44	50	0.60	61	0.73	66	0.79	74	0.88	92	1.10	103	1.23	124	1.48
175	35	0.42	49	0.58	61	0.73	67	0.80	76	0.90	94	1.12	107	1.27	127	1.51
200	33	0.39	49	0.58	62	0.74	68	0.81	78	0.93	98	1.17	110	1.31	131	1.56
225	31	0.37	48	0.57	62	0.74	69	0.82	80	0.95	102	1.21	114	1.36	135	1.61
250	29	0.35	47	0.56	62	0.74	70	0.83	81	0.96	108	1.29	118	1.40	138	1.64
275	27	0.32	46	0.55	63	0.75	71	0.85	83	0.99	110	1.31	122	1.45	142	1.69
300	25	0.30	45	0.54	63	0.75	72	0.86	85	1.01	114	1.36	126	1.50	146	1.74
325	24	0.29	45	0.54	63	0.75	73	0.87	87	1.04	118	1.40	130	1.55	150	1.79

Base 630

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	122	0.67	142	0.78	156	0.85	162	0.89	172	0.94	191	1.04	224	1.22	277	1.51
100	116	0.63	140	0.77	157	0.86	165	0.90	177	0.97	202	1.10	235	1.28	288	1.57
150	110	0.60	138	0.75	158	0.86	168	0.92	182	0.99	213	1.16	246	1.34	299	1.63
200	105	0.57	136	0.74	159	0.87	171	0.93	188	1.03	224	1.22	257	1.40	310	1.69
250	100	0.55	133	0.73	160	0.87	173	0.95	194	1.06	234	1.28	267	1.46	321	1.75
300	95	0.52	130	0.71	162	0.89	176	0.96	199	1.09	245	1.34	278	1.52	332	1.81
350	90	0.49	128	0.70	163	0.89	179	0.98	205	1.12	256	1.40	289	1.58	343	1.87
400	84	0.46	127	0.69	164	0.90	182	0.99	210	1.15	267	1.46	300	1.64	354	1.93
450	78	0.43	125	0.68	165	0.90	184	1.01	215	1.17	278	1.52	311	1.70	365	1.99
500	72	0.39	123	0.67	166	0.91	187	1.02	220	1.20	289	1.58	322	1.76	376	2.05
550	67	0.37	120	0.66	167	0.91	190	1.04	226	1.24	300	1.64	333	1.82	387	2.11
600	62	0.34	118	0.64	168	0.92	193	1.05	231	1.26	311	1.70	344	1.88	397	2.17

Hydraulic Data

Max-E-Channel With Concrete Top Units

Base 205

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	9	0.38	11	0.46	12	0.50	13	0.54	14	0.58	17	0.71	19	0.79	24	1.00
50	7	0.29	10	0.42	13	0.54	14	0.58	16	0.67	19	0.79	22	0.92	26	1.08
75	6	0.25	10	0.42	13	0.54	14	0.58	17	0.71	22	0.92	24	1.00	29	1.21
100	5	0.21	9	0.38	13	0.54	15	0.63	18	0.75	24	1.00	27	1.13	31	1.29

Base 295

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	22	0.46	26	0.54	29	0.60	31	0.65	33	0.69	37	0.77	44	0.92	54	1.13
50	20	0.42	26	0.54	30	0.63	32	0.67	35	0.73	41	0.85	47	0.98	57	1.19
75	18	0.38	25	0.52	30	0.63	33	0.69	37	0.77	45	0.94	51	1.06	61	1.27
100	17	0.35	24	0.50	31	0.65	34	0.71	38	0.79	48	1.00	55	1.15	65	1.35
125	15	0.31	23	0.48	31	0.65	35	0.73	40	0.83	52	1.08	58	1.21	68	1.42
150	13	0.27	23	0.48	31	0.65	35	0.73	42	0.88	56	1.17	62	1.29	72	1.50
175	11	0.23	22	0.46	32	0.67	36	0.75	44	0.92	59	1.23	66	1.38	76	1.58

Base 365

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	35	0.51	41	0.60	46	0.68	47	0.69	50	0.74	56	0.82	66	0.97	81	1.19
50	33	0.49	40	0.59	46	0.68	48	0.71	52	0.76	60	0.88	70	1.03	85	1.25
75	31	0.46	39	0.57	46	0.68	49	0.72	54	0.79	64	0.94	74	1.09	89	1.31
100	29	0.43	39	0.57	47	0.69	50	0.74	56	0.82	68	1.00	78	1.15	93	1.37
125	27	0.40	38	0.56	47	0.69	51	0.75	58	0.85	73	1.07	82	1.21	98	1.44
150	25	0.37	37	0.54	47	0.69	52	0.76	60	0.88	77	1.13	86	1.26	102	1.50
175	23	0.34	36	0.53	48	0.71	53	0.78	62	0.91	81	1.19	90	1.32	106	1.56
200	21	0.31	35	0.51	48	0.71	54	0.79	66	0.97	85	1.25	94	1.38	108	1.59
225	19	0.28	35	0.51	49	0.72	55	0.81	67	0.99	89	1.31	98	1.44	114	1.68

Base 630

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length (m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
50	108	0.65	126	0.75	139	0.83	145	0.87	154	0.92	172	1.03	201	1.20	249	1.49
100	102	0.61	124	0.74	141	0.84	148	0.89	160	0.96	184	1.10	213	1.28	261	1.56
150	96	0.57	123	0.74	142	0.85	151	0.90	166	0.99	195	1.17	224	1.34	272	1.63
200	90	0.54	120	0.72	143	0.86	154	0.92	171	1.02	207	1.24	236	1.41	284	1.70
250	83	0.50	117	0.70	144	0.86	157	0.94	177	1.06	218	1.31	248	1.49	295	1.77
300	79	0.47	115	0.69	145	0.87	160	0.96	183	1.10	230	1.38	259	1.55	307	1.84
350	73	0.44	113	0.68	146	0.87	163	0.98	188	1.13	241	1.44	271	1.62	318	1.90
400	67	0.40	110	0.66	148	0.89	166	0.99	194	1.16	253	1.52	282	1.69	330	1.98
450	62	0.37	108	0.65	149	0.89	168	1.01	200	1.20	265	1.59	294	1.76	341	2.04
500	56	0.34	106	0.63	150	0.90	171	1.02	205	1.23	276	1.65	305	1.83	353	2.11

Theoretical Outfall Capacities

Outfall Type	Outlet Pipe Diameter (mm)	l/s	m/s
Max-E-Channel Outfall with Base 205	150	36	3.32
Max-E-Channel Outfall with Base 295	150	38	3.52
Max-E-Channel Outfall with Base 365	150	40	3.67
Max-E-Channel Outfall with Base 205	225	82	3.40
Max-E-Channel Outfall with Base 295	225	87	3.60
Max-E-Channel Outfall with Base 365	225	91	3.75

Max-E Channel Component Codes

A Top Units

Top Units	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Item Code
Cast Iron Grate	F900	500	430	165	62	DR975020
Standard Grey Reinforced Concrete Top	E600	250	430	170	39	**DR975810**
Conservation Reinforced Top	E600	250	430	170	36	DR975830

B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 205	500	430	280	205	135	70	**DR720021**
Channel 295	500	430	280	295	205	85	**DR720010**
Channel 365	500	440	280	365	275	96	**DR720030**
Channel 630	500	440/490	280/360	630	555	110	**DR720045**

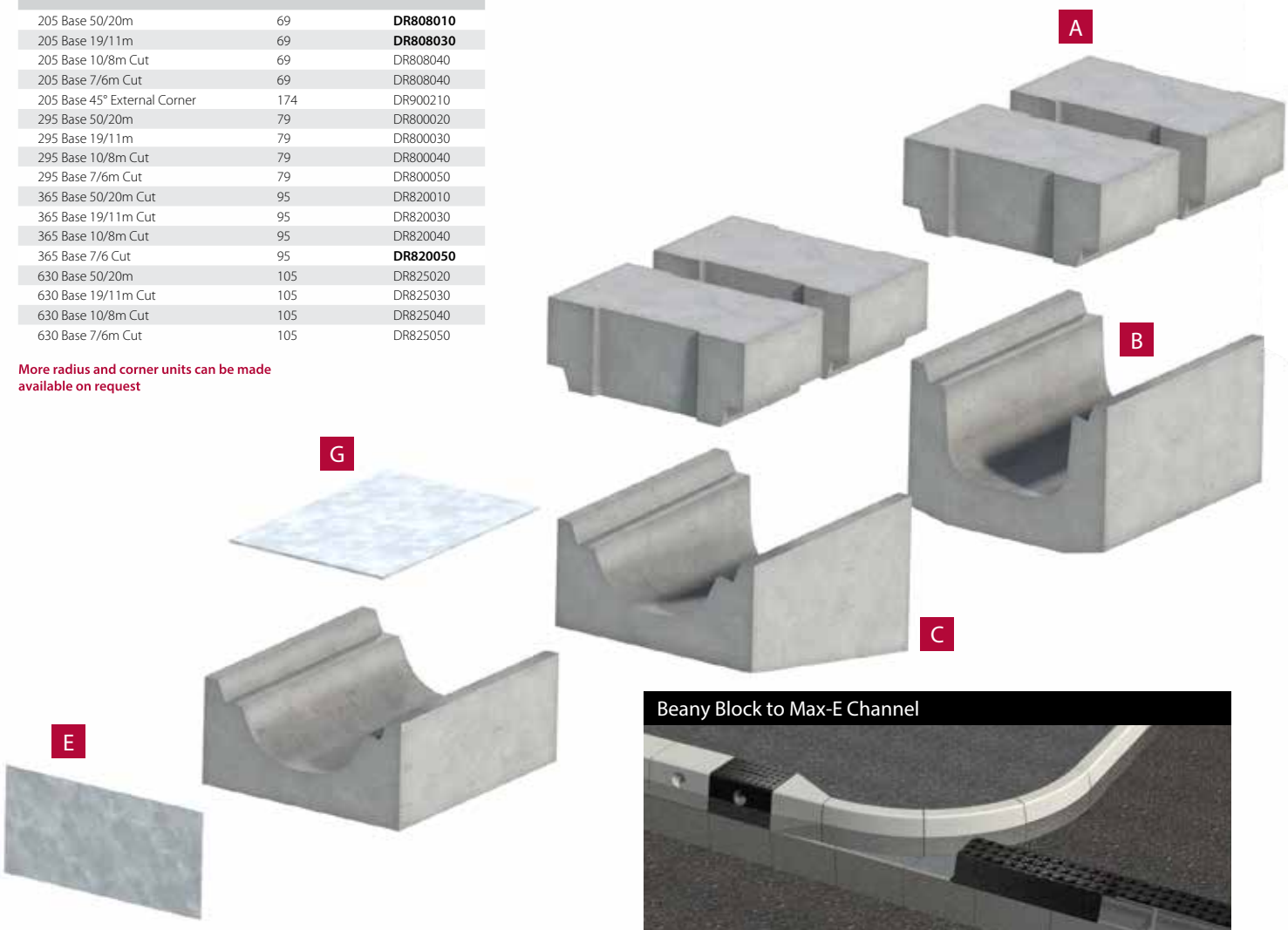
C Transition Channels

Transition Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/ Downstream	Invert Depth (mm) Upsteam/ Downstream	Unit Weight (kg)	Item Code
205 - 295	500	430	280	205/295	135/205	100	DR870010
295 - 365	500	430	280	295/365	205/275	87	DR870021

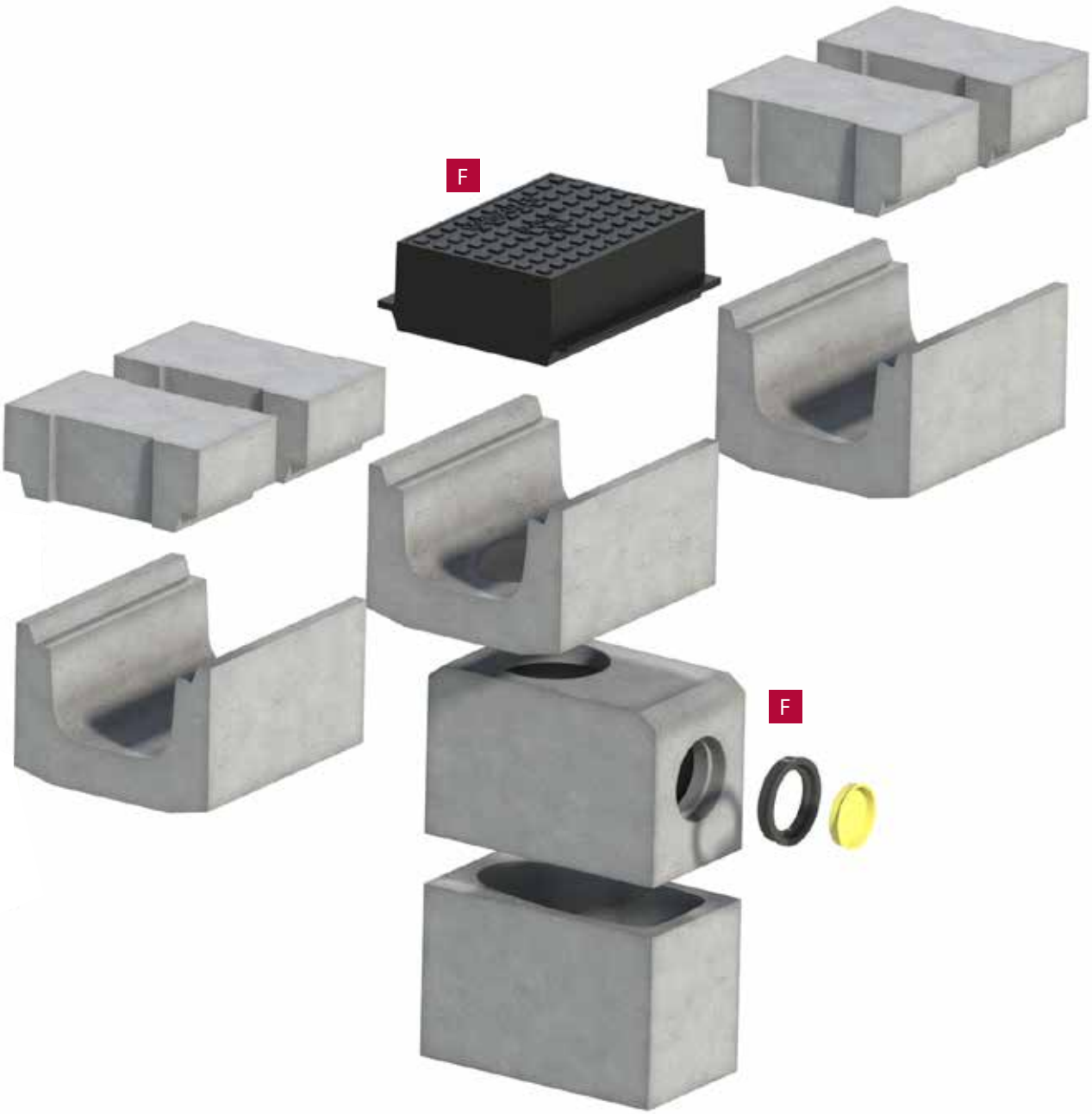
D Radial Channels

Radial Base Channels	Unit Weight (kg)	Item Code
205 Base 50/20m	69	**DR808010**
205 Base 19/11m	69	**DR808030**
205 Base 10/8m Cut	69	DR808040
205 Base 7/6m Cut	69	DR808040
205 Base 45° External Corner	174	DR900210
295 Base 50/20m	79	DR800020
295 Base 19/11m	79	DR800030
295 Base 10/8m Cut	79	DR800040
295 Base 7/6m Cut	79	DR800050
365 Base 50/20m Cut	95	DR820010
365 Base 19/11m Cut	95	DR820030
365 Base 10/8m Cut	95	DR820040
365 Base 7/6 Cut	95	**DR820050**
630 Base 50/20m	105	DR825020
630 Base 19/11m Cut	105	DR825030
630 Base 10/8m Cut	105	DR825040
630 Base 7/6m Cut	105	DR825050

More radius and corner units can be made available on request



Beany Block to Max-E Channel



E End Caps

End Caps	Unit Weight (kg)	Item Code
205 Base End Cap	2.2	**DR7200250**
295 Base End Cap	3	**DR7200150**
365 Base End Cap	3.8	**DR7200350**

F Outfalls & Access Covers

Outfalls & Access Covers	Unit Weight (kg)	Item Code
Max-E Full Depth Access Cover & Frame	85	**DR9800150**
Gully Outfall 225	242	**DR4604060**
Gully Outfall 150	277	**DR4604010**

G Cover Plates

Cover Plates	Unit Weight (kg)	Item Code
Cover Plate Standard	17	**DR910005**
Cover Plate Cut 50/11m	16	DR910010

Max-E-Channel with reference numbers indicated in **bold** black are available ex-stock. Max-E-Channel with reference numbers indicated in light are manufactured to order. Contact our sales office to discuss your requirements.

Beany Block to Max-E Channel

Beany can be used with Max-E Channel where the drainage run continues but the kerb line finishes. A smooth channel invert ensures undisturbed flow

Standard Details

Drawing 1 of 4

*For values of T & H, refer to Beany Block details.

Cross Section

Base Unit & Reinforced Concrete Top Unit (With Flexible Or Concrete Pavement Loading E600)

Cross Section

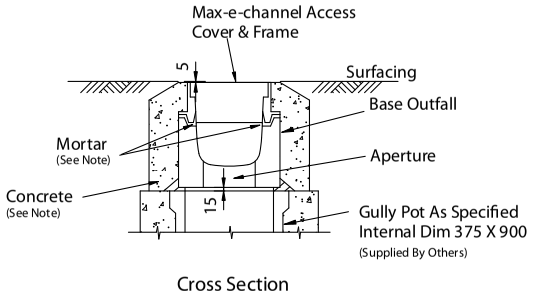
Base Unit & Concrete Top Unit (With Flexible Or Block Paved Surfacing Loading C250)

Cross Section

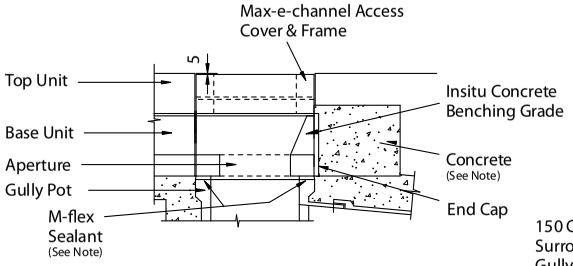
Base 630 & Cast Iron Top Unit (Loading To D400)

Cross Section

E600 & F900 Applications For Base 630 only

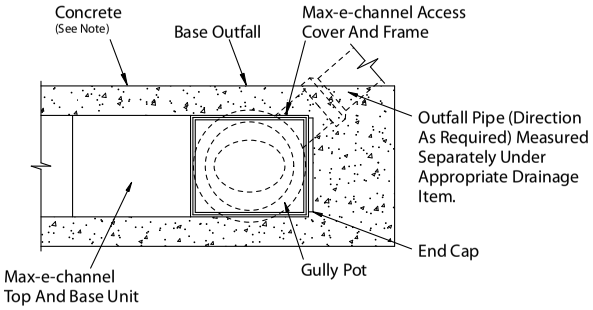


Cross Section

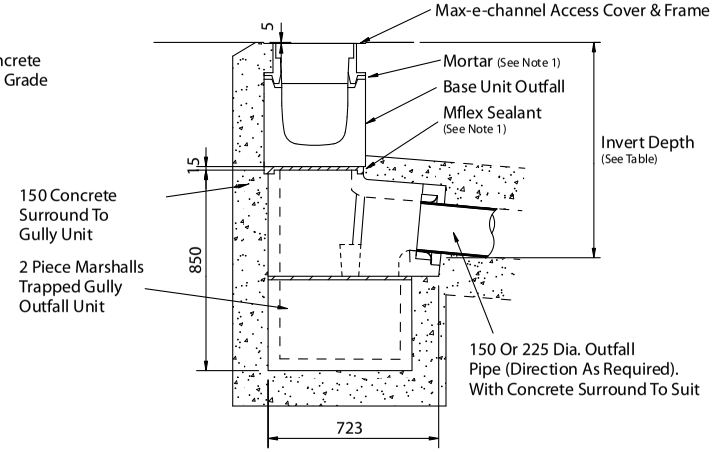


Longitudinal Section

Outfall Using Gully Pot



Plan



Cross Section

Outfall Using Marshalls Gully Outfall

Outfall Pipe Invert Depth From Carriageway Level (Mm)		
Beany Base	150 Ø Outfall	225 Ø Outfall
205	701	738
295	791	828
365	861	898

Standard Details

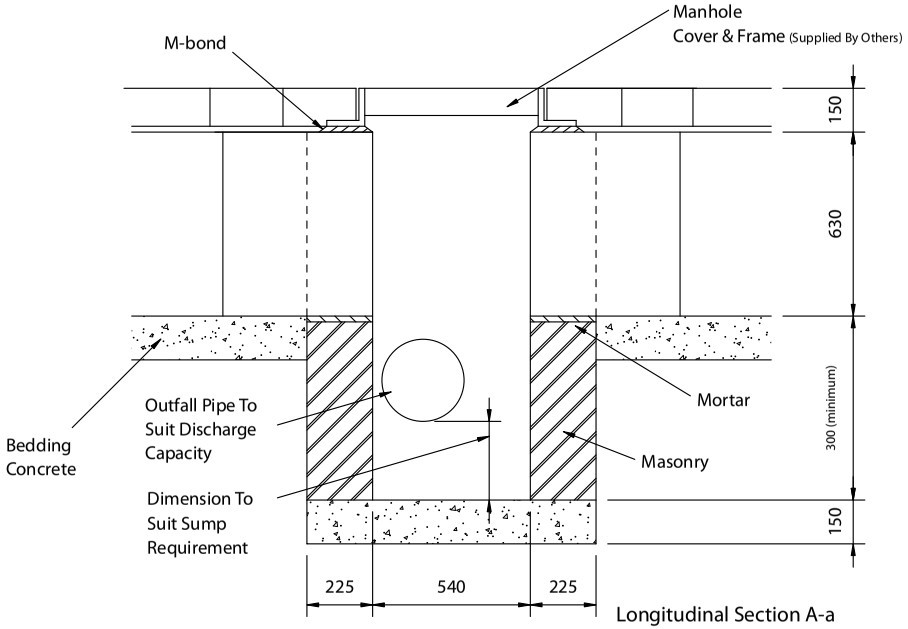
Drawing 3 of 4

Outfall Direct To 225 Dia. Pipe

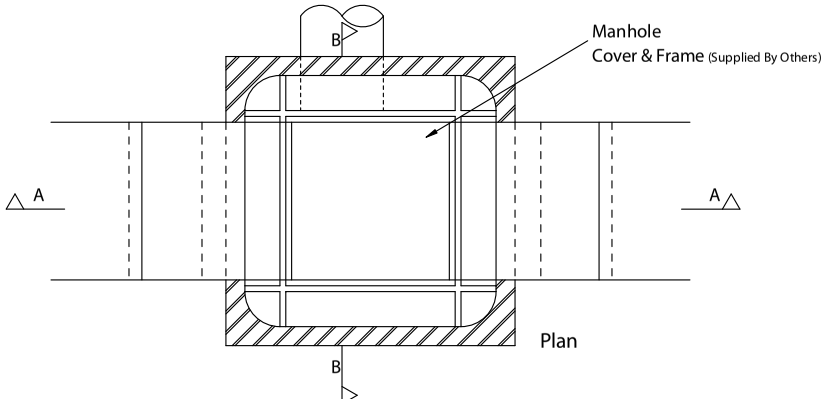
'T' Junction

Silt Trap

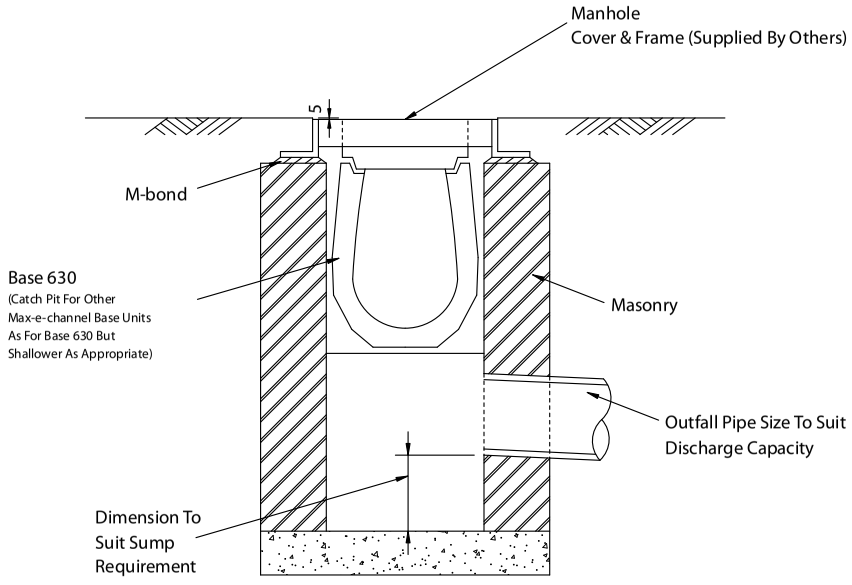
Access Cover



Longitudinal Section A-a



Plan



Cross Section B-b

Max-E-Channel Catchpit/outfall With Base 630

Standard Details

Notes For Max-E-Channel

Drawings 1 to 4

1. Mortars shall be;

i) A Mortar class 12 cement mortar to BS EN 998-2 for bedding of the Concrete Top Units for applications up to Load Classification D400 to BS EN 1433

ii) Marshalls' M-Bond epoxy mortar for bedding of Cast Iron Top Units and reinforced concrete Top Units for Load Classification E600 and F900

iii) Marshalls' M-Flex for bedding Base Block Outfalls onto the Beany Trapped Gully Unit

iv) Marshalls' M-Flex for bedding the sections of the Marshalls' Trapped Gully Unit sections

2. Concrete bed, haunch and surround shall be;

i) A C25/30 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to Load Classification F900 to BS EN 1433

ii) Reinforcement details for Base 630 E600 and F900 applications only are as indicated

iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Beany Trapped Gully, Silt Traps, Catch Pits and outfall details

iv) The specification for carrier pipe concrete surround is by others

3. Marshalls' vertical joint sealant, M-Seal, shall be applied to all Base Blocks.

4. For Base 630 applications, all Outfalls, Silt Traps and junctions should be formed by a brick Catch Pit structure;

i) The outfall pipe diameter, gradient, depth to invert, depth of trap shall be by others

ii) The internal dimensions of the catch pit shall be 540 wide x 1000 long for Base 630 applications

iii) Corbelled brickwork with a maximum of 22mm steps shall be used to support the Access Cover and Frames

5. Movement joint details that fully isolate the Max-E-Channel whilst maintaining restraint shall be provided adjacent to all concrete slabs, even when the slab is covered by other materials.

6. When used in conjunction with the Beany Block system, Max-E-Channel base units are the same as Beany Block Bases.

7. All dimensions are in millimetres.

Specification

Introduction

The following specification covers the complete Max-E-Channel system including ancillary fittings and is compatible with the Standard Detail sheets.

Where the Manual of Contract Documents for Highway Works is used, information for "Appendix 5/6: Linear Drainage Systems" is available on request.

Max-E-Channel

1. The linear drainage system shall be Max-E-Channel, manufactured in pre-cast concrete, with the exception of certain fitments of cast iron or galvanised steel as supplied by Marshalls, Halifax HX5 9HT in accordance with Standard Detail Sheets.

2. The linear drainage system shall consist of a two part system consisting of top units of plain concrete/reinforced concrete/ galvanised mild steel/cast iron* together with base units that are 205/295/365/630mm* deep. The overall width of the system is not less than 430mm.

3. All components of the Max-E-Channel system, shall comply with the British Standard BS EN1433, Load Classification as follows:

(i) Reinforced concrete top units to E600*

(ii) Cast iron top units to F900*

4. The system shall have a minimum of 11,200mm^2/m water inlet aperture area.

5. When installed, the minimum depth of construction above the top of the base unit to the drained area surface level shall be not less than 150mm.

6. The linear drainage system comprising straight top and base units, outfalls, silt traps, access covers, junctions, end caps and sealant shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.

Note: * delete as required

Construction

Introduction
Installation of the Max-E-Channel Linear Drainage System should be carried out in accordance with the Specification and Standard Detail Sheets. The following method of installation is recommended.

Excavation
Sufficient material should be excavated to accommodate Top and Base Units, concrete bedding and haunching, any 'soft spots' or poorly compacted formation should be made good.

Setting Out
Setting out pins should be accurately located, with a string line level with the top front corners of the Base Units. Pins can be located to the rear of the Units to avoid having to lift the Units over the string line.

Base Units
Starting at the Outfall, i.e. working uphill, the Units should be bedded on to a freshly mixed foundation of the appropriate grade and thickness of concrete (refer to Standard Detail Sheet.).

Concrete bed, haunch and surround shall be:

i) A C25/30 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to Load Classification F900 to BS EN 1433

ii) Reinforcement details for Base 630 application E600 and F900 ONLY are as indicated

iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Max-E-Channel Trapped Gullies, Silt Traps, Catch Pits and outfall details

iv) The specification for carrier pipe concrete surround is by others

Alternatively, the Units may be bedded on to a layer of cement mortar 10-40mm thick on a previously prepared concrete foundation.

Sufficient M-Seal bituminous mastic jointing compound should be trowelled on to one or both end faces so that the joint will be well sealed when the next Unit is tamped into position. Surplus sealant shall be removed from the inner surface of the Units as work proceeds.

18 litres of M-Seal should be sufficient for the following length of Max-E-Channel:

M-Seal Requirement	
Base Type	**Coverage (m/18l)**
205	90
295	70
365	55
630	35

Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter. Cutting of Base Junctions or Outfall Units is not recommended.

At the termination of Max-E-Channel runs not located at outfalls, the base units shall be closed using galvanised steel end caps as detailed in the Standard Detail Sheets.

Top Units
The string line should be set to the level of the top of the units.

Again, starting at the Outfall, the Units should be set directly onto a liberal quantity of stiff, cement mortar (or M Bond epoxy mortar where specified) to completely fill the whole of the joint. Cement mortar shall be Class 12 in accordance with BS EN 998-2. These should be tamped into position close to previously laid Units and the alignment checked. The levels should be checked using the string line and a spirit level. In addition, the general alignment should be checked from all directions as each unit is laid. Surplus mortar shall be removed from the units as work proceeds.

Top Units shall be laid with the top of the unit 5mm below the final pavement level.

The inside and outside of the joints between Base and Top Units should be pointed and cleaned out with a brush or rag as work proceeds.

Notes:

1. In order to obtain a 'good line', it is very important to lay the Top Units on the specified thickness of compacted mortar using the string line and Base Units as a guide. Too thin a layer of mortar will not allow sufficient sideways movement of the units to achieve an acceptable alignment.

2. It is not necessary for Top and Base Unit vertical joints to line up.

3. Where Max-E-Channel is laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the units and haunching adjacent to the slab joints and also longitudinal movement joints between the haunching and the slabs. Where necessary, Top Unit drainage apertures shall be protected against the ingress of material during concreting operations.

4. Outfalls, Silt Traps and Access Covers shall be constructed in accordance with the Standard Detail Sheet using the appropriate type of Base Unit. Units shall be bedded on sufficient M-Flex sealant over a gully pot, Outfall Unit or vertical pipe, to make a watertight joint. Where necessary in-situ concrete benching shall be shaped to the full depth of the Base unit. In Silt Traps, the pipe shall be bedded into mix ST4 concrete which shall be fully compacted to make a watertight seal.

5. In situ concrete haunching or surround should not be placed until the installed units have been inspected and approved by the Engineer. The haunching/surrounding should be carried out as one operation to complete lines of Top and Base Units in accordance with the Standard Detail Sheet.

6. Adjacent carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed. Base Units, Outfalls or Junctions not covered by fully bedded Top Units or covers and frames, shall be adequately supported against loadings imposed by construction traffic.

7. On completion of the works, the Max-E-Channel System shall be cleaned out by high pressure water jetting (100-150 bar at 200 l/min minimum) and left free from obstructions and all Outfalls and Silt Traps shall be emptied. Top Unit drainage apertures shall be covered by timber boards or other approved method, during jetting operations. The cleaning process shall be repeated where necessary after the completion of any remedial works.

8. Installation operations should be discontinued if weather conditions are such that the performance of the Max-E-Channel may be jeopardised.

   Installation should not be undertaken when the temperature is below 3°C on a falling thermometer and below 1°C on a rising thermometer.

9. All necessary Personal Protective Equipment (PPE) should be worn on site, as the site rules dictate. Goggles, ear protection, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

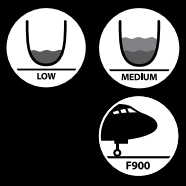
Traffic Drain

Traffic Drain, Bedford

Traffic Drain Cast Iron

Traffic Drain

Grate Drainage System



Traffic Drain is a medium capacity system that complements the Mini Beany range to provide continuity of flow between kerb and grate units. The robust concrete channel and strong cast iron grates are suitable to withstand fast moving vehicles and heavy loading highway application. Traffic Drain is a medium capacity system that complements the Mini Beany range to provide continuity of flow between kerb and grate units.

NBS Plus

Q10 170

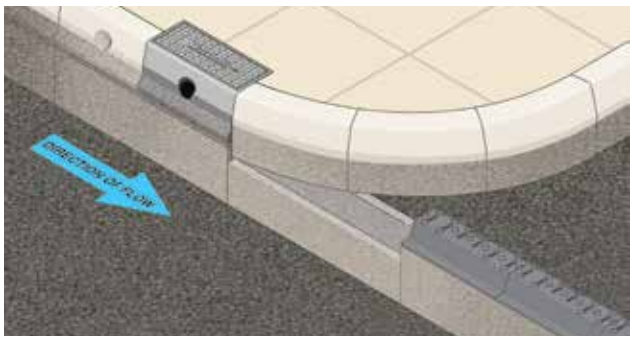
Traffic Drain

Grate Drainage System

- Traffic Drain utilises the same base units as the Mini Beany system combining with Traffic Drain top unit to form a linear drainage system which is laid level with the pavement surface.
- Traffic Drain top unit is manufactured from Cast iron
- The cast iron top unit is then bedded onto any of the 4 Mini Beany base units being 210mm, 260mm, 310mm and 360mm
- This forms a robust linear drainage system suitable for draining large paved surfaces varying from pedestrian precincts to heavy duty industrial areas and highways.

Versatile

- As expected Traffic Drain integrates with the Mini Beany Top Units creating a unique system capable of providing continuous drainage of the carriageway at road and vehicular crossings.



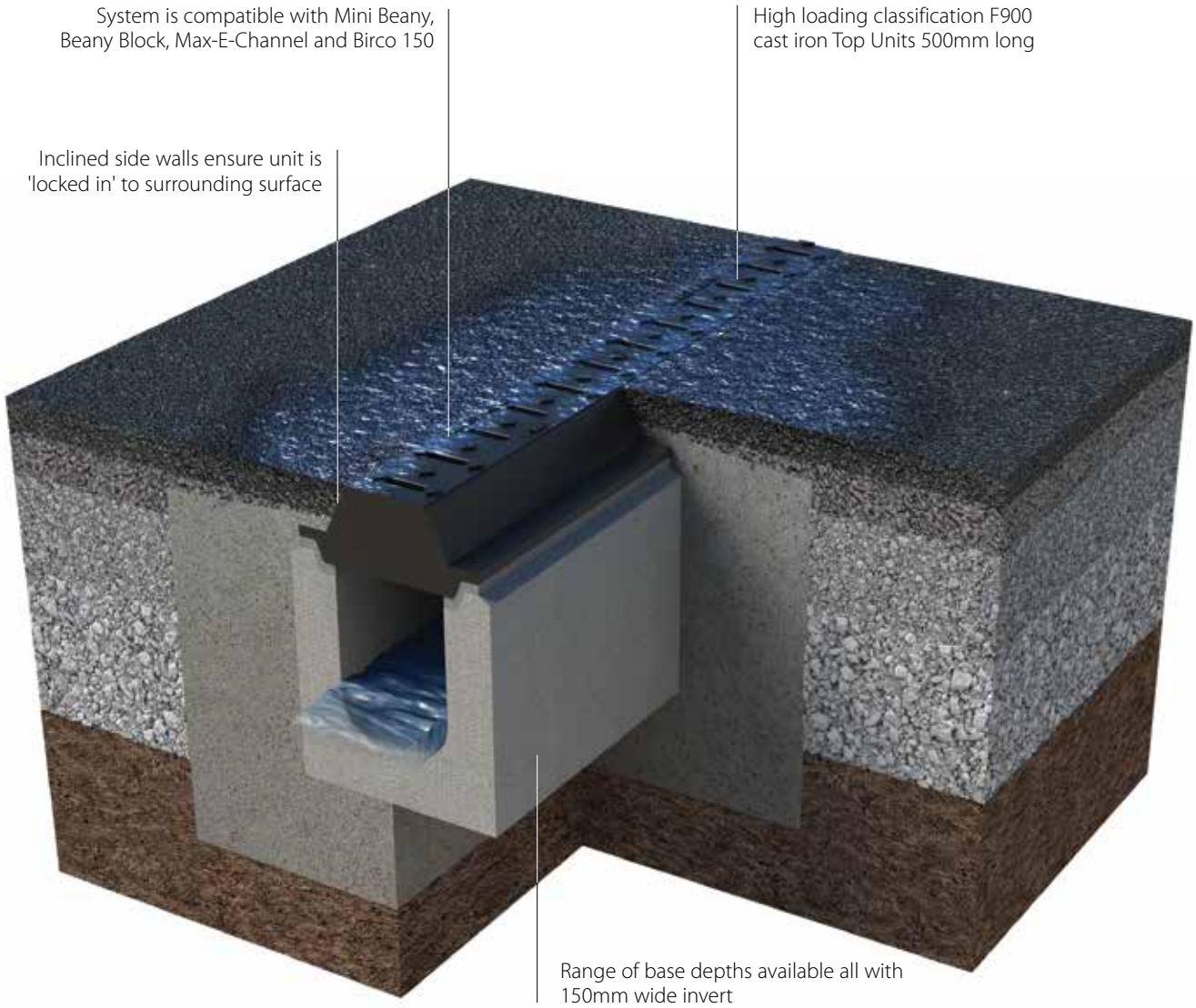
Mini Beany to Traffic Drain (cast iron with holes)

Load Classifications

- The Traffic Drain is strength tested in accordance with BS EN 1433:2002 to F900 Classification

Access Cover and Frame

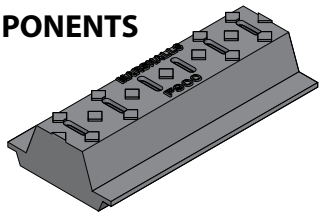
- A heavy duty cover frame is available for use with Outfalls and Silt Traps to allow for inspection and maintenance.



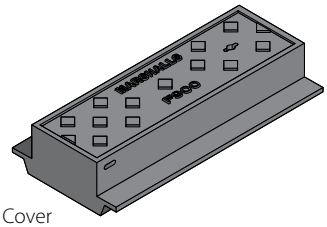
Components

TOP COMPONENTS

Top Units



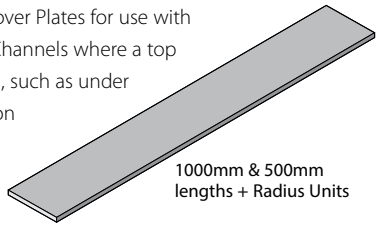
Traffic Drain Top Unit



Traffic Drain Access Cover and Frame 500mm long

Cover Plates

Galvanised steel Cover Plates for use with Traffic Drain Base Channels where a top unit is not required, such as under kerbs for connection to Beany.

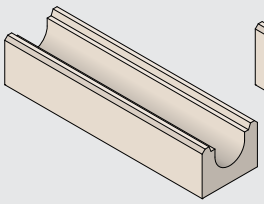


1000mm & 500mm lengths + Radius Units

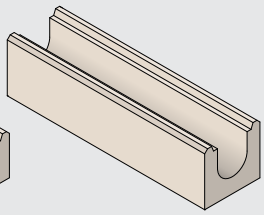
BASE COMPONENTS

All Base Units are 1000mm long, half channels, ancillary items and transition units are 500mm long.

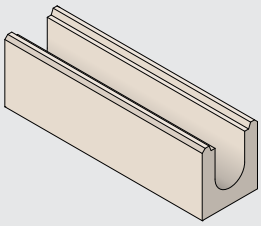
Base Channels



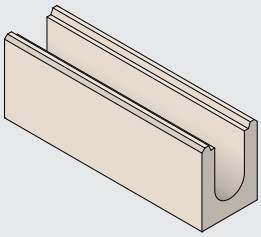
Base 210



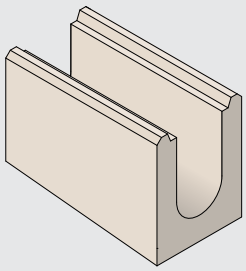
Base 260



Base 310



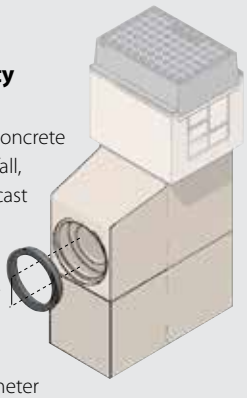
Base 360



Base Transitions 210-260, 260-310, 310-360

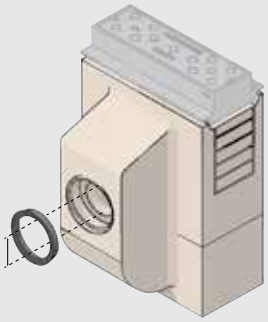
OUTFALLS

High Capacity Outfall



- A 2 section concrete trapped outfall, silt box and cast iron Max-E-Channel access cover.
- Outlet for 150mm or 225mm diameter pipe with universal seals.
- Bottom 2 sections can be orientated in any direction allowing flexibility of pipework layout.
- Cut-out panels in the silt box allow Traffic Drain runs from both sides.

Note: Silt Box and cast iron Access Cover Frame available separately.



Inline Side Outlet Outfall

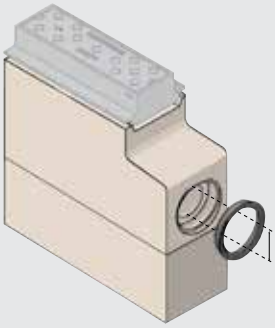
- A 2 section concrete trapped outfall, silt box and cast iron Traffic Drain Access Cover and Frame.
- Side outlet for 150mm diameter pipework with universal seal.
- Cut-out panels in the silt box allow Traffic Drain runs from both sides.

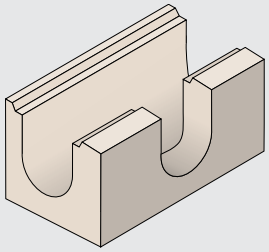
Note: Cast iron Access Cover and Frame available separately.

Inline End Outlet Outfall

- A 2 section concrete trapped outfall, with cast iron Traffic Drain Access Cover and Frame.
- End outlet for 100mm diameter pipework with universal seal.
- Cut-out panel to allow Traffic Drain run from one side only.

Note: Cast iron Access Cover and Frame available separately.



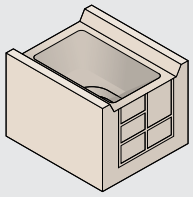


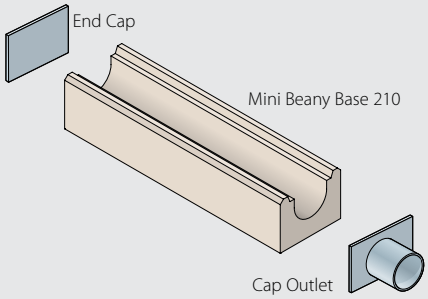
Traffic Drain T Junction

Available in all 4 base channel depths. 500mm in length.

Silt Box

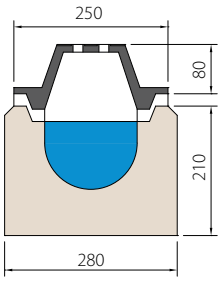
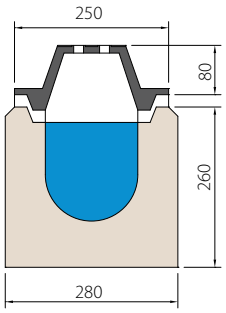
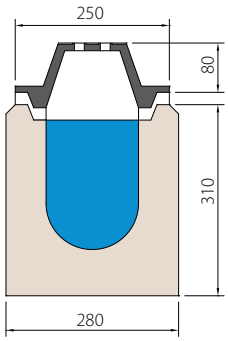
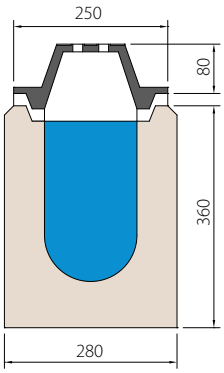
A concrete unit that with a Max-E-Channel cast iron Access Cover and Frame allows a high capacity outfall or silt trap to be installed in a run of traffic drain. It has cut-out panels either end to accept runs from either or both sides. An aperture in the base allows water to flow vertically into an outfall or silt trap.



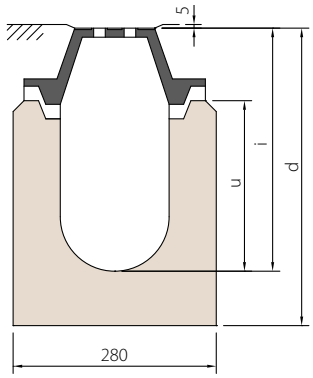


Hydraulic Data

FLOW CAPACITY

Traffic Drain 210	Traffic Drain 260	Traffic Drain 310	Traffic Drain 360
			
			
Equivalent Pipe Diameter (mm) 140	Equivalent Pipe Diameter (mm) 170	Equivalent Pipe Diameter (mm) 190	Equivalent Pipe Diameter (mm) 210

Traffic Drain



ref.	d	i	u
210	310	235	135
260	360	285	185
310	410	335	235
360	460	385	285

Hydraulic Data

The Traffic Drain hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using spatially variable flow design principles.

Base 210

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	6	0.38	7	0.44	7	0.44	8	0.50	8	0.50	9	0.56	9	0.56	13	0.81
20	6	0.38	7	0.44	7	0.44	8	0.50	8	0.50	10	0.63	11	0.69	14	0.88
30	5	0.31	7	0.44	8	0.50	8	0.50	9	0.56	10	0.63	12	0.75	14	0.88
40	5	0.31	6	0.38	8	0.50	8	0.50	9	0.56	11	0.69	13	0.81	15	0.94
50	5	0.31	6	0.38	8	0.50	9	0.56	9	0.56	11	0.69	13	0.81	15	0.94
75	4	0.25	6	0.38	8	0.50	9	0.56	10	0.63	13	0.81	14	0.88	17	1.06
100	3	0.19	6	0.38	8	0.50	9	0.56	11	0.69	14	0.88	17	1.06	19	1.19

Base 260

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	10	0.42	11	0.46	12	0.50	13	0.54	14	0.58	15	0.63	17	0.71	22	0.92
20	9	0.38	11	0.46	12	0.50	13	0.54	14	0.58	16	0.67	18	0.75	22	0.92
30	9	0.38	11	0.46	12	0.50	13	0.54	14	0.58	16	0.67	18	0.75	24	1.00
40	9	0.38	11	0.46	13	0.54	13	0.54	14	0.58	17	0.71	19	0.79	24	1.00
50	8	0.33	11	0.46	13	0.54	13	0.54	15	0.63	17	0.71	20	0.83	25	1.04
75	8	0.33	10	0.42	13	0.54	14	0.58	16	0.67	19	0.79	22	0.92	26	1.08
100	7	0.29	10	0.42	14	0.58	14	0.58	16	0.67	21	0.88	26	1.08	29	1.21
150	5	0.21	9	0.38	15	0.63	15	0.63	18	0.75	24	1.00	27	1.13	31	1.29

Base 310

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	13	0.42	16	0.52	17	0.55	18	0.58	18	0.58	20	0.65	24	0.77	30	0.97
20	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	21	0.68	25	0.81	30	0.97
30	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	21	0.68	25	0.81	32	1.03
40	13	0.42	15	0.48	17	0.55	18	0.58	19	0.61	22	0.71	26	0.84	32	1.03
50	12	0.39	15	0.48	17	0.55	18	0.58	20	0.65	23	0.74	27	0.87	33	1.06
75	11	0.35	15	0.48	17	0.55	19	0.61	21	0.68	25	0.81	28	0.90	34	1.10
100	10	0.32	14	0.45	17	0.55	19	0.61	22	0.71	26	0.84	30	0.97	36	1.16
150	9	0.29	14	0.45	18	0.58	20	0.65	23	0.74	30	0.97	34	1.01	39	1.26
200	7	0.23	13	0.42	18	0.58	21	0.68	25	0.81	33	1.06	37	1.19	43	1.39

Base 360

Gradient	Zero		1 in 1000		1 in 500		1 in 400		1 in 300		1 in 200		1 in 100		1 in 50	
Length(m)	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
25	18	0.46	21	0.54	23	0.59	24	0.62	25	0.64	28	0.72	33	0.85	40	1.03
50	17	0.44	20	0.51	23	0.59	24	0.62	26	0.67	30	0.77	35	0.90	42	1.08
75	16	0.41	20	0.51	23	0.59	25	0.64	27	0.69	32	0.82	36	0.92	44	1.13
100	15	0.38	19	0.49	23	0.59	25	0.64	28	0.72	34	0.87	38	0.97	46	1.18
125	14	0.36	19	0.49	23	0.59	25	0.64	29	0.74	35	0.90	40	1.03	48	1.23
150	13	0.33	19	0.49	24	0.62	26	0.67	30	0.77	37	0.95	42	1.08	50	1.28
175	12	0.31	18	0.46	24	0.62	26	0.67	31	0.79	39	1.00	44	1.13	52	1.33
200	11	0.28	18	0.46	24	0.62	27	0.69	32	0.82	41	1.05	46	1.18	54	1.38
225	10	0.26	18	0.46	24	0.62	27	0.69	32	0.82	43	1.10	48	1.23	55	1.41
250	9	0.23	17	0.44	24	0.62	28	0.72	33	0.85	45	1.15	50	1.28	57	1.46
275	8	0.21	17	0.44	25	0.64	28	0.72	34	0.87	47	1.21	51	1.31	59	1.51

Theoretical Outfall Capacities

Outfall Type	Outlet Pipe Diameter (mm)	l/s	m/s
Traffic Drain High Capacity Outfall	225	87	3.61
Traffic Drain Inline End Outlet Outfall	150	29	2.67
Traffic Drain Inline Side Outlet Outfall	150	29	2.67

Traffic Drain Component Codes

A Top Unit

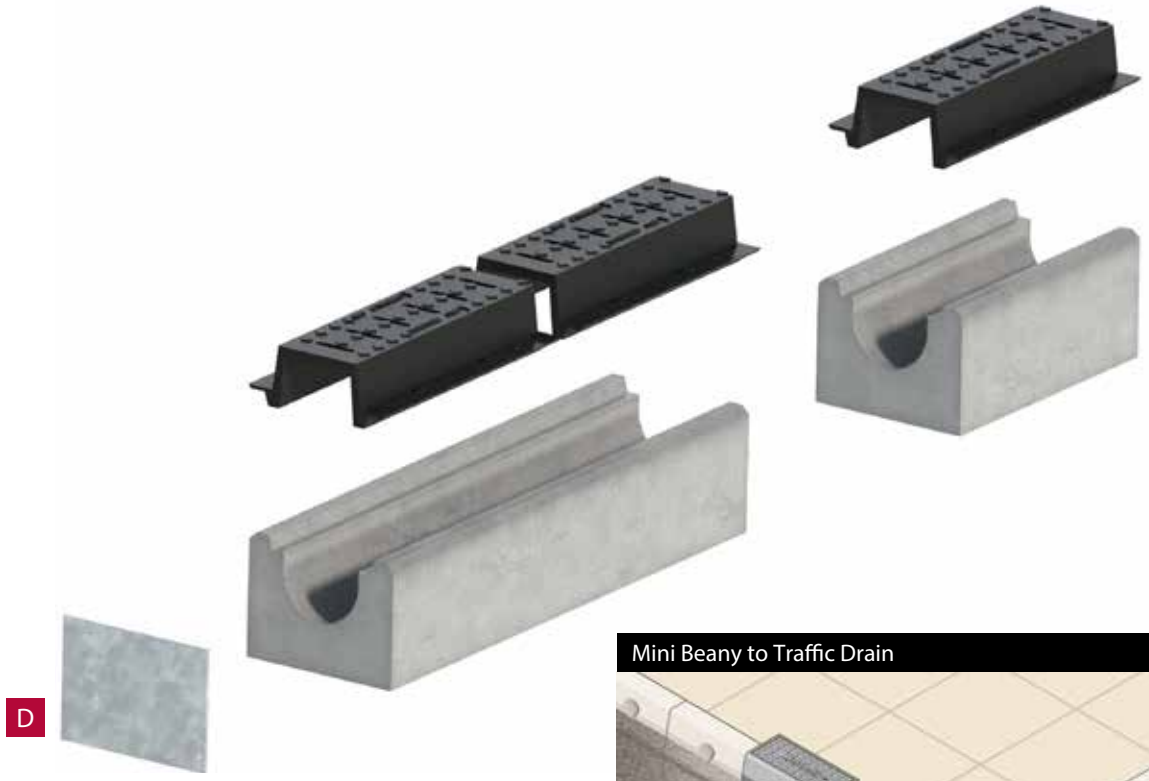
Top Unit	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Item Code
Traffic Drain Cast Iron	F900	500	250	110	23	**DR695020**

B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
210 Press Chan	1000	280	150	210	135	102	**DR696010**
260 Press Chan	1000	280	150	260	185	109	**DR697010**
310 Press Chan	1000	280	150	310	235	122	**DR698010**
360 Press Chan	1000	280	150	360	285	144	**DR699010**
210 Press Chan	500	280	150	210	135	51	**DR696020**
260 Press Chan	500	280	150	260	185	55	**DR697020**
310 Press Chan	500	280	150	310	235	61	DR698020
360 Press Chan	500	280	150	360	285	77	DR699020

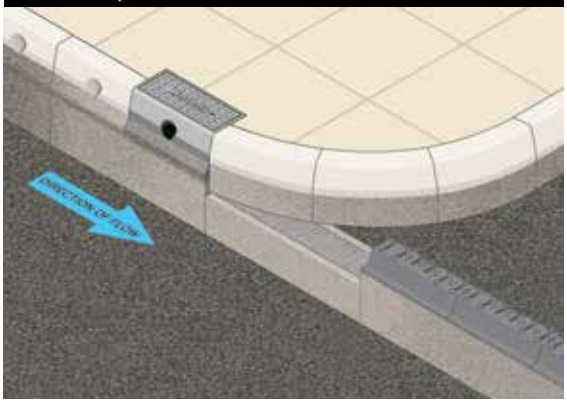
C Transition Channels

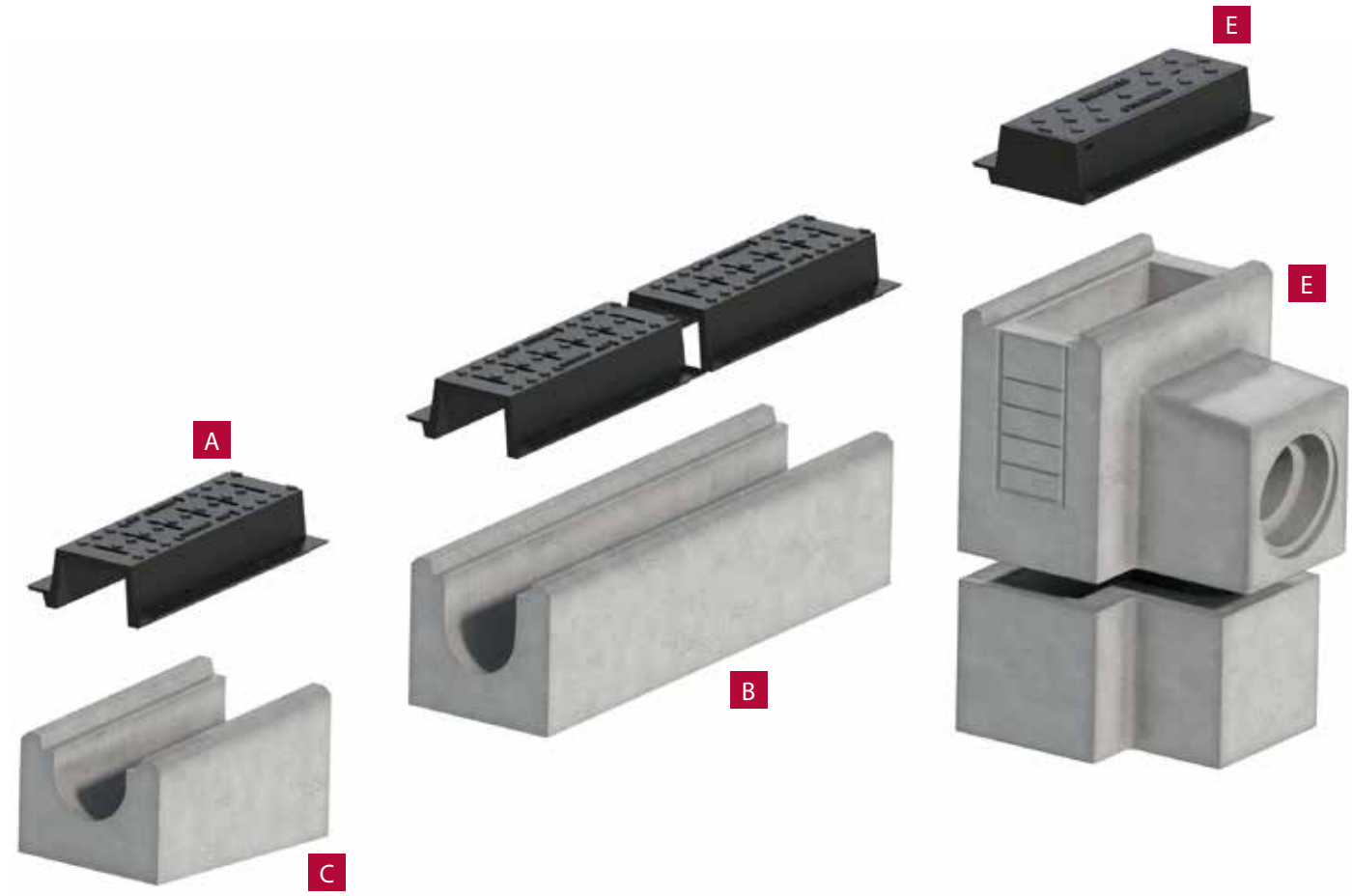
Transition Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/ Downstream	Invert Depth (mm) Upsteam/ Downstream	Unit Weight (kg)	Item Code
210 - 260	1000	280	150	210/260	135/185	54	DR696330
260 - 310	1000	280	150	260/310	185/235	61	DR697330
310 - 360	1000	280	150	310/360	235/285	77	DR698330



D

Mini Beany to Traffic Drain





D End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
210 End Cap	1	**DR696310**
260 End Cap	1	**DR697310**
310 End Cap	1	**DR698310**
360 End Cap	1	**DR699310**
210 Cap Outlet	2	DR696320
260 Cap Outlet	2	DR697320
310 Cap Outlet	2	DR698320
360 Cap Outlet	3	DR699320

E Outfalls & Access Covers

Outfalls & Access Covers	Unit Weight (kg)	Item Code
Traffic Drain Cast Iron Access C&F	34	**DR6950100**
Inline Side Outfall	150	**DR689000**
Inline End Outfall	142	DR689010
Silt Box	72	**DR689910**

F Cover Plates

Cover Plates	Unit Weight (kg)	Item Code
Cover Plate 500 mm	6	**DR691030**
Cover Plate 1000 mm	12	**DR691040**
Cover Plate 30/10	6	DR691050
Cover Plate 9/6	6	DR691060

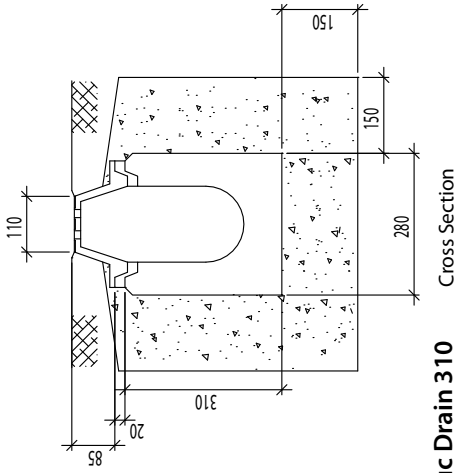
Mini Beany to Traffic Drain

Mini Beany can be used with Traffic Drain where the drainage run continues but the kerb line finishes. A smooth channel invert ensures undisturbed flow.

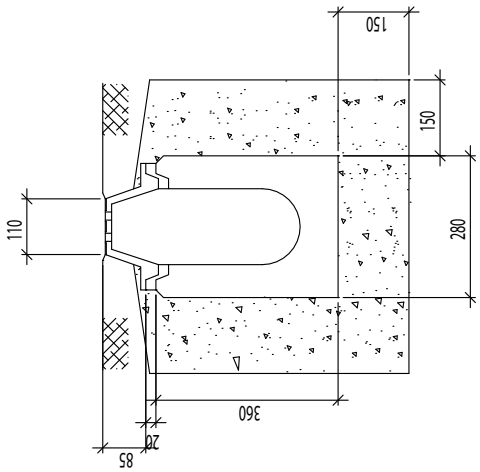
Traffic Drain with reference numbers indicated in **bold** black are available ex-stock.
Traffic Drain with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

Standard Details

Drawing 1 of 5



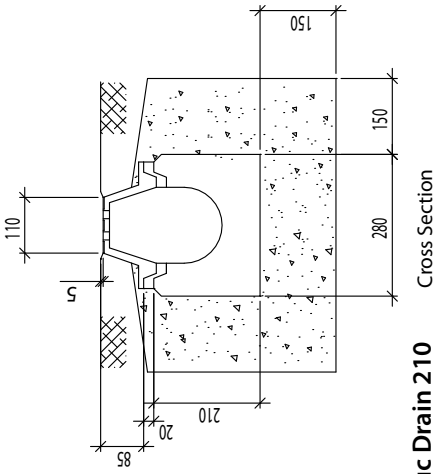
Traffic Drain 310 Cross Section



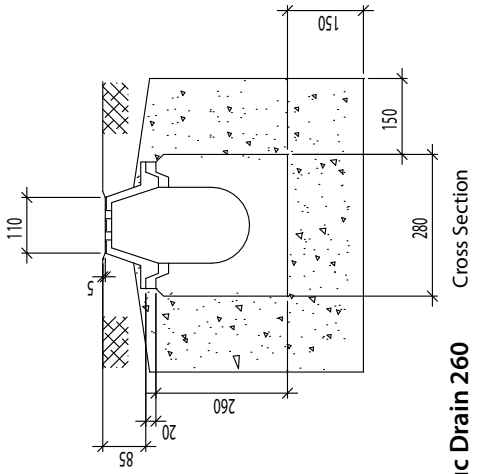
Traffic Drain 360 Cross Section

Base Unit Length = 1000mm

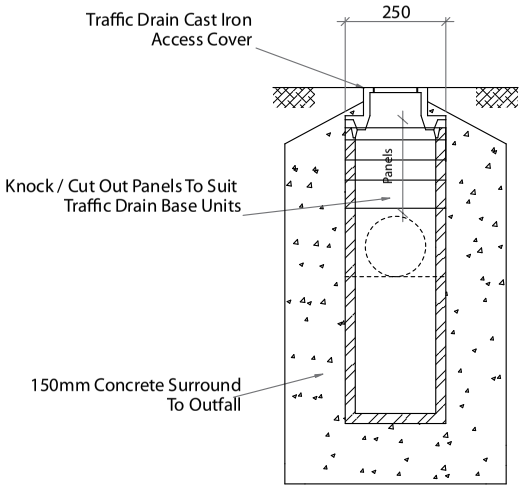
Top Unit Length = 500mm



Traffic Drain 210 Cross Section



Traffic Drain 260 Cross Section



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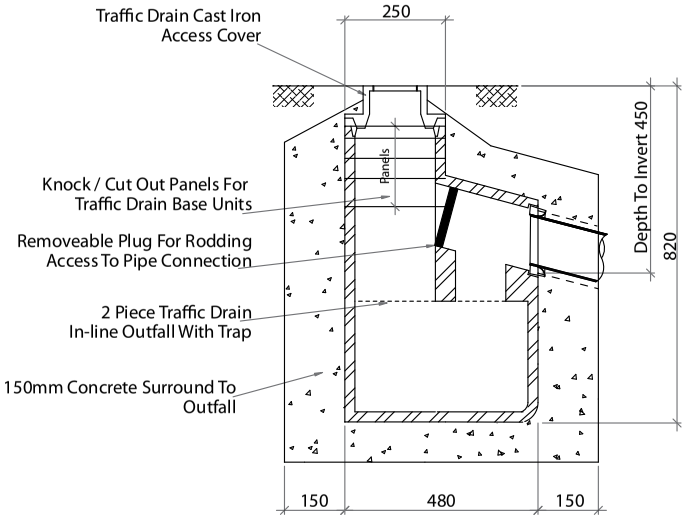
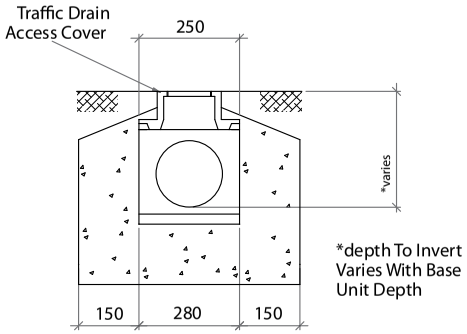


Cross Section

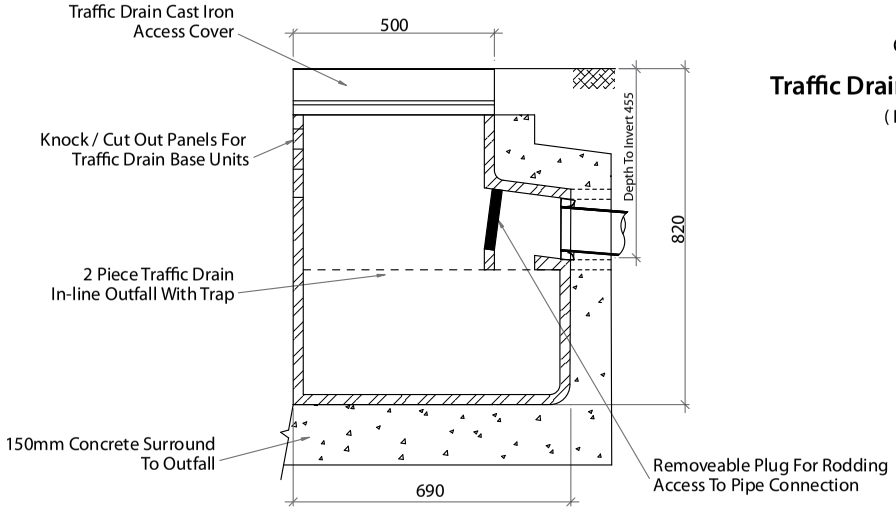
Traffic Drain Side Outlet Outfall

(Length = 500m)



Cross Section

Traffic Drain Cap Outlet

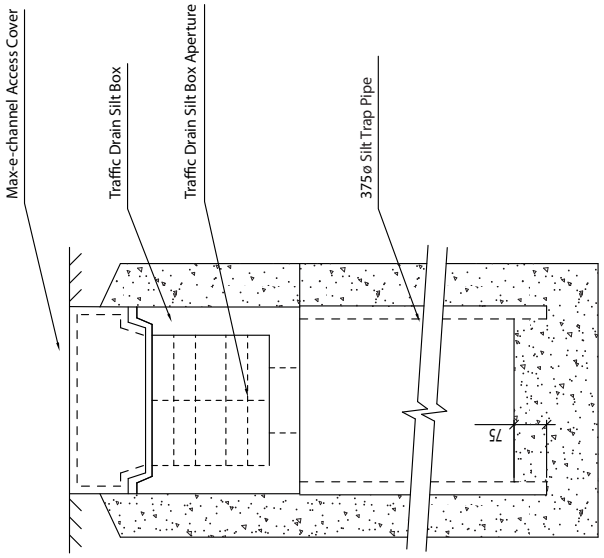


Longitudinal Elevation

Traffic Drain In-line Outlet Outfall

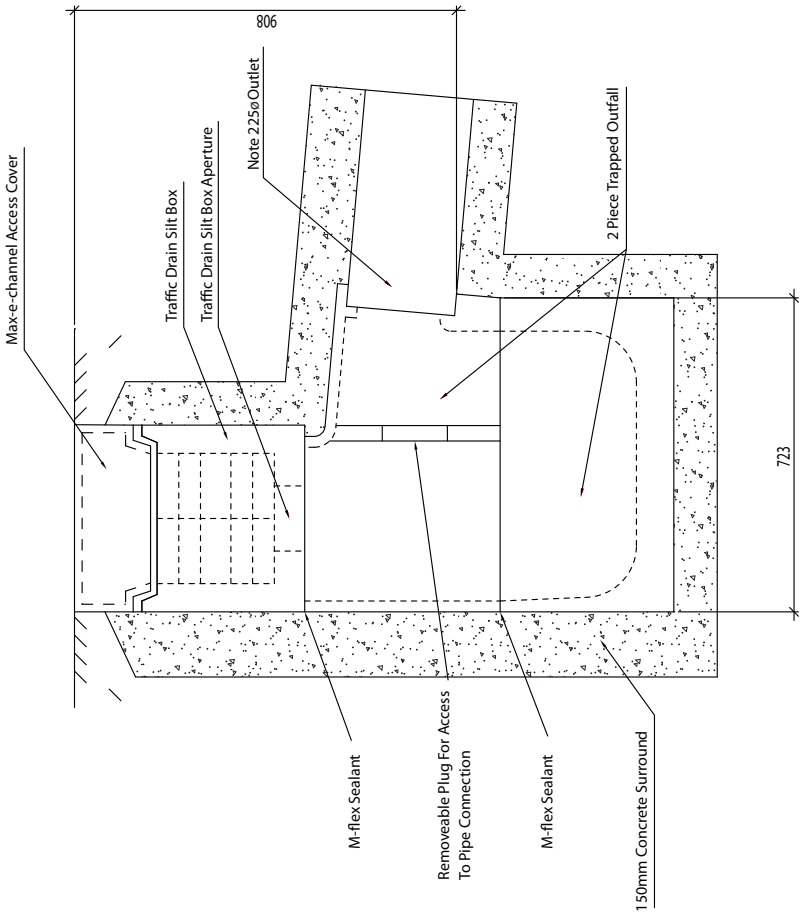
Standard Details

Drawing 3 of 5



Cross Section

Traffic Drain Silt Trap Assembly



Cross Section

Traffic Drain Trapped Gully

Drawing 4 of 5

Traffic Drain To Max-E-Channel - On-line Transition

Standard Details

Drawing 5 of 5

Base Depths	
Base Depth A	Base Depth B
260	210
310	260
360	310

Mini Beany To Traffic Drain Vehicle Crossing

Standard Details

Notes For Traffic Drain

Drawings 1 to 5

1. Mortars shall be;

   i) A Mortar class 12 cement mortar to BS EN 998-2 for bedding of the Cast Iron Top Units for applications up to Load Classification D400 to BS EN 1433

   ii) Marshalls' M-Bond epoxy mortar for bedding of Cast Iron Top Units for applications E600 and F900 to BS EN 1433

   iii) Marshalls' M-Flex for bedding the sections of the Traffic Drain High Capacity Outfall

2. Concrete bed, haunch and surround shall be;

   i) A C20/25 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to Load Classification C250 to BS EN 1433

   ii) A C25/30 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to Load Classification F900 to BS EN 1433

   iii) A mix ST4 concrete to BS 8500-1&2 and BS EN 206-1 for Outfalls and Silt Trap details

   iv) The specification for carrier pipe concrete surround is by others

3. Marshalls' vertical joint sealant, M-Seal, shall be applied to all Base Channels.

4. Movement joint details that fully isolate the Traffic Drain whilst maintaining restraint shall be provided adjacent to all concrete slabs, even when the slab is covered by other materials.

5. When used in conjunction with the Mini Beany system, Traffic Drain base channels are the same as Mini Beany base channels.

6. All dimensions are in millimetres.

Specification

Introduction

The following specification covers the complete Traffic Drain system including ancillary fittings and is compatible with the Standard Detail sheets.

Where the Manual of Contract Documents for Highway Works is used, information for "Appendix 5/6: Linear Drainage Systems" is available on request.

Traffic Drain

1. The linear drainage system shall be Traffic Drain, manufactured in pre-cast concrete and cast iron as supplied by Marshalls, Halifax HX5 9HT in accordance with Standard Detail Sheets.

2. The linear drainage system shall consist of a two part system with cast iron top units together with base units that are ***210/260/310/360mm**** deep. The overall width of the system shall be not less than 280mm.

3. All components of the Traffic Drain system, shall comply with the British Standard BS EN1433:2002, Load Classification F900 and the as following:

   (i) Cast iron top units with inclined side walls.

   (ii) The system shall have a minimum of 10,200mm^2/m water inlet aperture area.

   (iii) The top unit shall be bonded to the base units using Marshalls' M-Bond mortar.

   (iv) When installed, the minimum depth of construction above the top of the base unit to the drained area surface level shall be not less than 125mm.

4. The linear drainage system comprising straight top and base units, outfalls, silt traps, access covers, junctions, end caps and sealant shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.

Note: * delete as required

Construction

Introduction
Installation of the traffic drain linear drainage system should be carried out in accordance with the specification and standard detail sheets. The following method of installation is recommended.

Excavation
Sufficient material should be excavated to accommodate top and base units, concrete bedding and haunching, any 'soft spots' or poorly compacted formation should be made good.

Setting out
Setting out pins should be accurately located, with a string line level with the top front corners of the base units. Pins can be located to the rear of the units to avoid having to lift the units over the string line.

Base units
Starting at the outfall, i.e. Working uphill, the units should be bedded on to a freshly mixed foundation of the appropriate grade and thickness of concrete (refer to standard detail sheet.).
Concrete bed, haunch and surround shall be:

- A C20/25 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to load classification C250 to bs en 1433
- A C25/30 concrete to BS 8500-1&2 and BS EN 206-1 for applications up to load classification F900 to BS EN 1433
- A mix ST4 concrete to bs 8500-1&2 and BS EN 206-1 for Max-E-Channel trapped gullies, silt traps and outfall details
- The specification for carrier pipe concrete surround is by others

Alternatively, the units may be bedded on to a layer of cement mortar 10-40mm thick on a previously prepared concrete foundation.

Jointing of adjacent units shall be carried out during installation. Marshalls' M-Seal sealant should be trowel applied to the face of the channel. Surplus sealant shall be removed from the inner surface of the units as work proceeds.

One drum of M-Seal is sufficient to seal the following.

M-Seal Requirement	
Base Type	**Coverage (lin.m/18l)**
210	240
260	185
310	150
360	125

Where cutting is necessary, one or two base units shall be cut so that no single base unit is less than 350mm in length. All cutting and trimming of the units shall be carried out with a concrete saw or disc cutter.

At the termination of traffic drain runs, not located at outfalls, the base units shall be closed using galvanised steel end caps as detailed in the standard detail sheets.

Top units
The string line should be set to the level of the top front corner of the units.

Again, starting at the outfall, the units should be set directly onto a liberal quantity of stiff, cement mortar (or M-bond epoxy mortar* where specified) to completely fill the whole of the joint. Cement mortar shall be class 12 in accordance with BS EN 998-2. These should be tamped into position close to previously laid units and the alignment checked. The levels should be checked using the string line and a spirit level. In addition, the general alignment should be checked from all directions as each unit is laid. Surplus mortar shall be removed from the units as work proceeds.

Top units shall be laid with the top of the unit 5mm below the final pavement level.

The inside and outside of the joints between base and top units should be pointed and cleaned out with a brush or rag as work proceeds.

Top units shall not be cut.

* M-bond epoxy mortar coverage approximately
7.5l/m per 25 litres

Notes

1. In order to obtain a 'good line', it is very important to lay the top units on the specified thickness of compacted mortar using the string line and base units as a guide. Too thin a layer of mortar will not allow sufficient sideways movement of the units to achieve an acceptable alignment.
2. It is not necessary for top and base unit vertical joints to line up.
3. Where traffic drain is laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the units and haunching adjacent to the slab joints and also longitudinal movement joints between the haunching and the slabs. Where necessary, top unit drainage apertures shall be protected against the ingress of material during concreting operations.
4. Outfalls, silt traps and access covers shall be constructed in accordance with the standard detail sheet. In silt traps, the pipe shall be bedded into mix ST4 concrete which shall be fully compacted to make a watertight seal.
5. In situ concrete haunching or surround should not be placed until the installed blocks have been inspected and approved by the engineer. The haunching/surrounding should be carried out as one operation to complete lines of top and base units in accordance with the standard detail sheet
6. Adjacent carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed. Base units and outfalls, not covered by fully bedded top units or covers and frames, and shall be adequately supported against loadings imposed by construction traffic.
7. On completion of the works, the traffic drain system shall be cleaned out by high pressure water jetting (100-150 bar at 200 l/min minimum) and left free from obstructions and all outfalls and silt traps shall be emptied. Top unit drainage apertures shall be covered by timber boards or other approved method, during jetting operations. The cleaning process shall be repeated where necessary after the completion of any remedial works.
8. Installation operations should be discontinued if weather conditions are such that the performance of the inspection chamber may be jeopardised.

   Installation should not be undertaken when the temperature is below 3 degrees on a falling thermometer and below 1 degree on a rising thermometer.
9. All necessary personal protective equipment (PPE) should be worn on site, as the site rules dictate. Goggles, ear protection, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.

MARSHALLS
MARSHALLS

Birco

Grate Drainage System

- Robust and durable.
- Proven and trusted.
- Low to high capacity.
- Wide range of channels and gratings.
- Constant and inbuilt fall channels.
- Manufactured in accordance with BS EN 1433:2002.

Birco is a high quality linear drainage system combining robust concrete channels with a range of grates to suit all loading applications.

Birco linear drainage system is to intercept, store and transport surface water in a cost-effective and efficient way.

The Standard Range

Marshalls standard Birco range is extensive utilising five different systems which are detailed in this section:

- Birco 100.
- Birco 150.
- Birco 200.
- Birco 300_{AS}.
- Birco Shallow*.

* Where limited channel depth is critical, Birco Shallow is ideally suited and available in 100, 150 and 300mm channel widths.

Birco Special Ranges

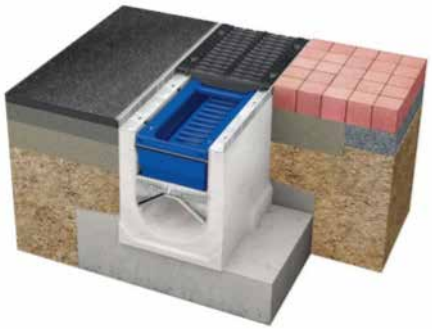
Marshalls also offers a variety of made to order specialist ranges to suit niche applications:

- BircoProfil, BircoTop & BircoTopline

  BircoProfil, BircoTop and BircoTopline steel channel systems is suitable for shallow construction heights and ensures optimum drainage performance and reliable traffic safety.

- BircoPur

  A modular filter system to clean run-off from debris, chemicals, combustion residues and leaching and is permanently reliable over the entire service life and especially maintenance-friendly.



- BircoDicht

  BircoDicht provides reliable, lasting protection in any area where liquids posing a threat to water needs to be collected. Its continuous PEHD lining and massive concrete body ensure that your waterway has a total tight seal.

For further information on these ranges or other specialist requirements please contact our technical department.

Channels

Birco channels are manufactured in high quality, precast concrete using the most up-to-date production techniques. All channels incorporate rolled galvanised steel edge angles firmly cast into each channel to position and attach the appropriate grating.

- Birco 100 have channel invert widths of 100mm.
- Birco 150, 200 and 300mm systems have channel invert widths in mm equivalent to their designation.

Constant Invert Depths

Channels are available in a range of standard constant invert depths to accommodate a range of drainage requirements.

Inbuilt Falls

To complement the standard constant depth channels, Birco 100, 150 and 200 Channels are also available with in-built gradients.

Outfalls

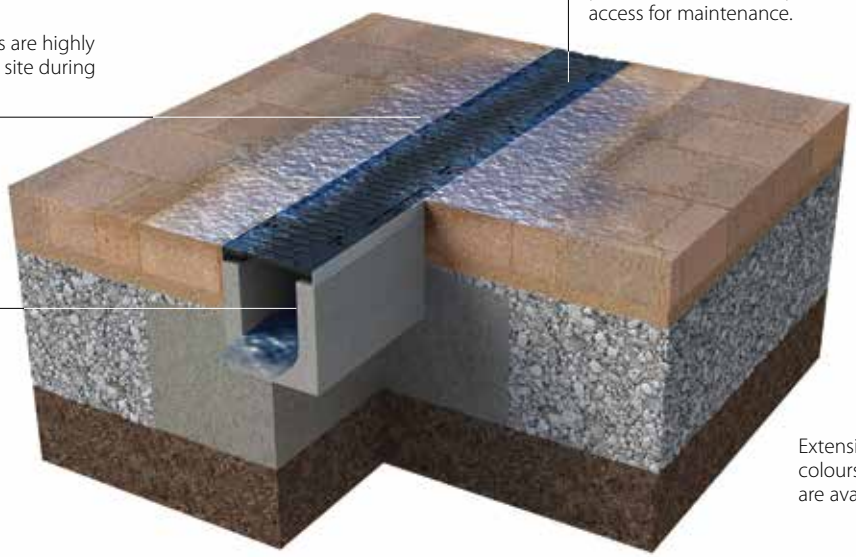
To complete the system, outfalls must be provided to discharge the water collected by the channels. A range of inline, side and end outlet and junction outfalls are available, all trapped and roddable as standard.

Various Outfalls can accommodate 100mm, 150mm and 225mm diameter discharge pipes.

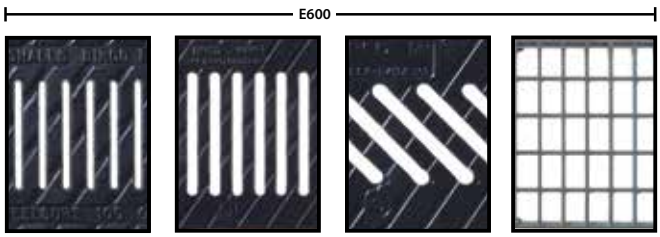
Gratings

The wide range of grating materials, profiles, colours and loading capacities available, allows Birco to provide a solution to almost any drainage problem:

- Grating of galvanised steel, stainless steel, cast iron (grey and ductile), and aluminium are available in the load classifications as defined in BS EN 1433: 2002.
- Cast iron (grey and ductile) are offered in a variety of profiles – ribbed (straight or diagonal), wave or ellipse. The ellipse pattern can be further customised with the addition of bespoke emblems or logos. Made to special order for high profile projects.
- Ribbed gratings are profiled to ensure water cannot cross the rib but is discharged through the slot into the channel.
- Heelsure cast iron gratings, having a 6mm narrow slot width, are designed to minimise the risk of trapping high heels, as well as providing an improved riding surface for small-wheeled trolleys, pushchairs, etc.
- Colour coated cast iron gratings which resist surface oxidisation and offer greater design flexibility are available.
- Solid covers can be supplied for alternative uses where gratings would not be suitable.



Birco 100, Manchester

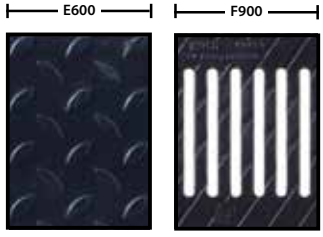


6mm Heelsure Cast Iron

12mm Slotted Cast Iron

13mm Diagonal Cast Iron

20 x 30mm Mesh Galvanised Steel



Cast Iron Solid Cover

12mm Slotted Cast Iron

Birco 100

Grate Drainage System

A multi-purpose low capacity linear drainage system, combining a robust concrete channel with a wide aesthetic choice of cast iron, stainless steel or galvanised grates. A variety of loadings make Birco 100 suitable for light to heavy trafficking so suitable for a variety of projects including civic, commercial, rail and industrial applications.

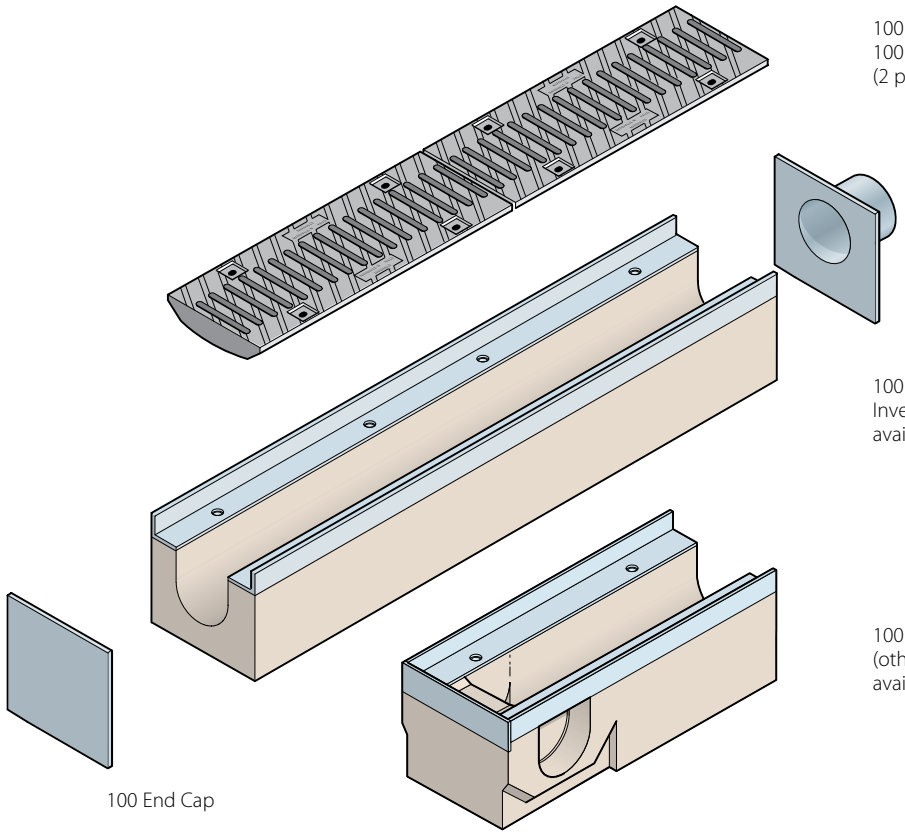
NBS Plus

Q10 180

Components

Grate Drainage System

- Birco 100 system is suitable for a wide range of applications up to Class F900 when used with the appropriate grating, the 100 denoting the 100mm width of the invert within the channel.
- The Birco 100 system comprises a range of channels, gratings and in-line outfalls with a common junction outfall for all Birco systems.
- Birco 100 channel has a wall thickness of 50mm with a heavy gauge rolled galvanised steel angle cast into the wall ensuring strength under the heavier load applications.
- The grating and covers are secured by bolting stainless steel bolts into threaded steel sockets cast into the channel wall.
- Birco 100 channels are offered in 5 constant invert depths of 130, 180, 230, 280 and 330mm, designed 0/0, 5/0, 10/0, 15/0 and 20/0 respectively, in 1000mm and 500mm channel lengths.
- Channels with inbuilt falls are available – 20 Inbuilt fall channels with a gradient 1%.



100 Cast Iron Grating
100 x 12mm slots
(2 pieces shown)

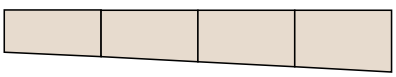
100 Cap Outlet
106mm O.D.

100 Channel Constant Depth Invert (other invert depths available – see table)

100 T Junction Channel (other invert depths available – see table)

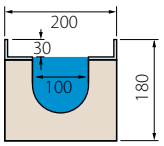
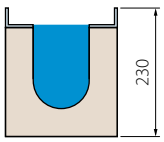
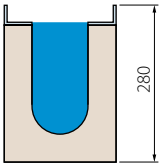
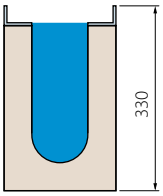
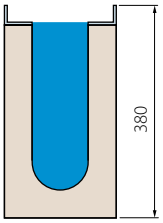
100 End Cap

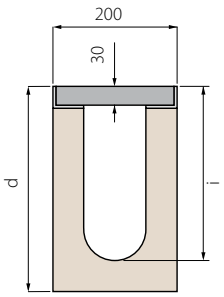
INBUILT FALLS
20 Inbuilt Fall Channels, with a gradient of 1.0%. Inbuilt fall channels are 1000mm long.



Hydraulic Data

FLOW CAPACITY

Birco 100 with 0/0 Channel Unit	Birco 100 with 5/0 Channel Unit	Birco 100 with 10/0 Channel Unit	Birco 100 with 15/0 Channel Unit	Birco 100 with 20/0 Channel Unit
 **(0/0)**	 **(5/0)**	 **(10/0)**	 **(15/0)**	 **(20/0)**
 Equivalent Pipe Diameter (mm) 120	 Equivalent Pipe Diameter (mm) 145	 Equivalent Pipe Diameter (mm) 160	 Equivalent Pipe Diameter (mm) 175	 Equivalent Pipe Diameter (mm) 190



BIRCO 100		
ref.	d	i
0/0	180	130
IBF 1-5*	190-230*	140-180*
5/0	230	180
IBF 6-10*	240-280*	190-230*
10/0	280	230
IBF 11-15*	290-330*	240-280*
15/0	330	280
IBF 16-20*	340-380*	290-330*
20/0	380	330

*-dimensions at downstream end; deduct 10mm for upstream end..
All dimensions measured from grating surface, pavement should be 5mm above this level.

The Birco hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the Colebrook-White formulae.

Birco 100										
Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0***	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	27	3.06	46	3.29	64	3.39	84	3.50	103	3.55
20	19	2.16	32	2.32	45	2.40	59	2.47	73	2.51
30	16	1.76	26	1.89	37	1.95	48	2.01	59	2.04
40	14	1.52	23	1.64	32	1.69	42	1.74	51	1.77
50	12	1.36	20	1.46	29	1.51	37	1.56	46	1.58
75	10	1.11	17	1.19	23	1.23	30	1.27	37	1.29
100	9	0.96	14	1.03	20	1.06	26	1.10	32	1.11
150	7	0.78	12	0.84	16	0.87	21	0.89	26	0.91
200	6	0.67	10	0.72	14	0.75	18	0.77	23	0.78
300	5	0.55	8	0.59	12	0.61	15	0.63	18	0.64
400	4	0.47	7	0.51	10	0.53	13	0.54	16	0.55
500	4	0.42	6	0.45	9	0.47	12	0.48	14	0.49
750	3	0.34	5	0.37	7	0.38	9	0.39	12	0.40
1000	3	0.29	4	0.32	6	0.33	8	0.34	10	0.34
1500	2	0.24	4	0.26	5	0.27	7	0.27	8	0.28
2000	2	0.21	3	0.22	4	0.23	6	0.24	7	0.24

Birco 100 Component Codes

A Gratings

Gratings	Loading	Length (mm)	Width (mm)	Unit Weight (kg)	Item Code
6mm Heelsure Cast Iron	E600	500	187	7.2	**DR115135**
12mm Slotted Cast Iron	E600	500	187	6.2	DR115125
13mm Diagonal Cast Iron	E600	500	187	12.4	DR115020
20 x 30mm Mesh Galvanised Steel	E600	500	187	4.86	DR115285
Cast Iron Solid Cover	E600	500	187	7.46	DR115250
12mm Slotted Cast Iron	F900	500	187	7.4	DR115130

F Outfalls

Outfalls	Unit Weight (kg)	Item Code
100 End Outfall 100mm	105	DR130170
100 Side Outfall 150mm	142	**DR130175**
100 Shallow Outfall 100mm	142	DR420480

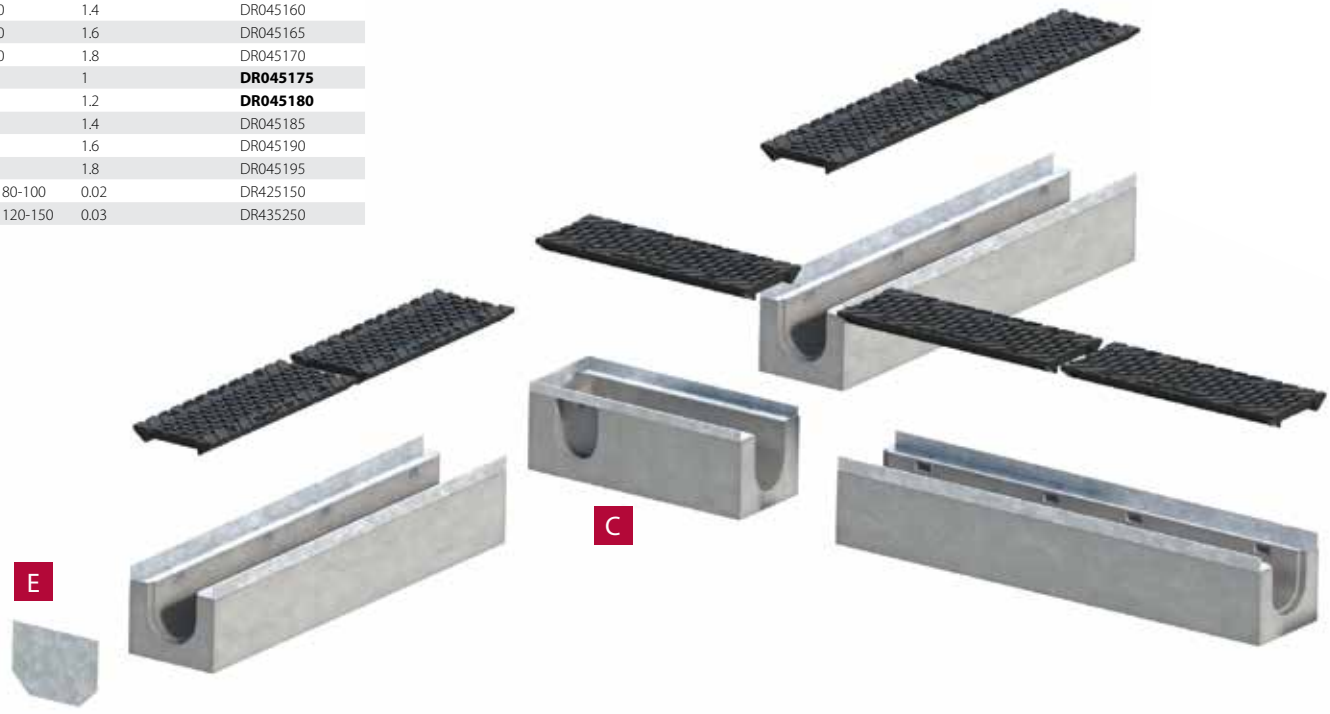
Birco 100 with reference numbers indicated in **bold** black are available ex-stock.
Birco 100 with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requrements.

C T Junction Channels

T Junction Channels	Unit Weight (kg)	Item Code
T- Channel 0/0	27	DR010210
T- Channel 5/0	33	DR010220
T- Channel 10/0	39	DR010230

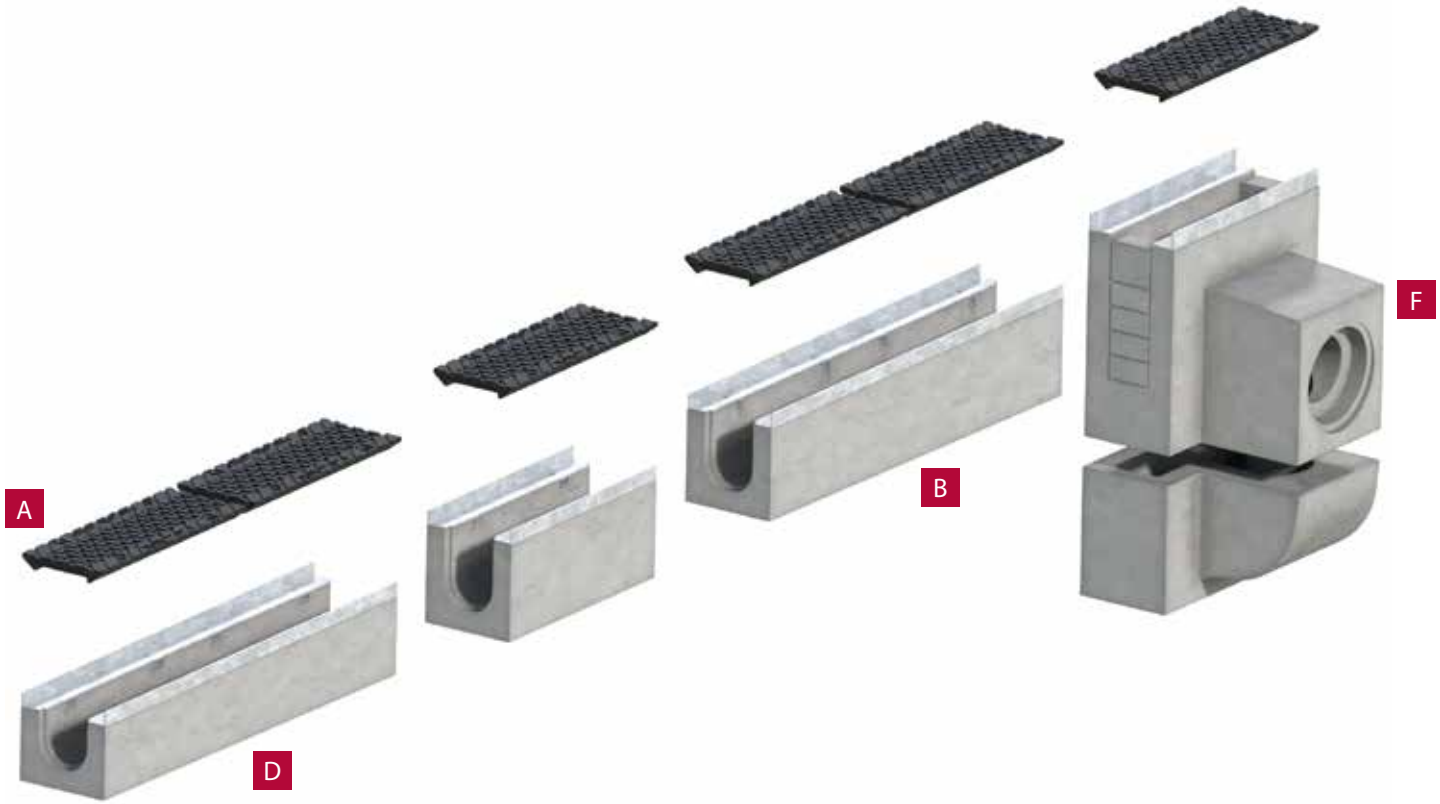
E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
100 End Cap 0/0	1	**DR045150**
100 End Cap 5/0	1.2	**DR045155**
100 End Cap 10/0	1.4	DR045160
100 End Cap 15/0	1.6	DR045165
100 End Cap 20/0	1.8	DR045170
Cap Outlet 0/0	1	**DR045175**
Cap Outlet 5/0	1.2	**DR045180**
Cap Outlet 10/0	1.4	DR045185
Cap Outlet 15/0	1.6	DR045190
Cap Outlet 20/0	1.8	DR045195
Shallow End Cap 80-100	0.02	DR425150
Shallow End Cap 120-150	0.03	DR435250



B Constant Depth Channels

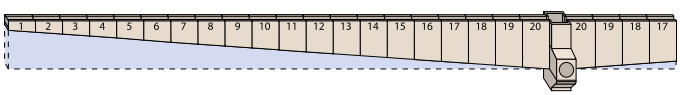
Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	200	100	180	130	54	**DR080105**
Channel 5/0	1000	200	100	230	180	66	**DR080115**
Channel 10/0	1000	200	100	280	230	78	DR080125
Channel 15/0	1000	200	100	330	280	90	DR080135
Channel 20/0	1000	200	100	380	330	102	DR080145
Channel 0/0	500	200	100	180	130	27	DR090150
Channel 5/0	500	200	100	230	180	33	DR090160
Channel 10/0	500	200	100	280	230	38	DR090170
Channel 15/0	500	200	100	330	280	43	DR090180
Channel 20/0	500	200	100	380	330	51	DR090190
Shallow 80	1000	200	100	80	50		DR420450
Shallow 100	1000	200	100	100	70		DR420460
Shallow 150	1000	200	100	150	110		DR420480



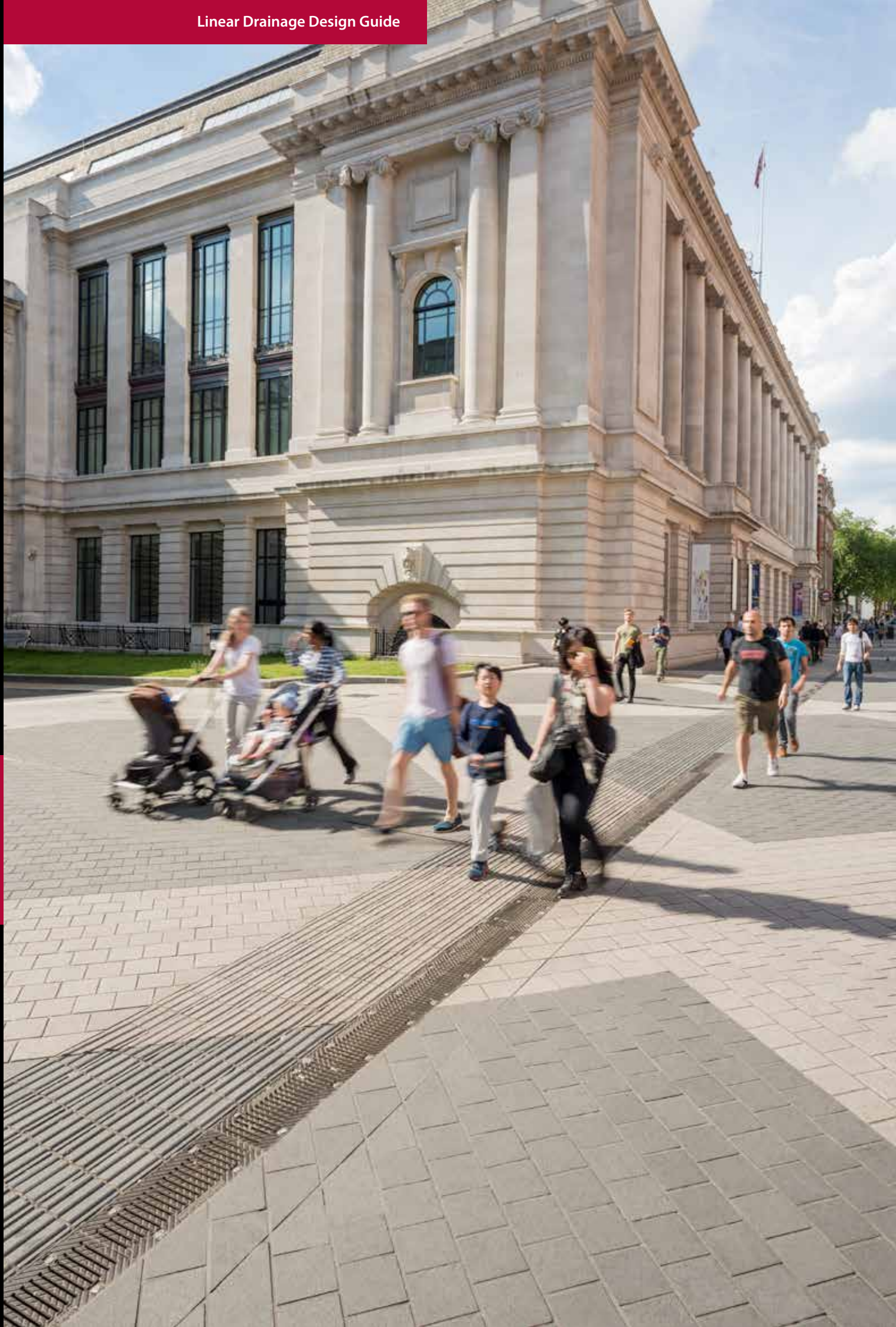
D Inbuilt Fall Channels

Inbuilt Fall Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/ Downstream	Invert Depth (mm) Upsteam/ Downstream	Unit Weight (kg)	Item Code
IBF Channel No. 1	1000	200	100	180/190	130/140	57	DR020010
IBF Channel No. 2	1000	200	100	190/200	140/150	57.5	DR020020
IBF Channel No. 3	1000	200	100	200/210	150/160	61	DR020030
IBF Channel No. 4	1000	200	100	210/220	160/170	62.5	DR020040
IBF Channel No. 5	1000	200	100	220/230	170/180	65	DR020050
IBF Channel No. 6	1000	200	100	230/240	180/190	67	DR020060
IBF Channel No. 7	1000	200	100	240/250	190/200	69	DR020070
IBF Channel No. 8	1000	200	100	250/260	200/210	71	DR020080
IBF Channel No. 9	1000	200	100	260/270	210/220	73	DR020090
IBF Channel No. 10	1000	200	100	270/280	220/230	77	DR020100
IBF Channel No. 11	1000	200	100	280/290	230/240	77	DR020110
IBF Channel No. 12	1000	200	100	290/300	240/250	81.5	DR020120
IBF Channel No. 13	1000	200	100	300/310	250/260	81	DR020130
IBF Channel No. 14	1000	200	100	310/320	260/270	86.5	DR020140
IBF Channel No. 15	1000	200	100	320/330	270/280	85	DR020150
IBF Channel No. 16	1000	200	100	330/340	280/290	91	DR020160
IBF Channel No. 17	1000	200	100	340/350	290/300	93.5	DR020170
IBF Channel No. 18	1000	200	100	350/360	300/310	96	DR020180
IBF Channel No. 19	1000	200	100	360/370	310/320	98.5	DR020190
IBF Channel No. 20	1000	200	100	370/380	320/330	101	DR020200

Inbuilt Fall



Birco 100 Channels are available with inbuilt falls. Inbuilt Fall Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Inbuilt fall channels are 1000mm long.



Birco 150, London

E600

6mm Heelsure
Cast Iron

12mm Slotted
Cast Iron

12mm Slotted
Galvanised Cast Iron

E600

20 X 30mm Mesh
Galvanised Steel

Cast Iron
Solid Cover

F900

12mm Slotted
Cast Iron

Birco 150

Grate Drainage System

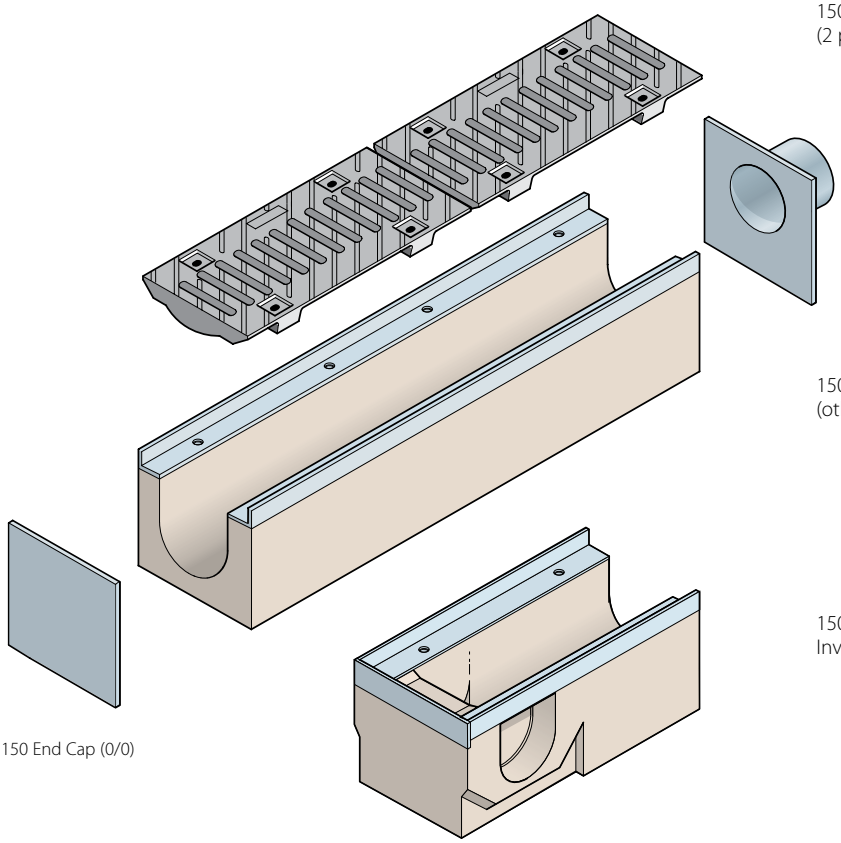
A medium capacity linear drainage system which combines a robust concrete channel with a wide aesthetic choice of cast iron and galvanised steel grates. Birco 150 is available up to the highest loading classification making it suitable for a variety of commercial, rail and industrial applications.

NBS Plus
Q10 180

Components

Grate Drainage System

- Birco 150 offers an increased flow capacity over the Birco 100 and is suitable for applications up to and including Class F900, when used with the appropriate grating.
- The Birco 150 system comprises a range of channels, gratings and covers together with complementary in-line outfalls. A common junction outfall is available for all Birco systems available for use in the Birco 150 range up to the 15/0 channel.
- The grating and covers are secured by bolting stainless steel bolts into threaded steel sockets cast into the channel wall.
- Birco 150 channels are offered in 5 constant invert depths of 180, 230, 280, 330 and 380mm designated 0/0, 5/0, 10/0, 15/0 and 20/0 respectively, in 500 & 1000mm channel lengths.
- Channels with inbuilt falls are available – 20 Inbuilt fall channels with a gradient 1%.



150 Cast Iron Grating150 x 12mm slots (2 pieces shown)

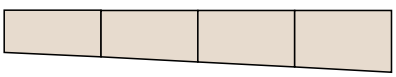
150 Cap Outlet (0/0) 158mm O.D.

150 Channel (0/0) Constant Depth Invert (other invert depths available – see table)

150 T Junction Channel (0/0) Constant Depth Invert (other invert depths available – see table)

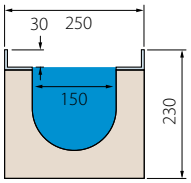
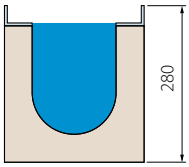
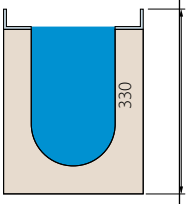
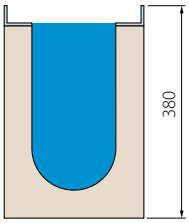
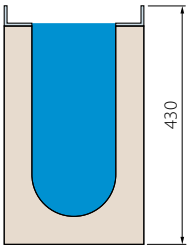
150 End Cap (0/0)

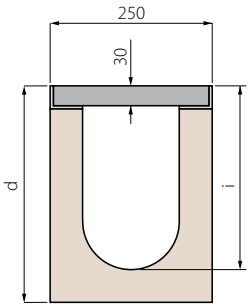
INBUILT FALLS
20 Inbuilt Fall Channels, with a gradient of 1%. Inbuilt fall channels are 1000mm long.



Hydraulic Data

FLOW CAPACITY

Birco 150 with 0/0 Channel Unit	Birco 150 with 5/0 Channel Unit	Birco 150 with 10/0 Channel Unit	Birco 150 with 15/0 Channel Unit	Birco 150 with 20/0 Channel Unit
 **(0/0)**	 **(5/0)**	 **(10/0)**	 **(15/0)**	 **(20/0)**
 Equivalent Pipe Diameter (mm) 175	 Equivalent Pipe Diameter (mm) 200	 Equivalent Pipe Diameter (mm) 225	 Equivalent Pipe Diameter (mm) 245	 Equivalent Pipe Diameter (mm) 260



BIRCO 150		
ref.	d	i
0/0	230	180
IBF 1-5*	240-280*	190-230*
5/0	280	230
IBF 6-10*	290-330*	240-280*
10/0	330	280
IBF 11-15*	340-380*	290-330*
15/0	380	330
IBF 16-20*	390-430*	340-380*
20/0	430	380

*-dimensions at downstream end; deduct 10mm for upstream end..
All dimensions measured from grating surface, pavement should be 5mm above this level.

The Birco hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the Colebrook-White formulae.

Birco 150										
Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0***	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	79.22	3.96	95.62	4.09	115.54	4.19	133.53	4.27	152.04	4.33
20	55.93	2.8	67.52	2.89	81.58	2.96	94.28	3.01	107.36	3.06
30	45.61	2.28	55.06	2.35	66.54	2.41	76.9	2.46	87.56	2.49
40	39.46	1.97	47.64	2.04	57.57	2.09	66.53	2.13	75.76	2.16
50	35.26	1.76	42.57	1.82	51.45	1.86	59.46	1.9	67.71	1.93
75	28.74	1.44	34.7	1.48	41.93	1.52	48.47	1.55	55.19	1.57
100	24.85	1.24	30.01	1.28	36.26	1.31	41.91	1.34	47.73	1.36
150	20.24	1.01	24.44	1.04	29.54	1.07	34.14	1.09	38.88	1.11
200	17.49	0.87	21.12	0.9	25.53	0.92	29.51	0.94	33.61	0.96
300	14.23	0.71	17.19	0.73	20.78	0.75	24.02	0.77	27.35	0.78
400	12.29	0.61	14.84	0.63	17.94	0.65	20.74	0.66	23.62	0.67
500	10.97	0.55	13.24	0.57	16.01	0.58	18.51	0.59	21.08	0.6
750	8.91	0.45	10.76	0.46	13.01	0.47	15.04	0.48	17.13	0.49
1000	7.68	0.38	9.28	0.4	11.22	0.41	12.97	0.41	14.78	0.42
1500	6.23	0.31	7.53	0.32	9.1	0.33	10.52	0.34	11.99	0.34
2000	5.36	0.27	6.48	0.28	7.84	0.28	9.07	0.29	10.33	0.29

Birco 150 Component Codes

A Gratings

Gratings	Loading	Length (mm)	Width (mm)	Unit Weight (kg)	Item Code
6mm Heelsure Cast Iron	E600	500	237	10.5	**DR195240**
12mm Slotted Cast Iron	E600	500	237	11.0	DR195210
12mm Slotted Galvanised Cast Iron	E600	500	237	11	DR197030
20 x 30mm Mesh Galvanised Steel	E600	500	237	7.36	DR197290
20 x 30mm Mesh Galvanised Steel	E600	1000	237	15	DR197280
Cast Iron Solid Cover	E600	500	237	10.3	DR195230
12mm Slotted Cast Iron	F900	500	237	12.20	DR195220

C T Junction Channels

T-Junction Channels	Unit Weight (kg)	Item Code
T-Channel 0/0	38	DR190020
T-Channel 5/0	44	DR190030
T-Channel 10/0	50	DR190040

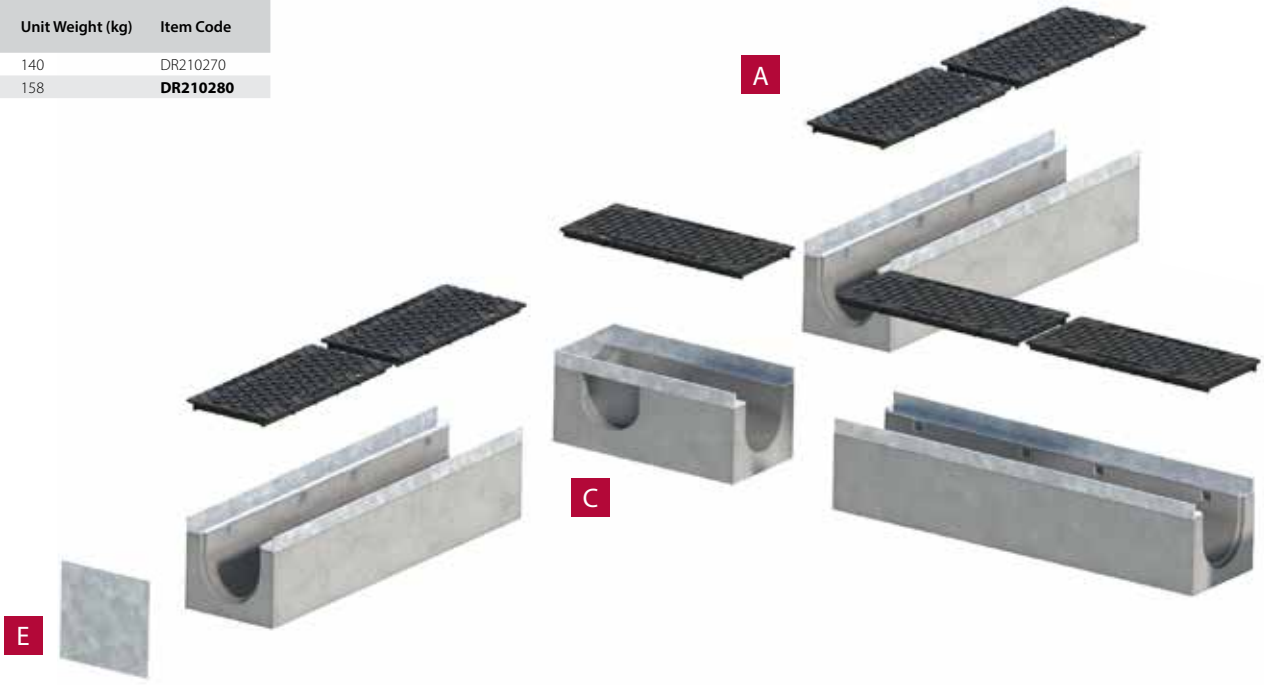
Birco 150 with reference numbers indicated in **bold** black are available ex-stock.
Birco 150 with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
150 End Cap 0/0	1	**DR197200**
150 End Cap 5/0	1.2	**DR197210**
150 End Cap 10/0	1.4	DR197220
150 End Cap 15/0	1.6	DR197230
150 Cap Outlet 0/0	2	**DR200250**
150 Cap Outlet 5/0	2	**DR200260**
150 Cap Outlet 10/0	2	DR200270
150 Cap Outlet 15/0	2	DR200280

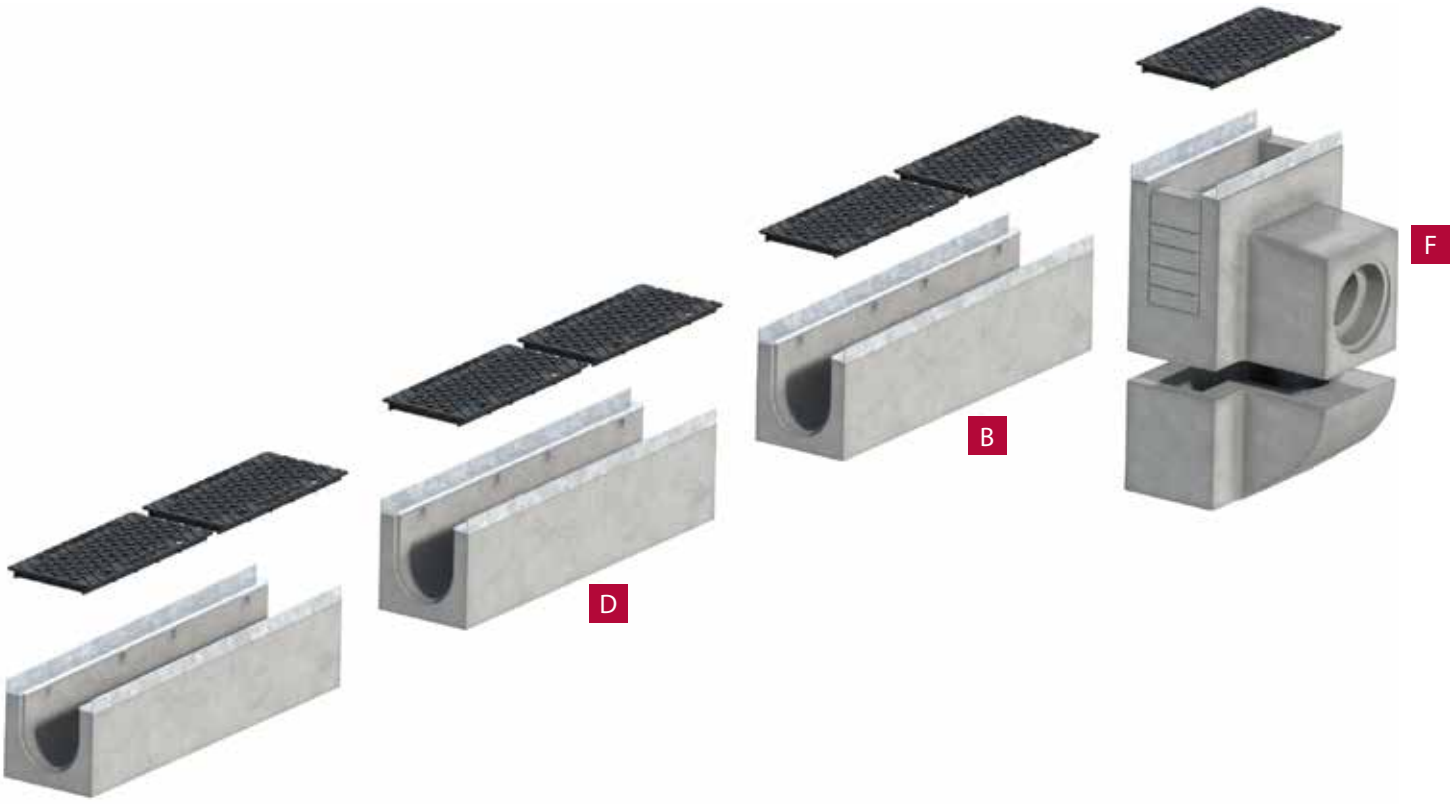
F Outfalls

Outfalls	Unit Weight (kg)	Item Code
150 End Outfall 100mm	140	DR210270
150 Side Outfall 150mm	158	**DR210280**



B Constant Depth Channels

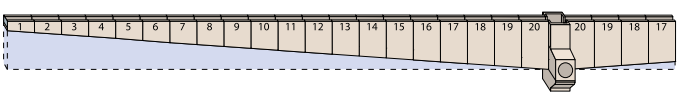
Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	250	150	230	180	76	**DR160200**
Channel 5/0	1000	250	150	280	230	88	**DR160205**
Channel 10/0	1000	250	150	330	280	100	DR160210
Channel 15/0	1000	250	150	380	330	112	DR160215
Channel 20/0	1000	250	150	430	380	124	DR160220
Channel 0/0	500	250	150	230	180	38	DR170206
Channel 5/0	500	250	150	280	230	44	DR170226
Channel 10/0	500	250	150	330	280	50	DR170236
Channel 15/0	500	250	150	380	330	45	DR170246



D Inbuilt Fall Channels

Inbuilt Fall Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm) Upsteam/ Downstream	Invert Depth (mm) Upsteam/ Downstream	Unit Weight (kg)	Item Code
IBF Channel No. 1	1000	250	150	230/240	180/190	76	DR180010
IBF Channel No. 2	1000	250	150	240/250	190/200	77	DR180020
IBF Channel No. 3	1000	250	150	250/260	200/210	77	DR180030
IBF Channel No. 4	1000	250	150	260/270	210/220	79	DR180040
IBF Channel No. 5	1000	250	150	270/280	220/230	80	DR180050
IBF Channel No. 6	1000	250	150	280/290	230/240	81	DR180060
IBF Channel No. 7	1000	250	150	290/300	240/250	82	DR180070
IBF Channel No. 8	1000	250	150	300/310	250/260	83	DR180080
IBF Channel No. 9	1000	250	150	310/320	260/270	84	DR180090
IBF Channel No. 10	1000	250	150	320/330	270/280	85	DR180100
IBF Channel No. 11	1000	250	150	330/340	280/290	86	DR180110
IBF Channel No. 12	1000	250	150	340/350	290/300	87	DR180120
IBF Channel No. 13	1000	250	150	350/360	300/310	88	DR180130
IBF Channel No. 14	1000	250	150	360/370	310/320	89	DR180140
IBF Channel No. 15	1000	250	150	370/380	320/330	90	DR180150
IBF Channel No. 16	1000	250	150	380/390	330/340	91	DR180160
IBF Channel No. 17	1000	250	150	390/400	340/350	92	DR180170
IBF Channel No. 18	1000	250	150	400/410	350/360	93	DR180180
IBF Channel No. 19	1000	250	150	410/420	360/370	94	DR180190
IBF Channel No. 20	1000	250	150	420/430	370/380	95	DR180200

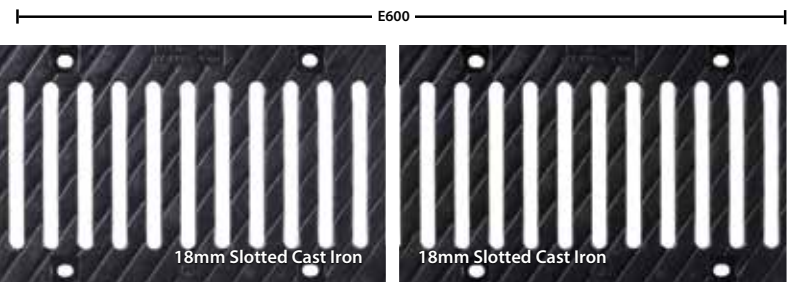
Inbuilt Fall



Birco 150 Channels are available with inbuilt falls. Inbuilt Fall Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Inbuilt fall channels are 1000mm long.

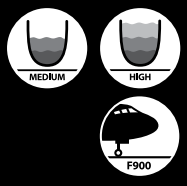

Bond

Birco 200, Gloucestershire



Birco 200

Grate Drainage System



A medium to high capacity linear drainage system which combines a robust concrete channel with a cast iron slotted grate. Suitable for loadings up to F900, making Birco 200 ideal for projects where vehicles impose particularly heavy wheel loads such as industrial applications.

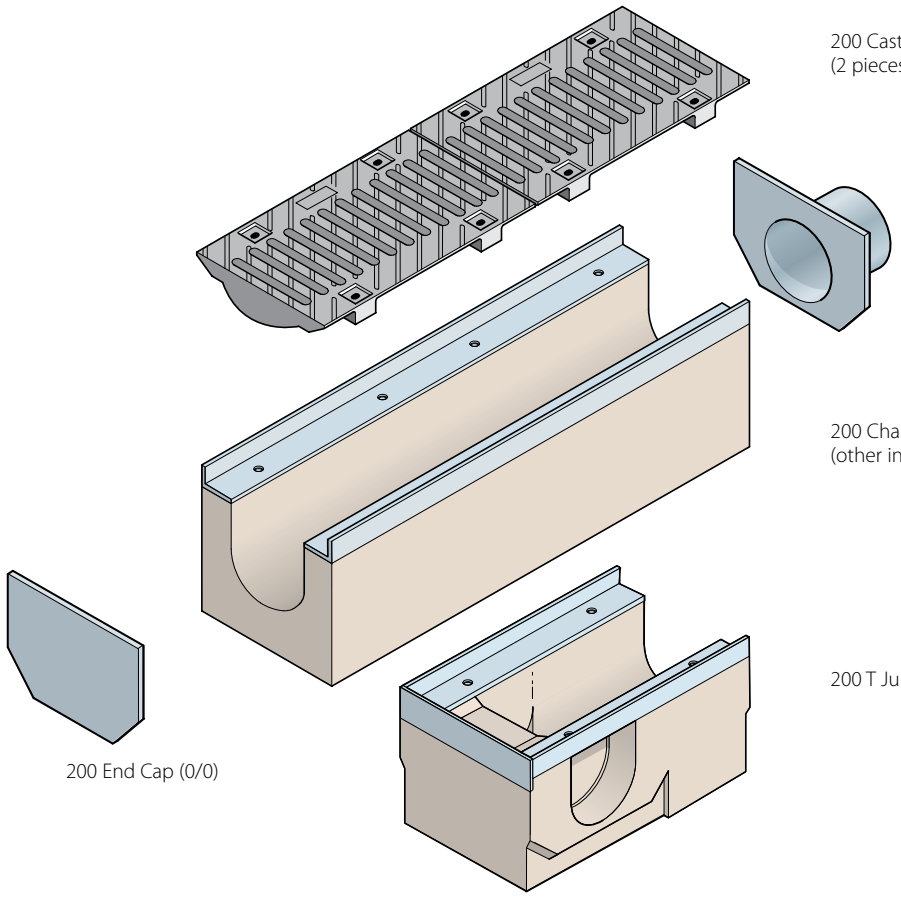
NBS Plus

Q10 180
Q10 115

Components

Grate Drainage System

- Birco 200 is a high capacity system, suitable for applications up to and including loading class F900, when used with appropriate grating.
- The Birco 200 system comprises of a range of channels, gratings and in-line outfalls.
- The grating and covers are secured by bolting stainless steel bolts into threaded steel sockets cast into the channel wall.
- Birco 200 channels are produced in 4 constant invert depths of 240, 265, 290 and 315mm designated 0/0, 5/0, 10/0 and 15/0 respectively, in 1000mm channel lengths.



200 Cast Iron Grating 200 x 18mm slots (2 pieces shown)

200 Cap Outlet (0/0) 198mm O.D.

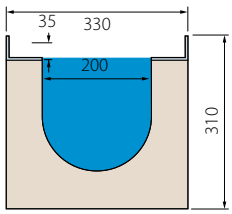
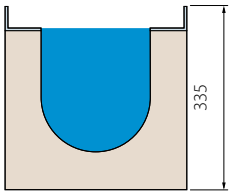
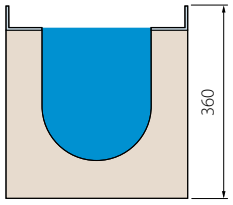
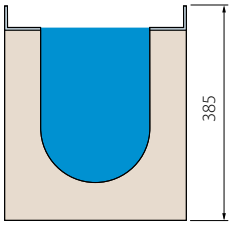
200 Channel (0/0) Constant Depth Invert (other invert depths available, see table)

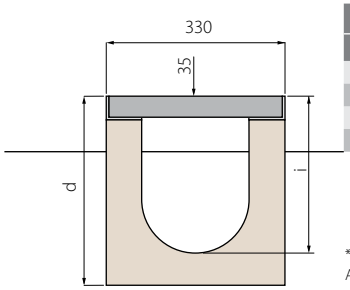
200 T Junction Channel (0/0)

200 End Cap (0/0)

Hydraulic Data

FLOW CAPACITY

Birco 200 with 0/0 Channel Unit	Birco 200 with 5/0 Channel Unit	Birco 200 with 10/0 Channel Unit	Birco 200 with 15/0 Channel Unit
 (0/0)	 (5/0)*	 (10/0)	 (15/0)*
 Equivalent Pipe Diameter (mm) 230	 Equivalent Pipe Diameter (mm) 245	 Equivalent Pipe Diameter (mm) 260	 Equivalent Pipe Diameter (mm) 270



BIRCO 200		
ref.	d	i
0/0	310	240
5/0	335	265
10/0	360	290
15/0	385	315

*-dimensions at downstream end; deduct 10mm for upstream end..
All dimensions measured from grating surface, pavement should be 5mm above this level.

The Birco hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the Colebrook-White formulae.

Birco 200								
Channel Type	**0/0**		**5/0**		**10/0**		**15/0**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	176	4.78	204	4.90	233	4.99	262	5.07
20	124	3.38	144	3.46	165	3.52	185	3.58
30	101	2.76	118	2.82	134	2.87	151	2.92
40	88	2.38	102	2.44	116	2.49	131	2.53
50	78	2.13	91	2.18	104	2.22	117	2.26
75	64	1.74	74	1.78	85	1.81	95	1.84
100	55	1.50	64	1.54	73	1.57	82	1.59
150	45	1.22	52	1.25	60	1.28	67	1.30
200	39	1.06	45	1.08	52	1.10	58	1.12
300	32	0.86	37	0.88	42	0.90	47	0.91
400	27	0.74	32	0.76	36	0.78	41	0.79
500	24	0.66	28	0.68	32	0.69	36	0.70
750	20	0.54	23	0.55	26	0.56	30	0.57
1000	17	0.47	20	0.48	23	0.49	26	0.49
1500	14	0.38	16	0.39	18	0.40	21	0.40
2000	12	0.33	14	0.33	16	0.34	18	0.35

Birco 200 Component Codes

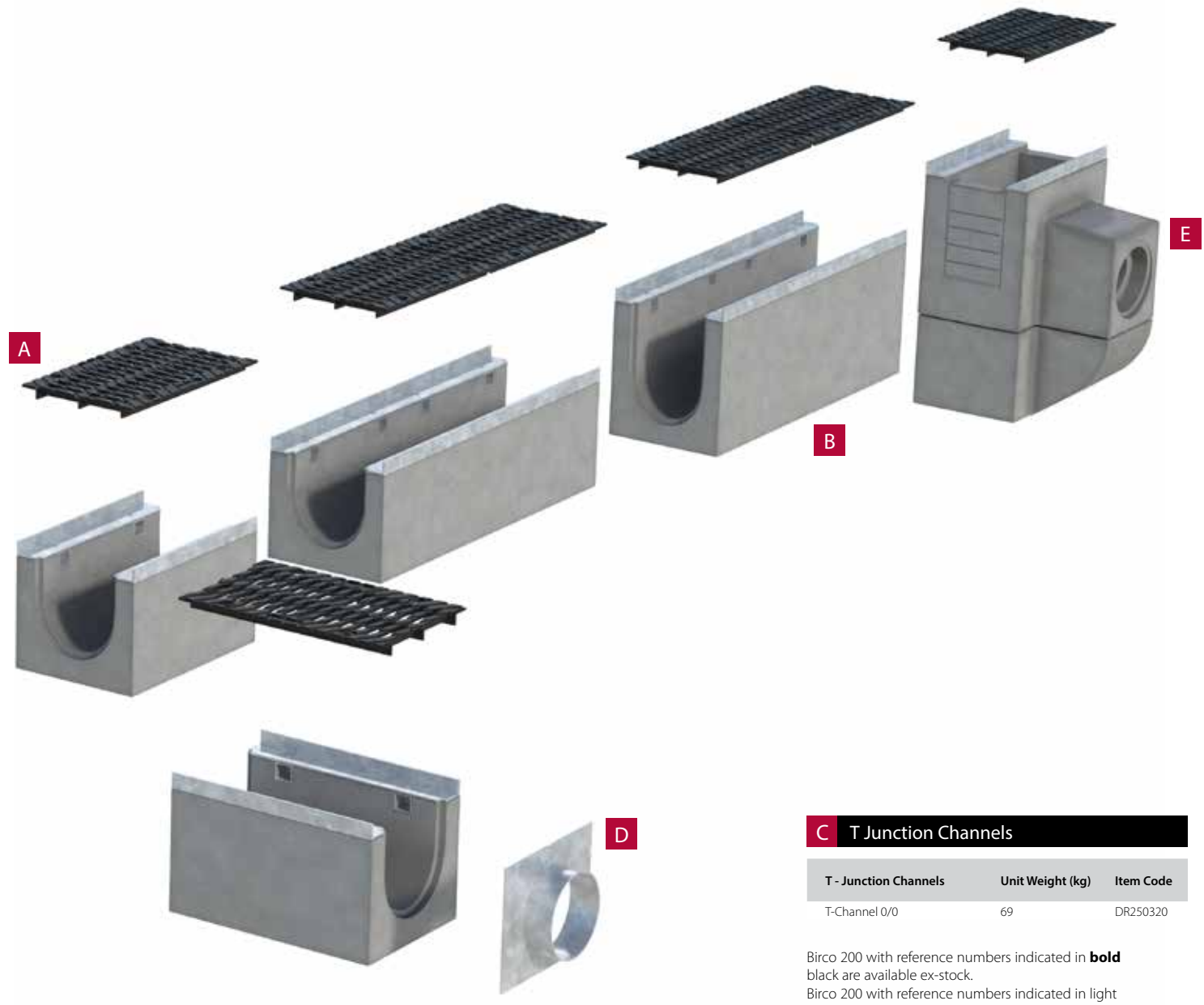
A Gratings

Gratings	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Item Code
18mm Slotted Cast Iron	E600	520	287	35	12.5	**DR2754100**

B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	330	200	310	240	142	**DR240300**
Channel 5/0	1000	330	200	335	265	140	DR240310
Channel 10/0	1000	330	200	360	290	147.5	DR240320
Channel 15/0	1000	330	200	385	315	153	DR240330

* Half meter channel are available upon request



C T Junction Channels

T - Junction Channels	Unit Weight (kg)	Item Code
T-Channel 0/0	69	DR250320

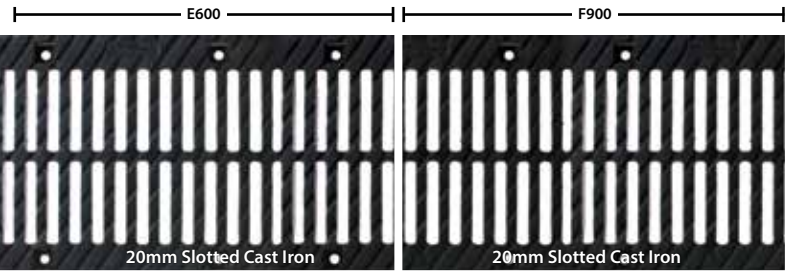
Birco 200 with reference numbers indicated in **bold** black are available ex-stock.
Birco 200 with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

D End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
200 End Cap	2	**DR280350**
200 Cap Outlet	2.5	**DR280370**

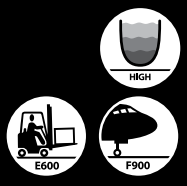
E Outfalls

Outfalls	Unit Weight (kg)	Item Code
200 Outfall 150mm Side	186	**DR290380**



Birco 300

Grate Drainage System



A high capacity linear drainage system which combines a robust concrete channel with a cast iron slotted grate. Suitable for loadings up to F900, Birco 300 is suitable for special projects with abnormally heavy wheel loads such as ports and aircraft pavements.

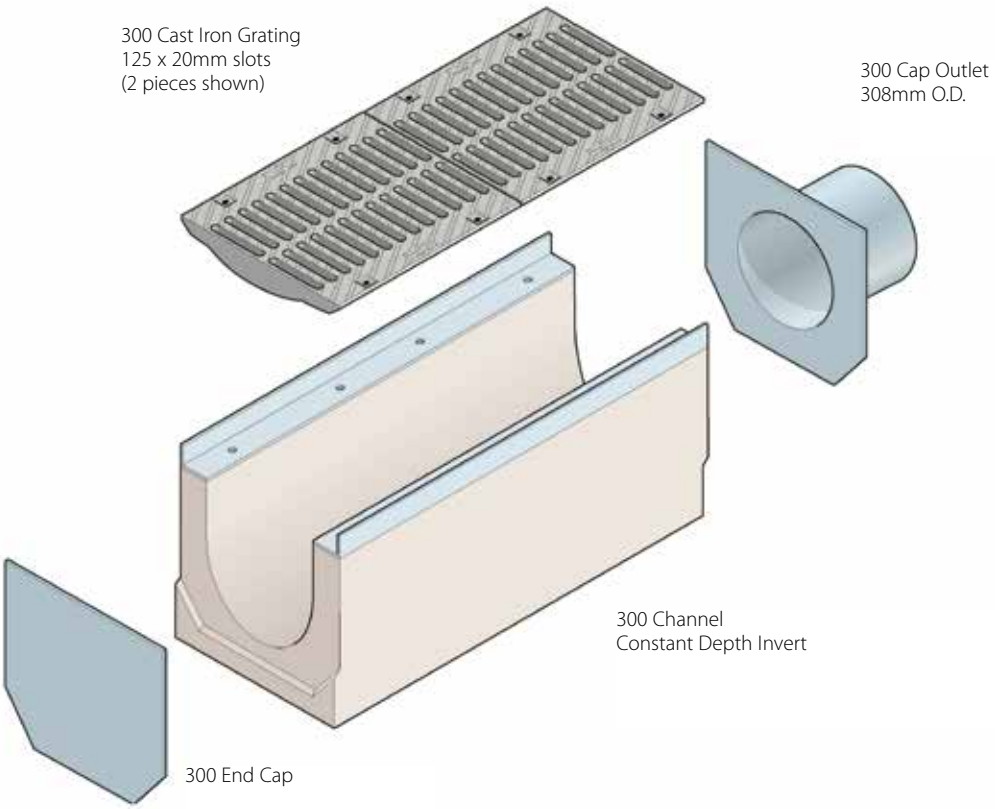
NBSPlus

Q10 115
Q10 180

Components

Grate Drainage System

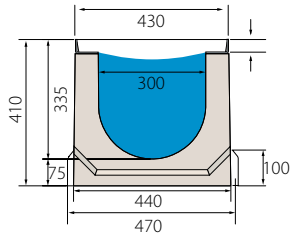
- Birco 300_{AS} has an increased flow capacity, designed to cater for the large surface discharges generated by areas such as aircraft pavements and industrial hardstandings.
- Birco 300_{AS} is suitable for applications up to and including Class F900 with the appropriate grating.
- The Birco 300_{AS} system comprises a single channel with a range of cast iron gratings.
- The grating and covers are secured by bolting stainless steel bolts into threaded steel sockets cast into the channel wall.
- Birco 300_{AS} channels are produced in 2 constant invert depths of 335mm and 475mm.



Hydraulic Data

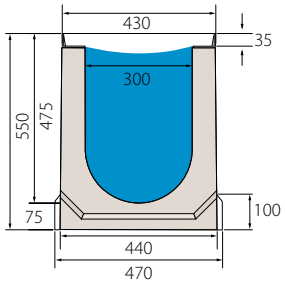
FLOW CAPACITY

Birco 300$_{AS}$



410mm Deep Channel

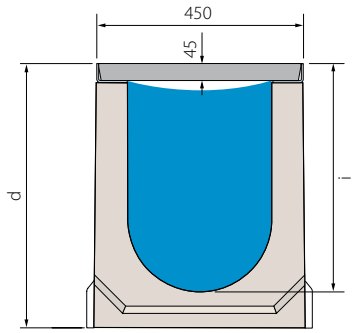
Equivalent Pipe Diameter 350mm



550mm Deep Channel

Equivalent Pipe Diameter 400mm

Birco 300$_{AS}$



ref.	d	i
DR3805000	410	335
DR3805200	550	475

All dimensions are measured from the grating surface, pavement should be 5mm above this level.

Birco 300				
Channel Type	**410**		**550**	
Gradient '1 in'	l/s	m/s	l/s	m/s
10	493.58	6.16	806.34	6.6
20	348.66	4.35	569.63	4.66
30	284.46	3.55	464.77	3.81
40	246.19	3.07	402.26	3.29
50	220.08	2.75	359.6	2.94
75	179.48	2.24	293.28	2.4
100	155.28	1.94	253.75	2.08
150	126.57	1.58	206.87	1.69
200	109.46	1.37	178.92	1.46
300	89.17	1.11	145.77	1.19
400	77.08	0.96	126.02	1.03
500	68.82	0.86	112.54	0.92
750	56	0.7	91.58	0.75
1000	48.36	0.6	79.1	0.65
1500	39.3	0.49	64.3	0.53
2000	33.9	0.42	55.48	0.45

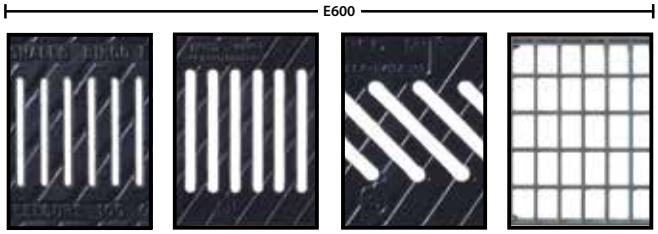
Component Codes

Gratings	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Item Code
20mm Slotted Cast Iron	E600	500	417	45	20.20	DR390620
20mm Slotted Cast Iron	F900	500	417	45	24.7	DR390630

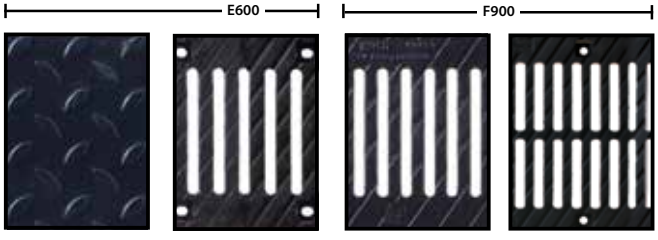
Base Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	430	300	410	290	228	DR380500
Channel 5/0	1000	430	300	550	430	228	DR380520

Channel Accessories	Unit Weight (kg)	Item Code
300 AS End Cap	2.5	DR395530
300 AS Cap Outlet	3	DR395540
300$_{AS}$ Outfall	220	DR395550

Birco 300 with reference numbers indicated in **bold** black are available ex-stock.
Birco 300 with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.



6mm Heelsure Cast Iron | 12mm Slotted Cast Iron | 13mm Diagonal Cast Iron | 20 x 30mm Mesh Galvanised Steel



Cast Iron Solid Cover | 18mm Slotted Cast Iron | 12mm Slotted Cast Iron | 20mm Slotted Cast Iron

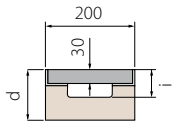
Birco Shallow

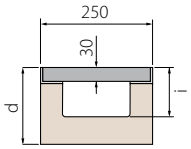
Grate Drainage System

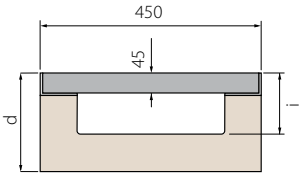
A low to medium capacity system and the perfect solution where excavation depths are limited. Available across a variety of cast iron, stainless steel or galavanised grates offering both aesthetic and loading choice. Supported by a comprehensive range of accessories and ancillary units making Birco Shallow ideal for civic, commercial and rail applications.

NBSPlus
Q10 180

Hydraulic Data







BIRCO 100 SHALLOW			BIRCO 150 SHALLOW			BIRCO 300 SHALLOW		
ref.	d	i	ref.	d	i	ref.	d	i
DR4204500	80	50	DR4304600	120	80	DR4504900	300	225
DR4204600	100	70	DR4304700	150	110			
DR4204800	150	110						

All dimensions are measured from the grating surface, pavement should be 5mm above this level.

Birco 100 Shallow

Channel Type	20 (80mm Deep)		40 (100mm Deep)		80 (150mm Deep)	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s
10	3.38	1.69	9.03	2.26	22.64	2.83
20	2.38	1.19	6.37	1.59	15.97	2
30	1.94	0.97	5.19	1.3	13.02	1.63
40	1.68	0.84	4.49	1.12	11.26	1.41
50	1.5	0.75	4.01	1	10.06	1.26
75	1.22	0.61	3.26	0.82	8.19	1.02
100	1.05	0.53	2.82	0.7	7.08	0.88
150	0.85	0.43	2.29	0.57	5.76	0.72
200	0.74	0.37	1.98	0.49	4.97	0.62
300	0.6	0.3	1.6	0.4	4.04	0.51
400	0.51	0.26	1.38	0.35	3.49	0.44
500	0.46	0.23	1.23	0.31	3.11	0.39
750	0.37	0.18	1	0.25	2.52	0.32
1000	0.32	0.16	0.86	0.21	2.17	0.27
1500	0.26	0.13	0.69	0.17	1.76	0.22
2000	0.22	0.11	0.59	0.15	1.51	0.19

Birco 150 Shallow

Channel Type	50 (120mm Deep)		80 (150mm Deep)	
Gradient "1 in"	l/s	m/s	l/s	m/s
10	20.77	2.77	39.43	3.29
20	14.65	1.95	27.83	2.32
30	11.95	1.59	22.69	1.89
40	10.33	1.38	19.63	1.64
50	9.23	1.23	17.54	1.46
75	7.52	1	14.29	1.19
100	6.49	0.87	12.35	1.03
150	5.28	0.7	10.05	0.84
200	4.56	0.61	8.68	0.72
300	3.71	0.49	7.06	0.59
400	3.2	0.43	6.1	0.51
500	2.85	0.38	5.44	0.45
750	2.31	0.31	4.41	0.37
1000	1.99	0.27	3.8	0.32
1500	1.61	0.21	3.08	0.26
2000	1.38	0.18	2.65	0.22

Birco 300 Shallow

Channel Type	180 (300mm Deep)	
Gradient "1 in"	l/s	m/s
10	285.6	5.29
20	201.71	3.74
30	164.55	3.05
40	142.4	2.64
50	127.28	2.36
75	103.78	1.92
100	89.77	1.66
150	73.16	1.35
200	63.26	1.17
300	51.51	0.95
400	44.51	0.82
500	39.74	0.74
750	32.31	0.6
1000	27.89	0.52
1500	22.65	0.42
2000	19.53	0.36

Component Codes

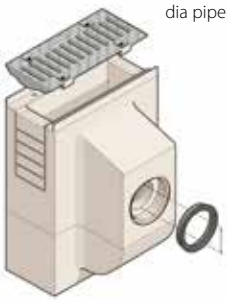
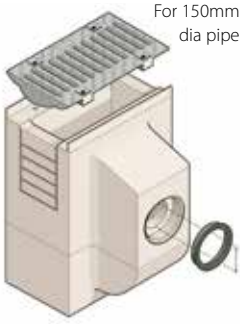
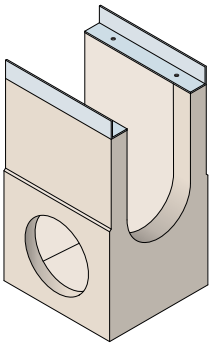
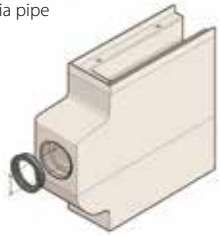
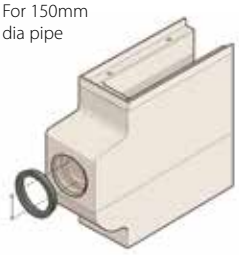
Gratings	Loading	Length (mm)	Width (mm)	Unit Weight (kg)	Item Code
Birco 100 6mm Heelsure Cast Iron	E600	500	187	7.2	**DR115135**
Birco 100 12mm Slotted Cast Iron	E600	500	187	6.2	DR115125
Birco 100 13mm Diagonal Cast Iron	E600	500	187	12.4	DR115020
Birco 100 20 x 30mm Mesh Galvanised Steel	E600	500	187	4.86	DR115285
Birco 100 Cast Iron Solid Cover	E600	500	187	7.46	DR115250
Birco 100 12mm Slotted Cast Iron	F900	500	187	7.4	DR115130
Birco 150 6mm Heelsure Cast Iron	E600	500	237	10.5	**DR195240**
Birco 150 12mm Slotted Cast Iron	E600	500	237	11.0	DR195210
Birco 150 12mm Slotted Galvanised Cast Iron	E600	500	237	11	DR197030
Birco 150 20 x 30mm Mesh Galvanised Steel	E600	500	237	7.36	DR197290
Birco 150 20 x 30mm Mesh Galvanised Steel	E600	1000	237	15	DR197280
Birco 150 Cast Iron Solid Cover	E600	500	237	10.3	DR195230
Birco 150 12mm Slotted Cast Iron	F900	500	237	12.20	DR195220
Birco 300 20mm Slotted Cast Iron	E600	500	417	20.20	DR390620
Birco 300 20mm Slotted Cast Iron	F900	500	417	24.7	DR390630

Base Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Channel Item Code
100 Shallow	1000	200	100	80	80	DR420450
	1000	200	100	100	100	DR420460
	1000	200	100	150	150	DR420480
150 Shallow	1000	250	150	120	120	DR430460
	1000	250	150	150	150	DR430470
300 Shallow	1000	430	300	300	300	DR420490

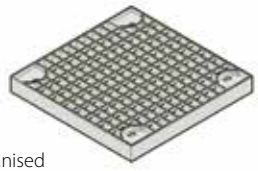
Birco Shallow with reference numbers indicated in **bold** black are available ex-stock.
Birco Shallow with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

Channel Accessories	Weight (kg)	Item Code
100 Shallow End Cap 80 - 120	0.02	DR425150
100 Shallow End Cap 150 - 200	0.03	DR425160
150 Shallow End Cap 120 - 150	0.03	DR435250
300 Shallow End Cap 300	0.06	DR455540

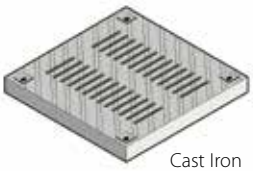
Birco Outfalls

Birco 100	Birco 150	Birco 200	Birco 300$_{AS}$
SIDE OUTFALLS			
For 150mm dia pipe  100 In-line Outfall 150 Side Trap (supplied in two sections with universal-fit seal and stopper included)	For 150mm dia pipe  150 In-line Outfall 150 Side Trap (supplied in two sections with universal-fit seal and stopper included)	For 150mm dia pipe  200 In-line Outfall, 150 Side Trap. (supplied in two sections with universal-fit seal and stopper included)	 300AS In-line Outfall, 300 side outlet (supplied in one section)
END OUTFALLS			
For 100mm dia pipe  100 In-line Outfall 100 In-line Trap (supplied in two sections with universal-fit seal and stopper included)	For 150mm dia pipe  150 In-line Outfall 150 In-line Trap (supplied in two sections with universal-fit seal and stopper included)		

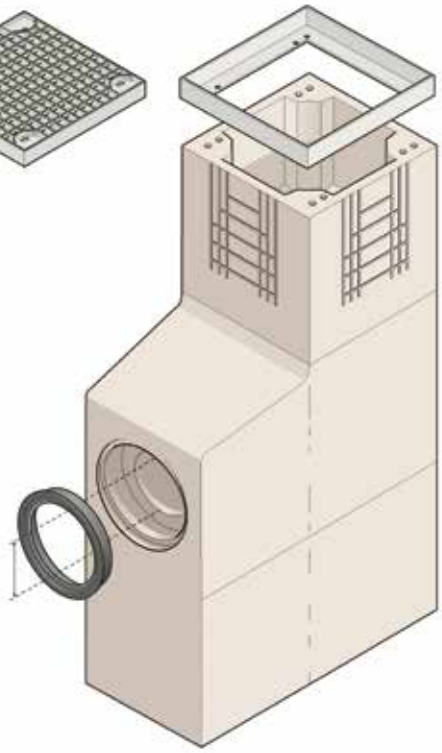
Birco System



Galvanised Junction/Outfall Grating 20 x 30mm mesh



Cast Iron Junction/Outfall Grating 100 x 8mm slots



For 150mm or 225mm dia. pipe

Junction/Outfall Unit (supplied in three sections, with frame & frame bolts, universal-fit seal and stopper included)

Hydraulic Data

Theoretical Outfall Capacities			
Outfall Type	**Outlet Pipe Diameter (mm)**	**m/s**	**l/s**
Birco 100 Inline End Outlet Outfall	100	2.27	11
Birco 100 Inline Side Outlet Outfall	150	2.42	26
Birco 150 inline End Outlet Outfall	150	2.42	26
Birco 150 inline Side Outlet Outfall	150	2.42	26
Birco 200 Inline Side Outlet Outfall	150	2.42	26
Birco 300 Inline Side Outlet Outfall	300	2.25	160
Junction Outfall 150mm	150	3.55	39
Junction Outfall 225mm	225	3.64	89

*The outfall capacities quoted are theoretical calculated figures

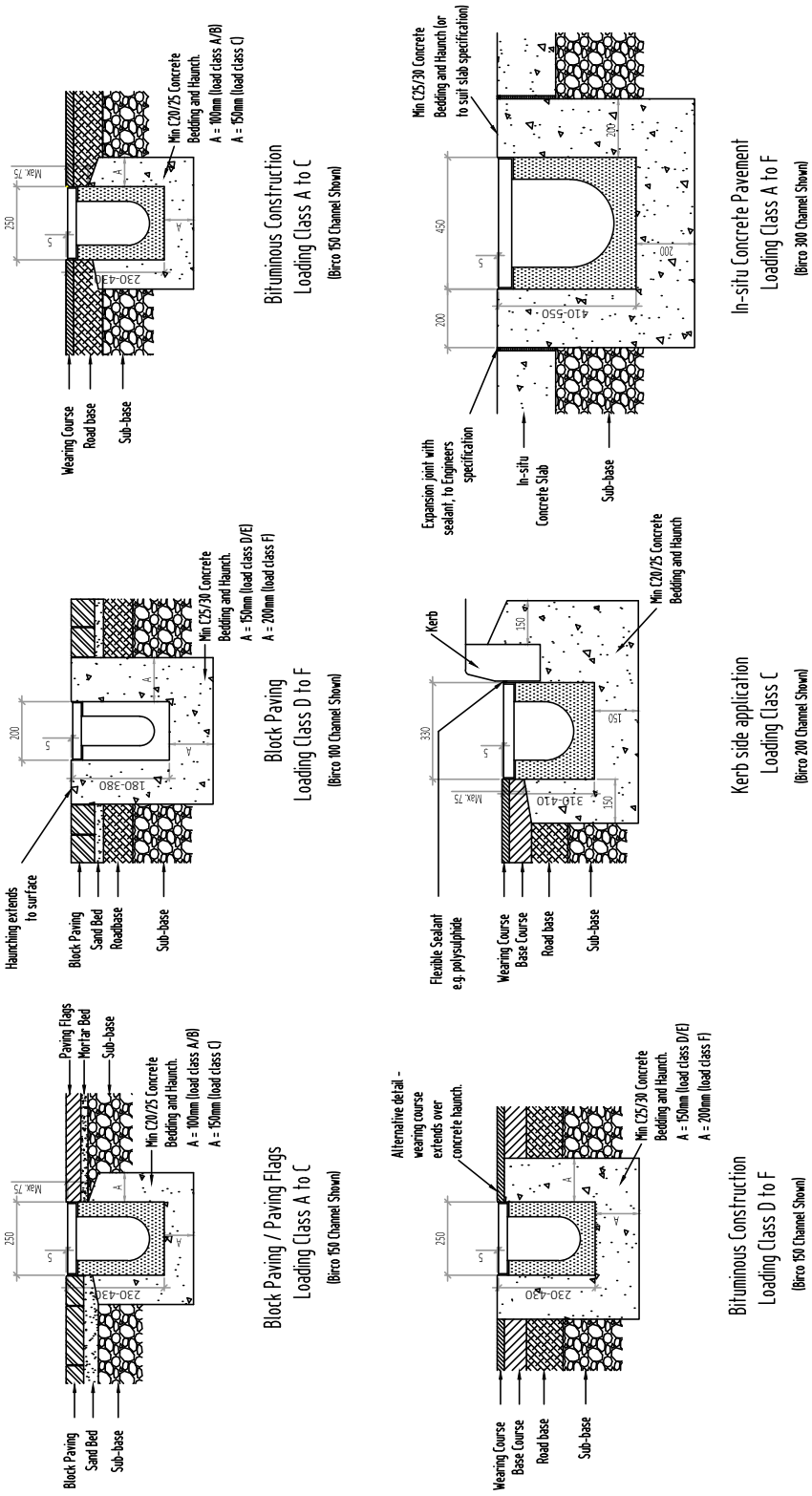
Component Codes

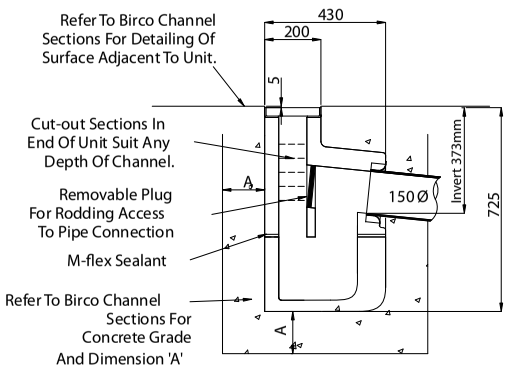
Birco 100 In-Line Outfalls and Standard Gratings*			
Item	**Description**	**Weight (kg)**	**Item Code**
Outfalls	100 In-line Trap (for 100mm dia pipe)	105	DR1301700
	150 Side Trap (for 150mm dia pipe)	142	**DR1301750**
Birco 150 In-Line Outfalls and Standard Gratings*			
Item	**Description**	**Weight (kg)**	**Item Code**
Outfalls	150 In-line Trap (for 150mm dia pipe)	140	DR2102700
	150 Side Trap (for 150mm dia pipe)	158	**DR2102800**
Birco 200 In-Line Outfall and Standard Gratings*			
Item	**Description**	**Weight (kg)**	**Item Code**
Outfalls	150 Side Trap (for 150mm dia pipe)	186	**DR2903800**
Birco 300$_{AS}$ Outfall			
Item	**Description**	**Weight (kg)**	**Item Code**
Outfalls	300$_{AS}$ Outfall	220	**DR3955500**
Birco System Junction Outfalls and Gratings*			
Item	**Description**	**Weight (kg)**	**Item Code**
Outfalls	Junction/Outfall 150 (for 150mm dia pipe)	340	DR4604000
	Junction/Outfall 225 (for225mm dia pipe)	305	DR4604050

*Special Gratings also available.
Items available ex-stock.
All outfall units are packed individually.

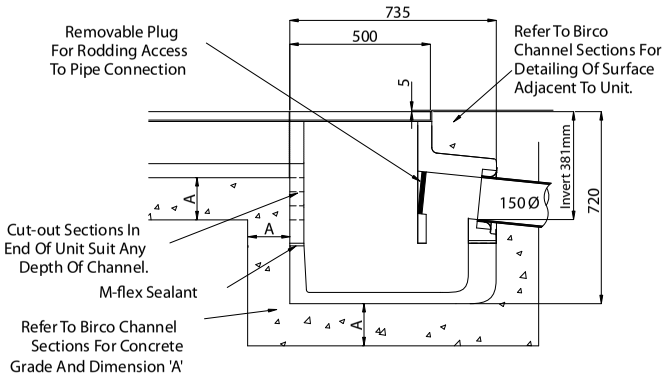
Standard Details

Drawing 1 of 2

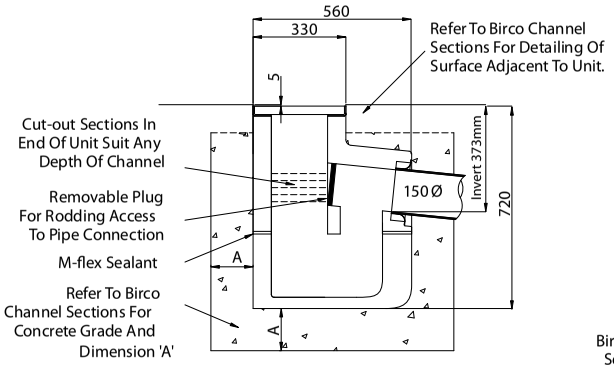




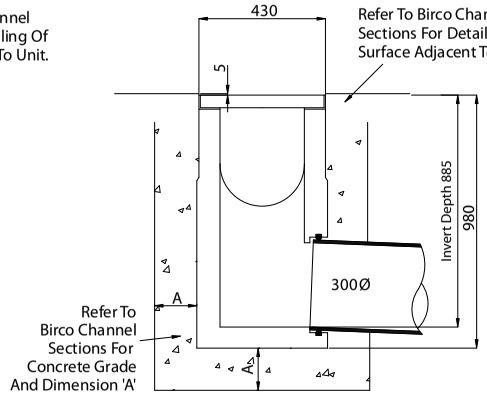
Birco 100 - Inline Side Outfall
(Unit Is 500mm Long)



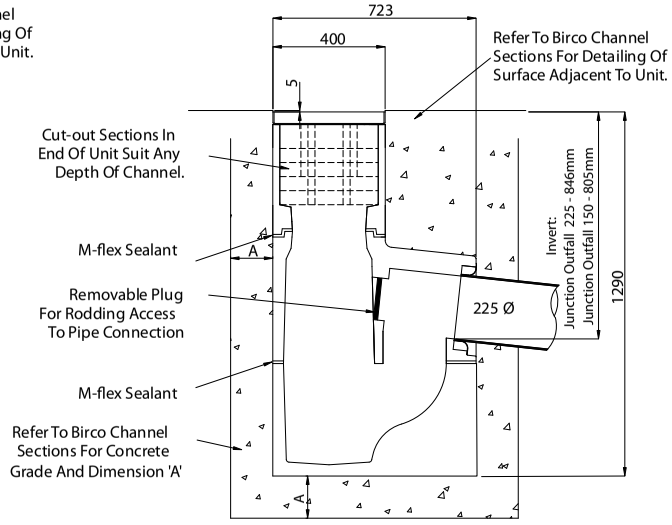
Birco 150 - Inline End Outfall
(Unit Is 250mm Wide)



Birco 200 - Inline Side Outfall
(Unit Is 500mm Long)



Birco 300$_{AS}$ Outfall
(Unit Is 500mm Long)



Birco Junction Outfall 150/225
(Unit Is 400mm Long)

Birco 100, 150, 200 & 300$_{AS}$ Outfall Details

Note: All Invert & Overall Depths Are Measured From Carriageway Surface

Standard Details

Notes For Birco Installation Details

Drawings 1 to 2

1. All loading applications are as defined in BS EN 1433:2002 "Drainage Channels for Vehicular and Pedestrian Areas - Classification, Design, Testing Requirements, Marking and Quality Control".

2. Birco outfall sections shall be jointed using Marshalls' M-Flex sealant.

3. The concrete grade and dimensions for bed, haunch and surround are shown in the Birco section of the Design Guide.

4. Where the concrete surround is taken to the surface, the concrete surround should have the appropriate freeze thaw resistance.

5. For high loading applications with poor conditions, consideration may be given to the local thickening of the sub-base.

6. Marshalls' vertical joint sealant, M-Flex, shall be applied to all vertical joints of the channels.

7. Birco gratings should be chosen to suit the appropriate loading application, taking into account both static and dynamic loading conditions.

8. Movement joints details that fully isolate the Birco system whilst maintaining restraint shall be provided adjacent to all concrete slabs even when the slab is covered by another material. The use of dowel bars in concrete slab joints is common and should be considered especially for higherloading applications.

9. All grating bolts should be tightened to the appropriate torque shown in the Birco section of the Design Guide.

10. The top surface of the grating shall be between 5mm below the final pavement level.

11. All dimensions are in millimetres.

Specification

Introduction

The following specification covers the complete Birco Linear Drainage System including ancillary fittings and is compatible with the Standard Detail Sheets.

Birco

1. The linear drainage system shall be ***100/150/200/300$_{AS}$, **** manufactured in pre-cast concrete, with the exception of certain fitments manufactured in steel or cast iron, as supplied by Marshalls, Halifax HX5 9HT in accordance with Standard Detail Sheets.

2. The linear drainage shall be a two part system consisting of galvanised steel/cast iron gratings/covers bolted to precast concrete drainage channels reference ***(0/0) /(5/0)/(10/0)/(15/0)/(20/0)**** deep together with drainage channels that have ***100-150-200 1.0%)**** inbuilt fall. The overall width of the system shall be not less than ***160/200/250/330/430**mm*.

3. All components of the Marshalls' Birco System shall comply with Load Classification ***C250/D400/E600/F900**** in accordance with BS EN 1433:2002 and the following:

   (i) The Gratings shall be bolted to the drainage channel with a minimum of ***4 No. M12/M16mm Ø stainless steel bolts per metre***

   (ii) The drainage channel will have cast-in ***4mm (100/150/200/300)**** thick galvanised steel edge angles

   (iii) The system shall have a minimum of ***refer to table**** mm^2/m water inlet aperture area

   (iv) The drainage channels shall have an invert width of ***100/150/200/300*mm****

4. The linear drainage system comprising gratings, covers, constant depth and inbuilt fall channels, outfalls, T junctions channels, end caps, cap outlets, and sealants shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.

Note: * delete as required

Construction

Introduction

Installation of the Marshalls' Birco Linear Drain System should be carried out in accordance with the Specification and Standard Detail Sheets. The following method of installation is recommended.

Excavation

Sufficient material should be excavated to accommodate the drainage channels, concrete bedding and haunching, any 'soft spots' or poorly compacted formation should be made good. The top of the Birco Channel shall be 5mm below the final pavement surface.

Channels and outfall units shall be bedded directly onto a freshly mixed concrete foundation as shown in the Birco Standard Detail Sheets, or alternatively bedded on a layer of Mortar Class 12 to BS EN 998-2:2003 not less than 10mm and not more than 40mm thick on a previously prepared concrete foundation.

Channels

Unless otherwise agreed, Channel Units shall be laid commencing at the outfall to previously established line and level. Setting out pins should be accurately located, with a string line level with the top of the drainage channels. Pins can be located to the rear of the channels to avoid having to lift components over the string line. Channel ends should abut as tightly as possible. The invert and surface levels of adjacent channels shall correspond. Any Units deviating more than 3mm in 3m from line and level shall be made good by lifting and relaying.

A complete line of Units shall be approved by the specifier before the completion of concrete haunching. Where cutting the Birco Channel Units is required, they shall be cut with a concrete saw or disc cutter, so that no single Unit is less than 350mm long. Birco gratings shall not be cut unless directed by the engineer. Any cut galvanised steel shall be renovated using Defcon Z, or similar approved.

In situ concrete haunching shall not be placed until the installed units have been inspected and approved by the specifier. The concrete haunching shall be of a concrete grade appropriate to the Drainage Channel Loading Class as specified in the contract or the Birco Standard Detail Sheets. Haunching shall be carried out as one operation to a complete line of Channel Units, to the dimensions indicated in the Birco Standard Detail sheets. Haunching / surround concrete to the Outfall Unit shall be of the same grade as the adjacent Channel Unit haunching in accordance with the Birco Standard detail sheets.

Where channels are laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the Units and haunching adjacent to the slab joints. Longitudinal movement joints shall also be formed between the haunching and the slabs as described in the contract and in accordance with Birco Drain Standard Detail Sheets.

Outfalls

Outfall Units shall be of the type specified in the contract and constructed as shown in the Birco Standard Detail Sheets. Unless otherwise described in the contract, they shall be bedded on and surrounded by 150mm of concrete of the appropriate grade. A suitable section of the wall of the outfall unit shall be cut out to allow adjacent drainage channels to abut without restricting the flow of water. Cutting shall be achieved by using a concrete saw or disc cutter. The horizontal joints between the sections of the outfall units shall be sealed with M-Flex sealant. The appropriate pipe adaptor shall be placed in the aperture for connection to the underground pipework.

Joint Sealant

Jointing of adjacent channels shall be carried prior to fixing the gratings. Marshalls' M-Flex sealant should be gunned into the sealant groove formed when adjacent channels abut. Surplus sealant shall be removed from the inner surface of the units as work proceeds.

One tube of M-Flex is suffient to seal the following:-

M-Flex Requirement	
Base Type	**Channels per tube**
BIRCO 100	
0/0	22
5/0	16
10/0	13
15/0	11
20/0	9
BIRCO 150	
0/0	15
5/0	13
10/0	11
15/0	10
20/0	8
BIRCO 200	
0/0	11
5/0	10
10/0	9
15/0	8
IBF 16-20	8

Gratings

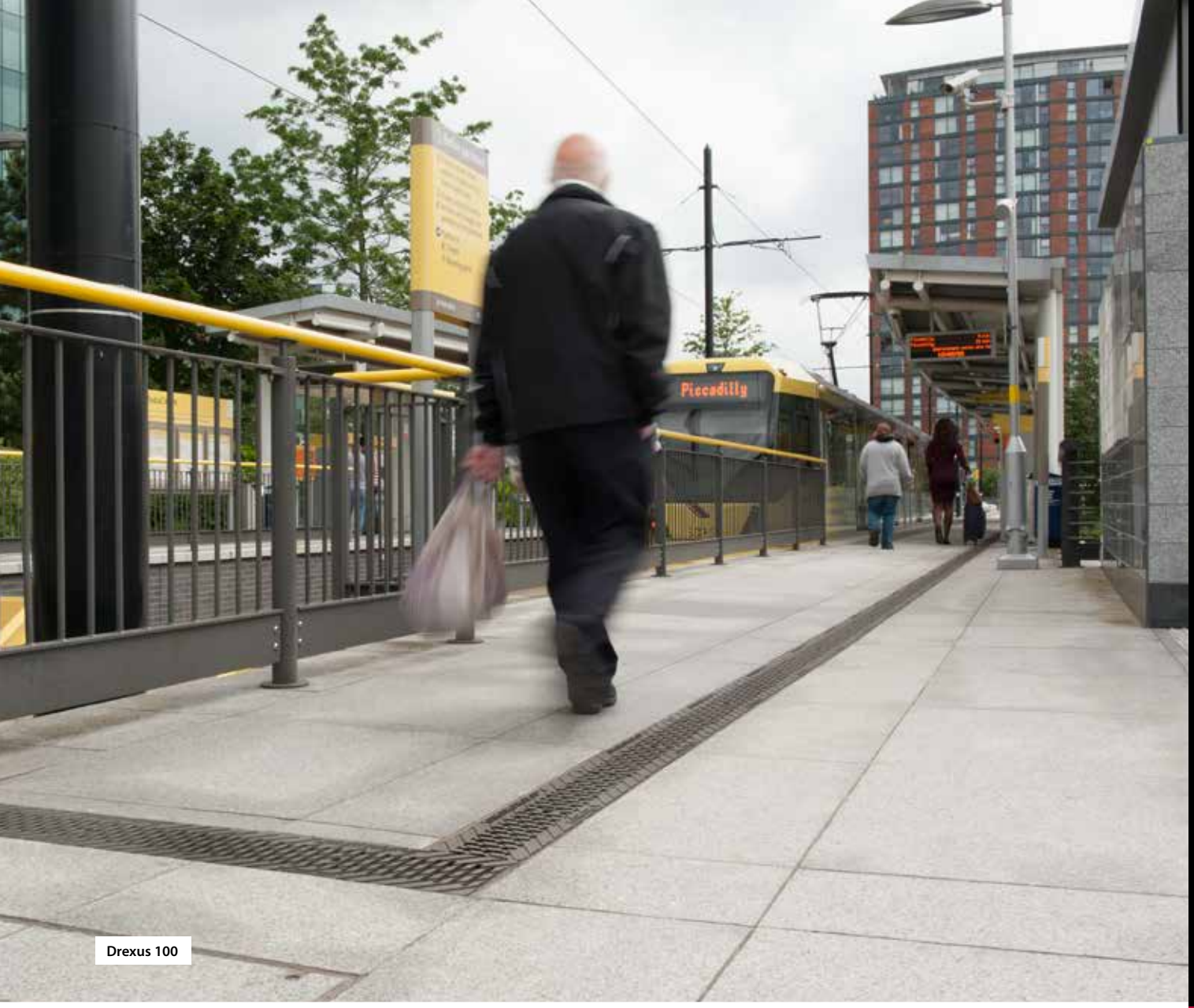
Adjacent Carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed.

Unless agreed with the specifier, Birco gratings shall be securely bolted to Birco Channel Units having internal depths greater than 150mm, before adjacent pavement construction is commenced.

On completion of the works, the drainage channel units shall be cleaned out and left free from obstruction. This shall be carried out either by removal of gratings or by high pressure water jetting (100-150 bar at 200 litres/min minimum). Unless otherwise agreed with the specifier, the slot openings shall be covered by timber boards or other method during jetting operations. Outfall units shall be emptied. The cleaning process should be repeated where necessary on completion of any remedial works.

All gratings shall be evenly spaced with bolts tightened down securely to the appropriate torque (100, 150 and 200: 75 Nm, 300:100Nm).

Drexus 100



Drexus 100

B125

6mm Heelsure
Cast Iron

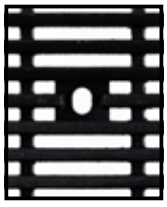
C250

6mm Heelsure
Cast Iron

12mm Slotted
Cast Iron

30 x 15mm Mesh
Galvanised Steel

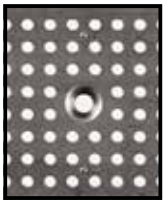
C250



Longitudinal Bar
Cast Iron

12mm Slotted
Galvanised Steel

12mm Slotted
Stainless Steel

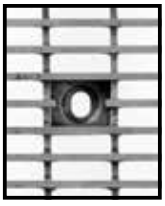


8mm Perforated
Galvanised Steel

C250

8mm Perforated
Stainless Steel

D400



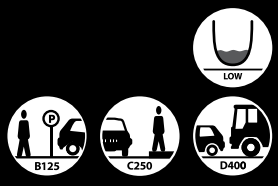
Longitudinal Bar
Galvanised Steel

6mm Heelsure
Cast Iron

12mm Slotted
Cast Iron

Drexus 100

Grate Drainage System



Marshalls Drexus 100 is a cost effective lighter weight linear drainage system providing loading of up to D400 when used with the range of Drexus 100 cast Iron grates. With wall thicknesses of just 30mm, and its scalloped side walls this unit is the lightest within the Marshalls channel range.

Available for both pedestrian and standard trafficking applications, making it suitable for a variety of projects including civic, commercial and rail applications.

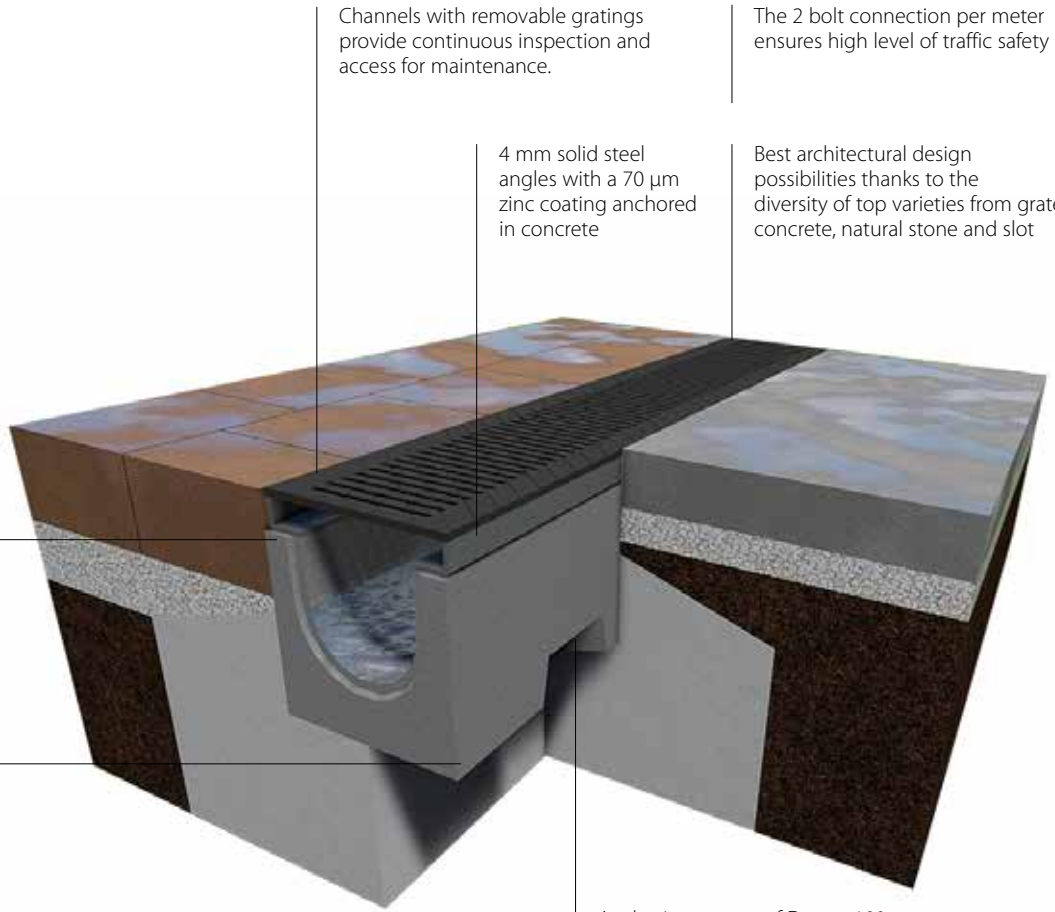
NBS Plus

Q10 180

Drexus 100

Grate Drainage System

- Drexus 100 is a robust general purpose linear drainage system for applications up to and including Load classification D400 when used with the Drexus 100 grating.
- Available for both pedestrian and standard trafficking applications, making it suitable for a variety of projects including civic, commercial and rail applications.
- The system comprises a range of channels, gratings and in-line outfalls with a common junction outfalls.
- Drexus 100 benefits a wall thickness of 30mm, resulting in this unit being the lightest Marshalls channel within the range.
- Gratings are securely fixed to the channel units by bolting through the grating to locking bars fitted into preformed recesses under the galvanised angles.
- Drexus 100 uses high quality 4 mm solid steel angles with a 70µm zinc coating for corrosion resistance.
- Anchors stably connect the solid steel angles with the concrete channels making it possible to conduct sealing of the base courses directly at the channel/solid steel edge when laying the channels.
- The anchoring system of Drexus 100 channels firmly bond the drainage channel to the adjoining base structure. When professionally laid, this virtually excludes the possibility of the sway or disengagement of the channels from the base structure.
- In order to ensure a permanently stabile connection between the individual channel units, all Drexus concrete channels are fitted with a DIN EN 1433-compliant safety sealing joint. Each safety sealing joint is visible from above, making inspection fast and easy
- 2 locking bars are provided per 1000mm length of channel.
- Drexus 100 channels are produced in 4 constant invert depths of 120, 145, 170, 195, 220mm – in 1000mm and 500mm channel lengths
- Channels with transition falls are available – 4 transition fall channels with a gradient to 2.5%. transition fall channels are 1000mm long



Drexus 100 Components

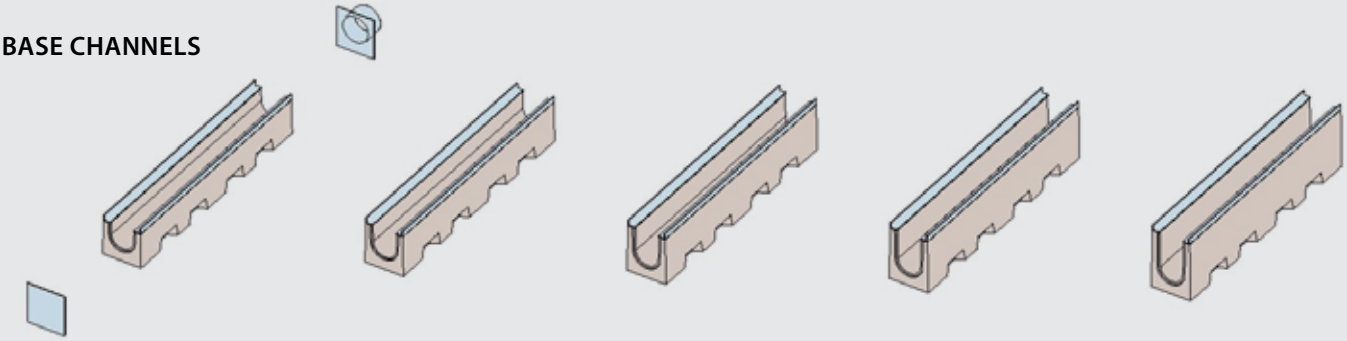
TOP COMPONENTS

Drexus 100 Gratings

BASE COMPONENTS

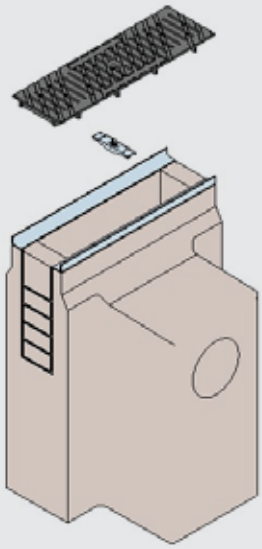
Base channels are available in 1000mm or 500mm lengths

BASE CHANNELS



0/0 Channel | 5/0 Channel | 5/0 Channel | 15/0 Channel | 20/0 Channel

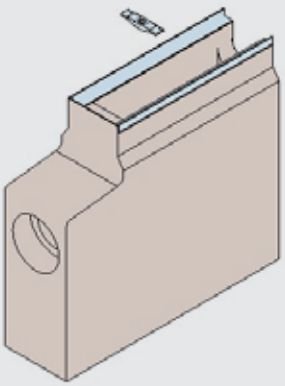
OUTFALLS



Inline Side Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- Side outlet for 150mm diameter pipework with universal sea.
- Cut-out panels in the silt box allows Drexus 100 runs from both sides

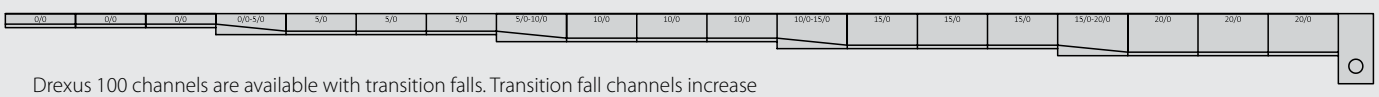
Note: Drexus 100 grate available separately.



Inline End Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- End outlet for 100mm diameter pipework with universal seal.
- Cut-out panels in the silt box allows Drexus 100 runs from both side.

Note: Drexus 100 grate available separately.

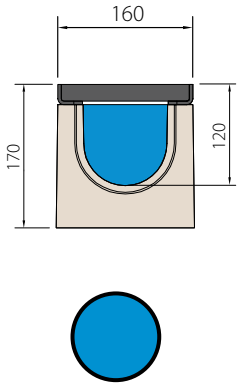
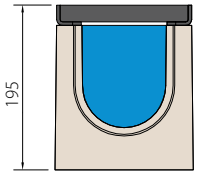
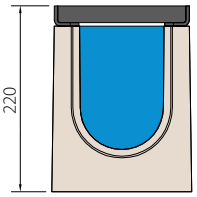
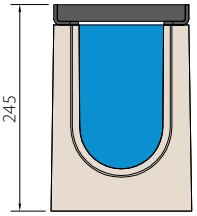
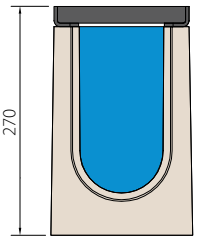
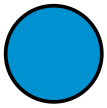
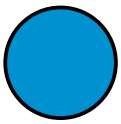
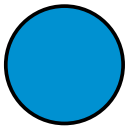
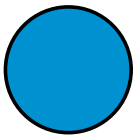


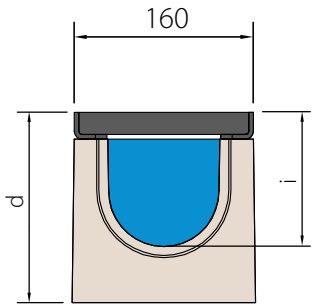
Drexus 100 channels are available with transition falls. Transition fall channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition falls are 1000mm long

Fig.11
Stepped constant depth channels laid on sloping ground

Hydraulic Data

FLOW CAPACITY

Drexus 100 0/0 Channel Unit	Drexus 100 5/0 Channel Unit	Drexus 100 10/0 Channel Unit	Drexus 100 15/0 Channel Unit	Drexus 100 20/0 Channel Unit
				
				
Equivalent Pipe Diameter (mm) 105	Equivalent Pipe Diameter (mm) 115	Equivalent Pipe Diameter (mm) 130	Equivalent Pipe Diameter (mm) 140	Equivalent Pipe Diameter (mm) 150

Drexus 100


ref.	d	i
0/0	170	185
5/0	195	210
10/0	220	235
15/0	245	260
20/0	270	285

Hydraulic Data

Drexus 100										
Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	27	3.02	35	3.15	44	3.25	53	3.31	62	3.36
20	19	2.13	25	2.23	31	2.29	37	2.33	43	2.37
30	15	1.74	20	1.81	25	1.87	30	1.9	35	1.93
40	13	1.5	18	1.57	22	1.62	26	1.65	31	1.67
50	12	1.34	16	1.4	20	1.44	24	1.47	27	1.5
75	10	1.09	13	1.14	16	1.18	19	1.2	22	1.22
100	8	0.94	11	0.99	14	1.02	17	1.04	19	1.05
150	7	0.77	9	0.8	11	0.83	13	0.84	16	0.86
200	6	0.66	8	0.69	10	0.72	12	0.73	14	0.74
300	5	0.54	6	0.56	8	0.58	9	0.59	11	0.6
400	4	0.47	5	0.49	7	0.5	8	0.51	10	0.52
500	4	0.42	5	0.43	6	0.45	7	0.46	8	0.46
750	3	0.34	4	0.35	5	0.36	6	0.37	7	0.38
1000	3	0.29	3	0.3	4	0.31	5	0.32	6	0.32
1500	2	0.23	3	0.25	3	0.25	4	0.26	5	0.26
2000	2	0.2	2	0.21	3	0.22	4	0.22	4	0.23
Equivalent pipe diameter	105mm		115mm		130mm		140mm		150mm	

Theoretical Outfall Capacities			
Outfall Type	**Outlet Pipe Diameter**	**m/s**	**l/s**
Drexus 100 Inline End Outlet Outfall	100mm	2.23	11
Drexus 100 Inline Side Outlet Outfall	150mm	2.39	26

Drexus 100 Component Codes

A Gratings

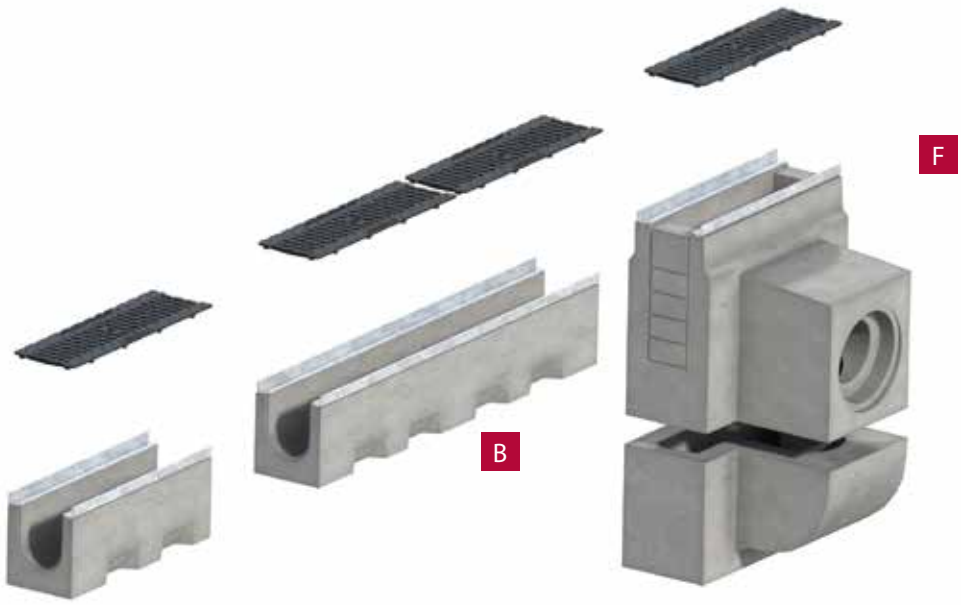
Gratings	Loading	Length (mm)	Width (mm)	Unit Weight (kg)	Item Code
6mm Heelsure Cast Iron	B125	500	153	3.8	DR544010
6mm Heelsure Cast Iron	C250	500	153	3.8	DR544020
12mm Slotted Cast Iron	C250	500	153	3.9	DR544030
30 x 15mm Mesh Galvanised Steel	C250	500	153	4.2	DR544170
30 x 15mm Mesh Galvanised Steel	C250	1000	153	8.4	DR544165
Longitudinal Bar Galvanised Steel	C250	500	153	2.8	DR544060
Longitudinal Bar Galvanised Steel	C250	1000	153	5.8	DR544070
Longitudinal Bar Cast Iron	C250	500	153	4.6	DR544080
8mm Perforated Galvanised Steel	C250	500	153	2.6	DR544090
8mm Perforated Galvanised Steel	C250	1000	153	5.3	DR544100
8mm Perforated Stainless Steel	C250	500	153	2.7	DR544110
8mm Perforated Stainless Steel	C250	1000	153	5.4	DR544130
12mm Slotted Galvanised Steel	C250	500	153	2.6	DR544140
12mm Slotted Galvanised Steel	C250	1000	153	5.4	DR544150
12mm Slotted Stainless Steel	C250	500	153	2.7	DR544160
12mm Slotted Stainless Steel	C250	1000	153	5.6	DR544180
6mm Heelsure Cast Iron	D400	500	153	4.5	**DR544040**
12mm Slotted Cast Iron	D400	500	153	4.95	**DR544050**

B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	160	100	170	120	38	**DR540015**
Channel 5/0	1000	160	100	195	145	46	**DR540025**
Channel 10/0	1000	160	100	220	170	54	DR540035
Channel 15/0	1000	160	100	245	195	62	DR540045
Channel 20/0	1000	160	100	270	220	70	DR540055
Channel 0/0	500	160	100	170	120	19	DR540515
Channel 5/0	500	160	100	195	145	23	DR540525
Channel 10/0	500	160	100	220	170	27	DR540535
Channel 15/0	500	160	100	245	195	31	DR540545
Channel 20/0	500	160	100	270	220	35	DR540555

C T Junction Channels

T Junction Channels	Unit Weight (kg)	Item Code
T- Channel 0/0	19	DR543700
T-Channel 10/0	27	DR543710
T-Channel 20/0	35	DR543720



D Channel Transitions

Channel Transitions	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
0/0 - 5/0	1000	160	100	170/195	120/145	41	**DR542010**
5/0 - 10/0	1000	160	100	195/220	145/170	45	**DR542020**
10/0 - 15/0	1000	160	100	220/245	170/195	48	DR542030
15/0 - 20/0	1000	160	100	245/270	195/220	52	DR542040

Drexus 100 Channels are available with transitions. Transition Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition channels are 1000mm long.

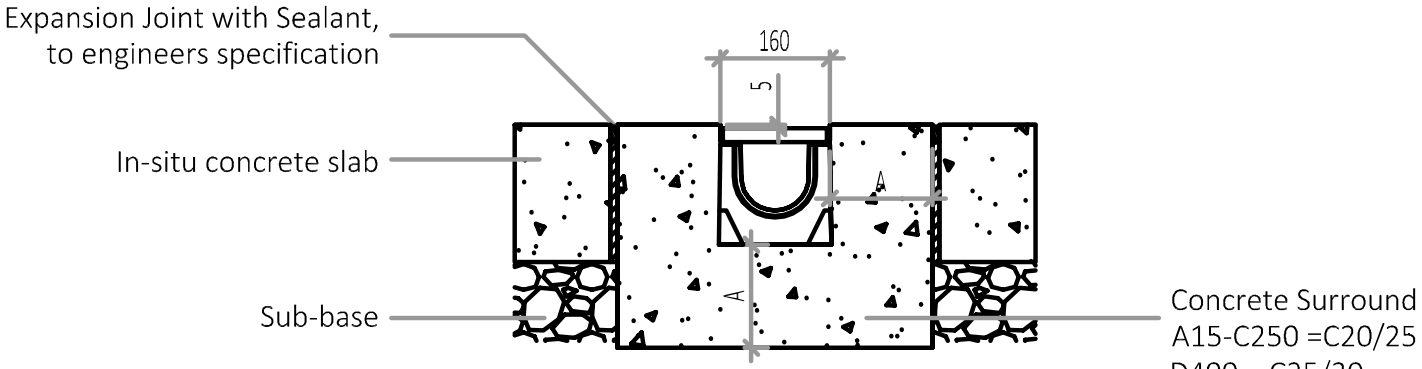
E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
End Cap 0/0	1	**DR537910**
End Cap 5/0	1.2	**DR537920**
End Cap 10/0	1.4	DR537930
End Cap 15/0	1.6	DR537940
End Cap 20/0	1.8	**DR537950**
Cap Outlet 0/0	1	**DR538410**
Cap Outlet 5/0	1.2	**DR538420**
Cap Outlet 10/0	1.4	DR538430
Cap Outlet 15/0	1.6	DR538440
Cap Outlet 20/0	1.8	**DR538450**

F Outfalls

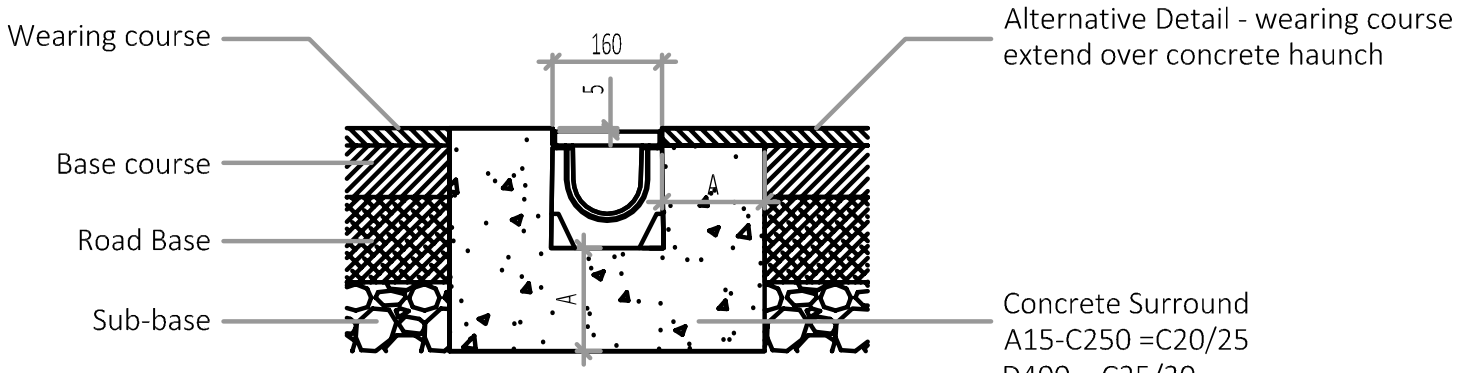
Outfalls	Unit Weight (kg)	Item Code
Side Outfall	137	**DR538510**
End Outfall	101	DR538520

Drexus 100 with reference numbers indicated in **bold** black are available ex-stock.
Drexus 100 with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.



Drexus 100 - In-situ Concrete Pavement Loading class up to D400

A = 100mm (load class A&B)
A = 150mm (load class C&D)

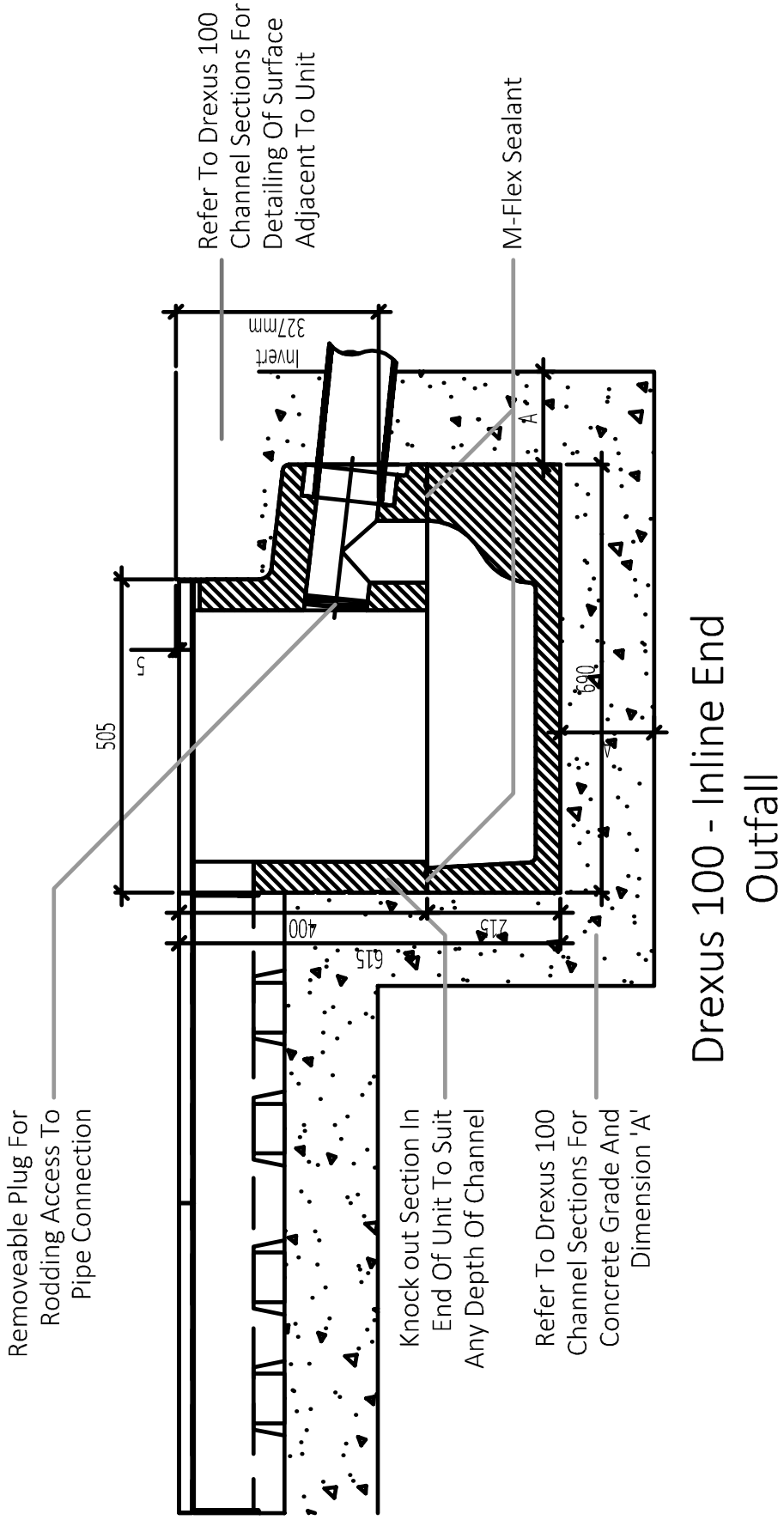


Drexus 100 - Bituminous Construction Loading class up to D400

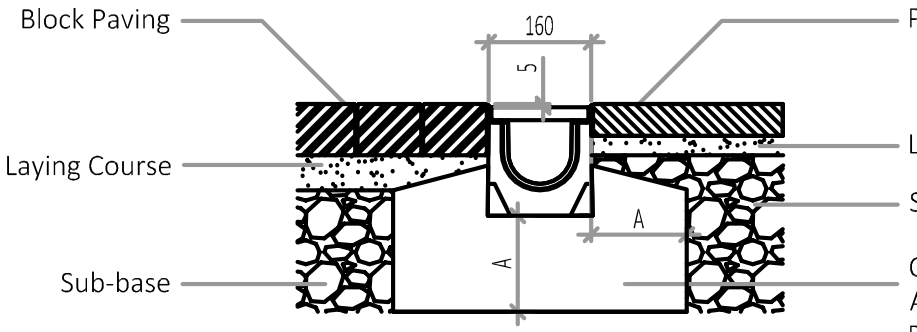
A = 100mm (load class A&B)
A = 150mm (load class C&D)

Drawing 1 of 3

Drawing 2 of 3

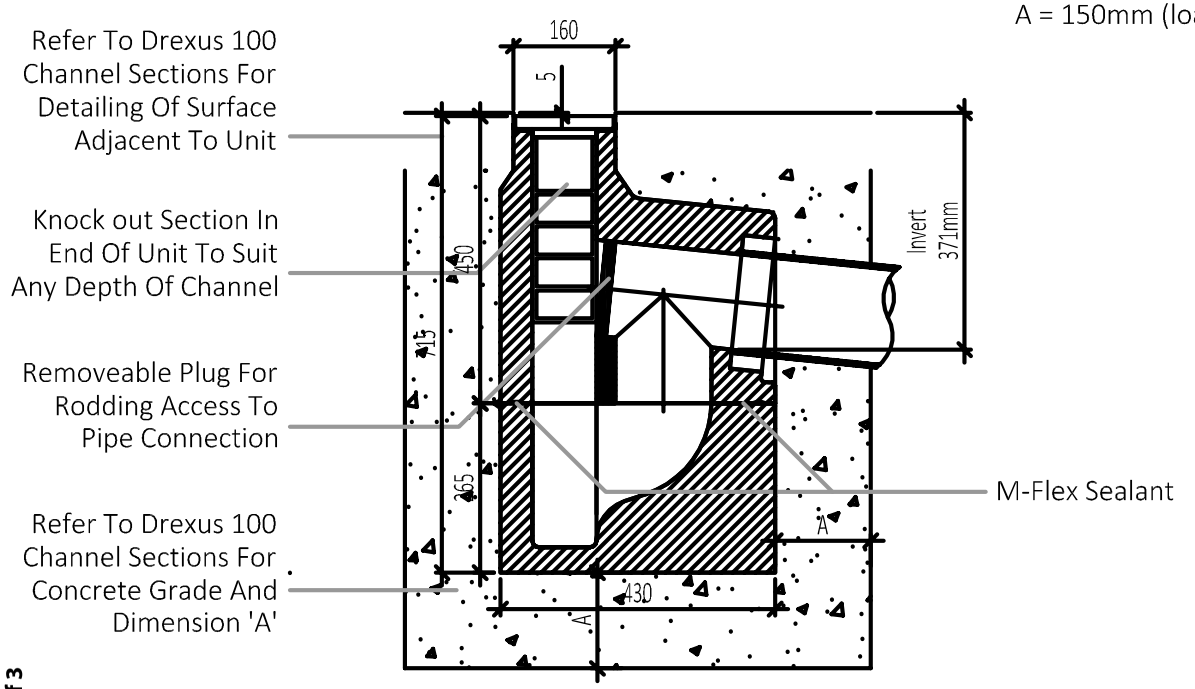


Drexus 100 - Inline End Outfall



Drexus 100 - Block paving/ Paving flags Loading class up to D400

A = 100mm (load class A&B)
A = 150mm (load class C&D)



Drexus 100 - Inline Side Outfall

Drawing 3 of 3

Standard Details

Notes for Drexus 100

Drawings 1 to 3

1. All dimensions are in millimetres.
2. All loading applications are as defined in BS EN 1433:2002 "Drainage Channels for Vehicular and Pedestrian Areas - classification, Design, Testing Requirements, and Evaluation of Conformity'".
3. Outfall sections shall be jointed using Marshall's' M-Flex sealant.
4. Vertical joints shall be jointed using Marshall's M-Flex sealant.
5. The concrete grade and dimensions for bed, haunch and surround are shown in the Drexus 100 section of the Design Guide.
6. Where the concrete surround is taken to the surface; the concrete should have the appropriate freeze thaw resistance.
7. For high loading applications with poor native ground conditions, consideration may be given to the local thickening of the sub-base.
8. Drexus 100 gratings should be chosen to suit the appropriate loading application, taking into account both static and dynamic loading conditions.
9. Movement joints details that fully isolate the Drexus 100 system whilst maintaining restraint shall be provided adjacent to all concrete slabs even when the slab is covered by another material. The use of dowel bars in concrete slab joints is common and should be considered especially for higher loading applications.
10. All grating bolts should be tightened to the appropriate torque shown in Drexus 100 section of the Design Guide.
11. The top surface of the grating shall be 5mm below the finished pavement level.
12. Mortar shall be Class 12 to BS EN 988-2:2003
13. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes. These may differ from customer requirements and site conditions and should be checked and accepted by the Engineer for project use.

Specification

Introduction

The following specification covers the complete Drexus 100 linear drainage system including ancillary fittings and is compatible with the standard detail drawings.

Drexus 100

1. The linear drainage system shall be Drexus 100 supplied by Marshalls plc. All channel materials and ancillary products detailed in this specification shall be supplied by Marshalls.
2. All components of the system shall be type tested and be fully compliant with the requirements of BS EN 1433:2002: Drainage channels for vehicular and pedestrian areas – Classification, design and testing requirements, marking and evaluation of conformity' when installed as per manufacturers recommendations.
3. The linear drainage system shall be Drexus 100 manufactured in pre-cast concrete, with the exception of certain fitments manufactured in steel or cast iron, as supplied by Marshalls in accordance with Standard Detail Sheets.
4. The linear drainage shall be a two part system consisting of ***galvanised steel/cast iron gratings/covers*** bolted to precast concrete drainage channels reference ***(0/0; 5/0; 10/0; 15/0; 20/0)**** deep.
5. All components of the Marshalls' Drexus 100 System shall comply with Load Classification ***C250/D400/E600/F900**** in accordance with BS EN 1433:2002 and the following:
   i. The gratings shall be bolted to the drainage channel with a minimum of ***4 No. M12 stainless steel bolts per metre / one centrally located M12 stainless steel bolt fixed to a locking bar****.
   ii. The drainage channel will have cast-in nominal 4mm thick galvanised steel edge angles.
   iii. The system shall have a minimum of ***refer to table**** mm^2/m water inlet aperture area.
   iv. The drainage channels shall have an invert width of 100 mm.
   v. The overall width of the channel shall be 160 mm.
   vi. The vertical channel surfaces and joints shall be made water tight using Marshalls' M-Flex sealant.
6. The linear drainage system comprising gratings, covers, constant depth and transition channels, outfalls, T junctions channels, end caps, cap outlets, and sealants shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.
7. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or ***as detailed in the contract / WRc Sewers for Adoption; 7th Edition : 2012 / BS EN 752:2008 / BS 8000: Part 14:1989****

Note: * delete as required

Construction

Excavation

1. Sufficient material should be excavated to accommodate channel units, concrete bedding and haunching.
2. Any 'soft spots' or poorly compacted formation should be made good.

Setting Out

1. Setting out pins should be accurately located to the correct line and level with a string line level with the top rear corners of the channel units.
2. It may be advantageous to locate setting out pins to the rear of the units to avoid having to lift the units over the string line.

Outfalls

1. Drexus Outfalls should be installed first.
2. Sufficient material should be excavated to accommodate the trapped Drexus Gulley.
3. 150mm of C25/30 mix (BS 8500-1&2) concrete of the appropriate mix is placed in the bottom of the excavation.
4. The bottom section of the two part Drexus Gulley is lowered into position, with the appropriate pipe adaptor placed the aperture for connection to the underground pipework.
5. A suitable section of the wall of the outfall unit shall be cut out to allow adjacent drainage channels to abut without restricting the flow of water. Cutting shall be achieved by using a concrete saw or disc cutter.
6. Sufficient M-Flex sealant is gunned onto the top horizontal surface of the bottom section of the two part Drexus Gulley so as to provide a seal between the top and bottom sections.
7. The top section of the two part Drexus Gulley is lowered into position
8. The bedding concrete should be laid and brought up to the appropriate level dependant on surface finish as shown in the Drexus 100 Standard Detail Sheet.

Channel Installation

1. Bedding concrete of the appropriate thickness and depth shall be laid as specified in the Drexus Standard Detail Sheets.
2. The top of the Drexus Channel shall be 5mm below the final pavement surface.
3. Channel Units shall be laid onto the freshly mixed bedding concrete, starting at the outfall, i.e. working uphill
4. Alternatively, the Channel Units may be bedded on to a layer of 10 to 40mm cement mortar (M12 mortar to BS EN 998-2) on a previously prepared concrete foundation.
5. The concrete haunching shall be of a concrete grade appropriate to the Drainage Channel Loading Class as specified in the Drexus Standard Detail Sheets.
6. Haunching shall be carried out as one operation to a complete line of Channel Units, to the dimensions indicated in the Drexus Standard Detail
7. Where channels are laid on or adjacent to existing or proposed concrete slabs, transverse joints shall be formed within the Units and haunching adjacent to the slab joints.
8. Longitudinal movement joints shall also be formed between the haunching and the slabs as described in the Drexus 100 Standard Detail Sheets.
9. Where cutting the Drexus Channel Units is required, they shall be cut with a concrete saw or disc cutter, so that no single Unit is less than 350mm long. Drexus gratings shall not be cut unless directed by the engineer.

Channel Joint Sealant

1. Jointing of adjacent channels shall be carried prior to fixing the gratings. Marshalls' M-Flex sealant should be gunned into the sealant groove formed when adjacent channels abut.
2. Surplus sealant shall be removed from the inner surface of the units as work proceeds.

Grating Installation

1. Adjacent Carriageway and/or footway construction shall not be commenced within 3 days of any jointing or haunching/surrounding concrete being placed.
2. Drexus gratings shall be securely bolted to Drexus Channel Units, before adjacent pavement construction is commenced.
3. All gratings shall be evenly spaced with bolts tightened down securely to the appropriate torque (25Nm).
4. On completion of the works, the drainage channel units shall be cleaned out and left free from obstruction. This shall be carried out either by removal of gratings or by high pressure water jetting (100-150 bar at 200 litres/min minimum). Unless otherwise agreed with the specifier, the slot openings shall be covered by timber boards or other method during jetting operations.
5. Outfall units shall be emptied.
6. The cleaning process should be repeated where necessary on completion of any remedial works.

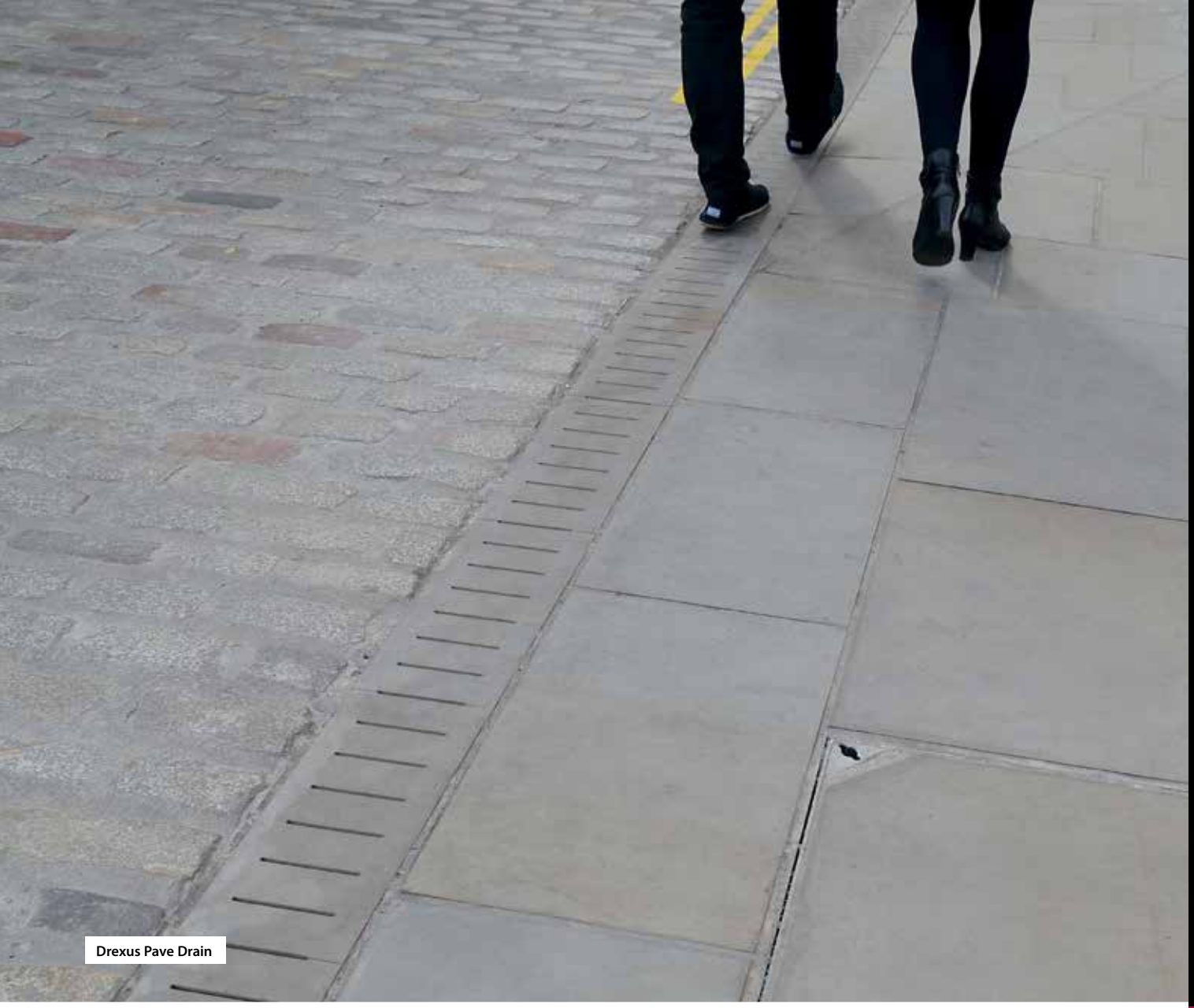
Drexus End Caps/End Cap Outlets

1. Where the Drexus Channel run does not terminate at an outfall, the channel unit shall be sealed using the Drexus End Cap or End Cap Outlet.
2. These are to be held in position by installing 150mm of concrete haunching.
3. Marshalls M-Flex sealant should be gunned into the sealant groove.

In accordance with the Health and Safety at Work etc Act 1974, the Manual Handling Operation Regulations 1992 (as amended 2004) and the Construction (Design and Management) Regulations 2015, risk assessments should be carried out to protect workers from risks associated with musculoskeletal disorders and work related upper limb disorders.

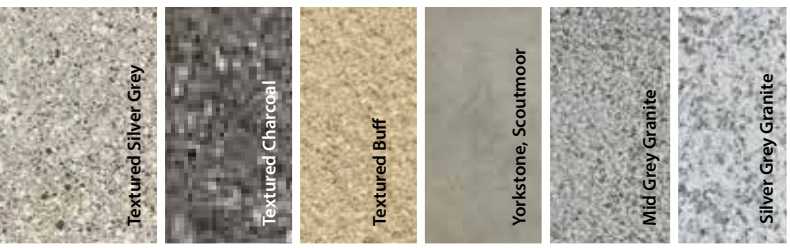
This may require the use of lifting aids to assist installation.

Drexus Pave Drain



Drexus Pave Drain

D400



Drexus Pave Drain

Concrete Drainage System

Marshalls Drexus Pave Drain offers a unique aesthetic for linear drainage. Through our concrete expertise and heritage in natural stone we have developed a drainage solution to complement our most popular paving products including premium concrete and natural stone. Drexus Pave Drain is available in a variety of finishes, suitable for any public realm development.

NBSPlus
Q10 180

* Not suitable for public road carriageways or motorways

Drexus Pave Drain

Concrete Drainage System

- Low Capacity.
- Discreet and complementary to the Marshalls paving ranges..
- Ideal for pedestrian areas and areas of occasional vehicle over run.
- Constant and transition channels.
- Load classification D400.

Marshalls Drexus Pave Drain is a linear drainage system for areas where a more aesthetic drainage solution is required to complement the adjoining paving.

Not only is it effective for removing surface water, it performs almost without trace as the concrete or stone top units can be designed to blend with the hard landscaping materials.

The top units used in the Drexus Pave Drain are 500mm long with nine 6mm slots spaced along the unit.

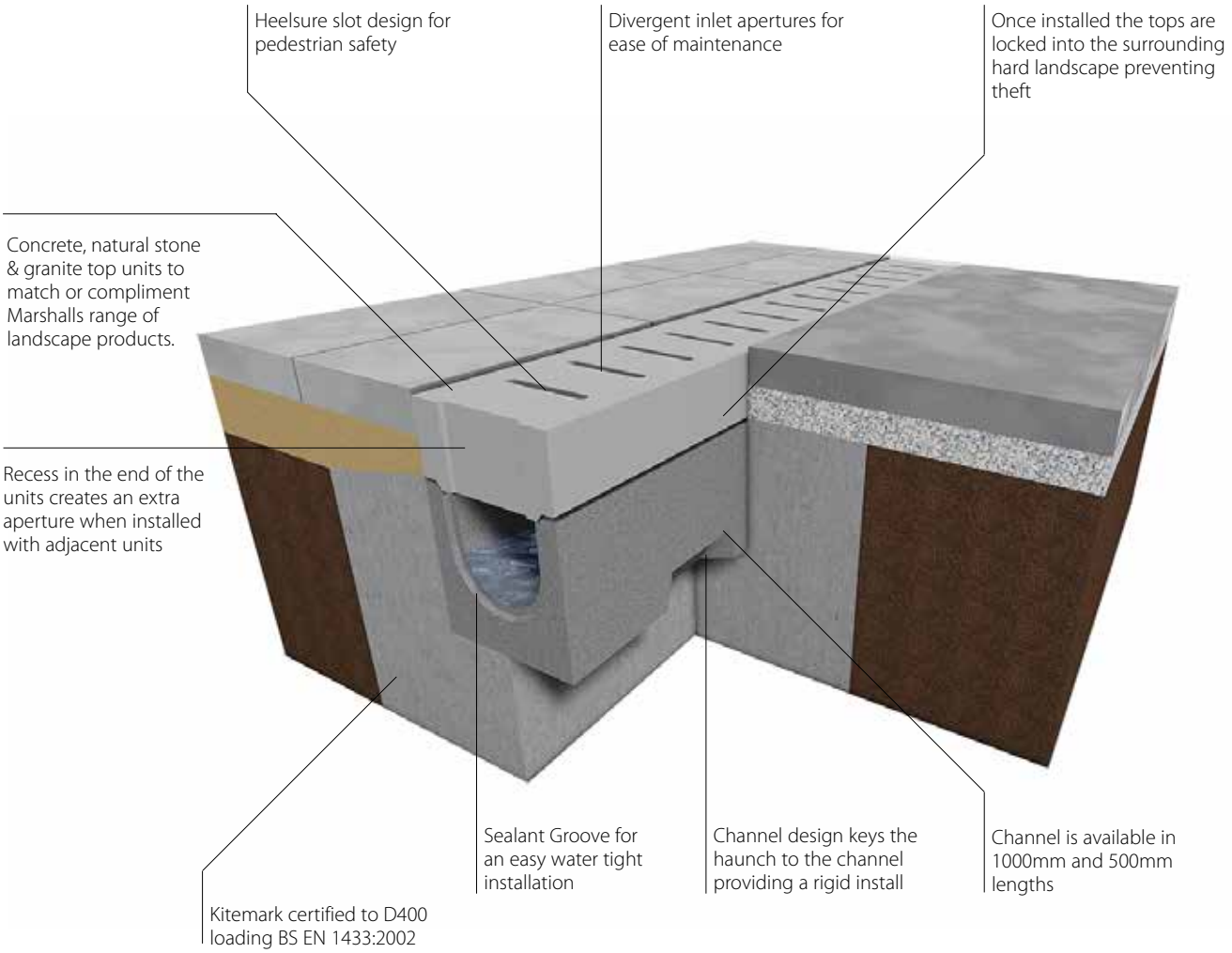
How the System Works

Drexus Pave Drain comprises a top unit and a channel unit. The top unit is available in a range of colours, finishes and materials to complement the extensive Marshalls paving range.

Coupled with the range of channel units, this leaves the designer scope to incorporate the linear drainage system discreetly into any landscape scheme.

Where the System Works

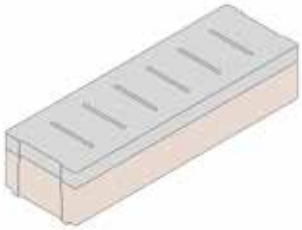
Utilised in a wide range of projects to date, from pedestrian areas and car parks to town centre developments and landscape schemes.



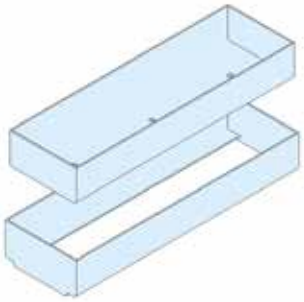
Components

TOP COMPONENTS

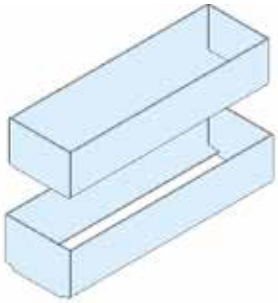
Concrete Top



Natural Stone Top



Concrete Top Access Cover



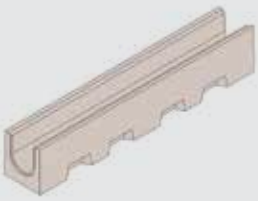
Natural Stone Access Cover

BASE COMPONENTS

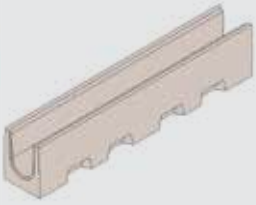
Base channels are available in 1000mm or 500mm lengths

BASE CHANNELS

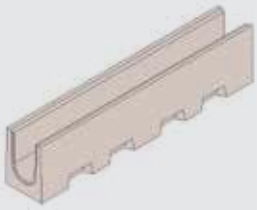
0/0 Channel



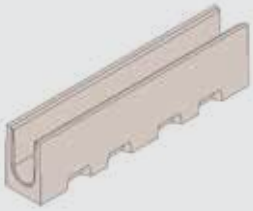
5/0 Channel



10/0 Channel

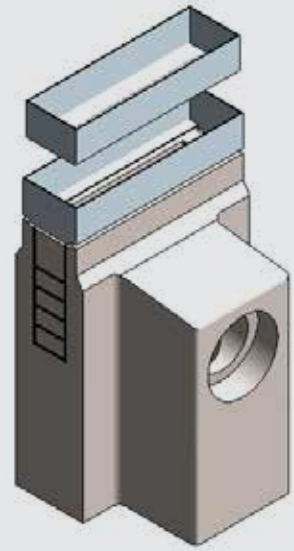


15/0 Channel



20/0 Channel

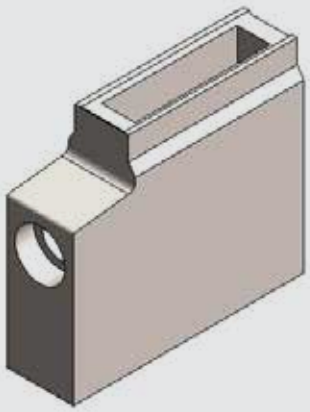
OUTFALLS



Inline Side Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- Side outlet for 150mm diameter pipework with universal sea.
- Cut-out panels in the silt box allows Drexus Pave Drain runs from both sides

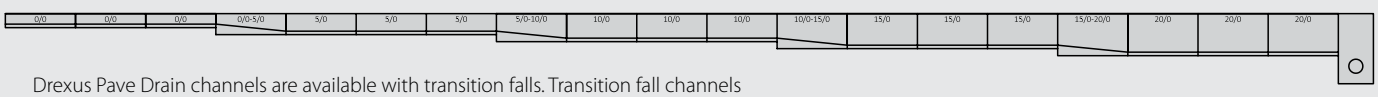
Note: Drexus Pave Drain Access Cover and Frame available separately.



Inline End Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- End outlet for 100mm diameter pipework with universal seal.
- Cut-out panels in the silt box allows Drexus Pave Drain runs from both side.

Note: Drexus Pave Drain Access Cover and Frame available separately.

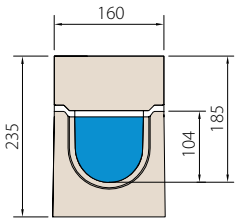
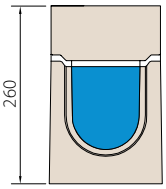
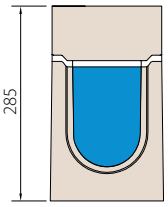
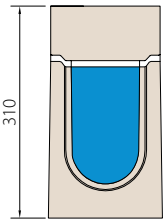
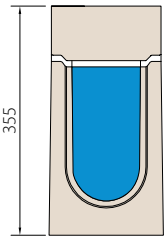


Drexus Pave Drain channels are available with transition falls. Transition fall channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition falls are 1000mm long

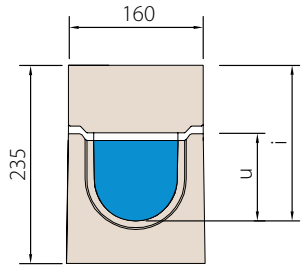
Fig.11
Stepped constant depth channels laid on sloping ground

Hydraulic Data

FLOW CAPACITY

Drexus Pave Drain with 0/0 Channel Unit	Drexus Pave Drain with 5/0 Channel Unit	Drexus Pave Drain with 10/0 Channel Unit	Drexus Pave Drain with 15/0 Channel Unit	Drexus Pave Drain with 20/0 Channel Unit
				
0/0 Channel	5/0 Channel	10/0 Channel	15/0 Channel	20/0 Channel
Equivalent Pipe Diameter (mm) 100	Equivalent Pipe Diameter (mm) 115	Equivalent Pipe Diameter (mm) 130	Equivalent Pipe Diameter (mm) 140	Equivalent Pipe Diameter (mm) 150

Drexus Pave Drain



ref.	d	i	u
0/0	235	185	104
5/0	260	210	129
10/0	285	235	154
15/0	310	260	179
20/0	335	285	204

*-dimensions at downstream end; deduct 10mm for upstream end.
All dimensions measured from top unit surface, pavement should be 5mm above this level.

Hydraulic Data

The Drexus Pave Drain hydraulic data stated in the following tables comprises of the flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the Colebrook-White formulae.

Drexus Pave Drain

Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	25	3	34	3.15	43	3.24	52	3.31	60	3.36
20	18	2.12	24	2.22	30	2.29	36	2.33	42	2.37
30	14	1.73	20	1.81	25	1.87	30	1.9	35	1.93
40	12	1.49	17	1.57	21	1.61	26	1.65	30	1.67
50	11	1.33	15	1.4	19	1.44	23	1.47	27	1.5
75	9	1.09	12	1.14	16	1.17	19	1.2	22	1.22
100	8	0.94	11	0.99	13	1.02	16	1.04	19	1.05
150	6	0.76	9	0.8	11	0.83	13	0.84	15	0.86
200	5	0.66	7	0.69	9	0.71	11	0.73	13	0.74
300	4	0.54	6	0.56	8	0.58	9	0.59	11	0.6
400	4	0.46	5	0.49	7	0.5	8	0.51	9	0.52
500	3	0.41	5	0.43	6	0.45	7	0.46	8	0.46
750	3	0.33	4	0.35	5	0.36	6	0.37	7	0.38
1000	2	0.29	3	0.3	4	0.31	5	0.32	6	0.32
1500	2	0.23	3	0.25	3	0.25	4	0.26	5	0.26
2000	2	0.2	2	0.21	3	0.22	3	0.22	4	0.23
Equivalent pipe diameter	100mm		115mm		130mm		140mm		150mm	

Theoretical Outfall Capacities

Outfall Type	**Outlet Pipe Diameter**	**m/s**	**l/s**
Drexus Pave Drain Inline End Outlet Outfall	100mm	2.23	11
Drexus Pave Drain Inline Side Outlet Outfall	150mm	2.39	26

Drexus Pave Drain Component Codes

A Tops

Top	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Horizontal Slot
Textured Grey	D400	500	160	80	15	**DR544810**
Textured Buff	D400	500	160	80	15	DR544820
Textured Charcoal	D400	500	160	80	15	**DR544830**
Granite Silver Grey	D400	500	160	110	17	DR544840
Granite Mid Grey	D400	500	160	110	17	DR544850
Yorkstone Scoutmoor	D400	500	160	110	17	DR544860

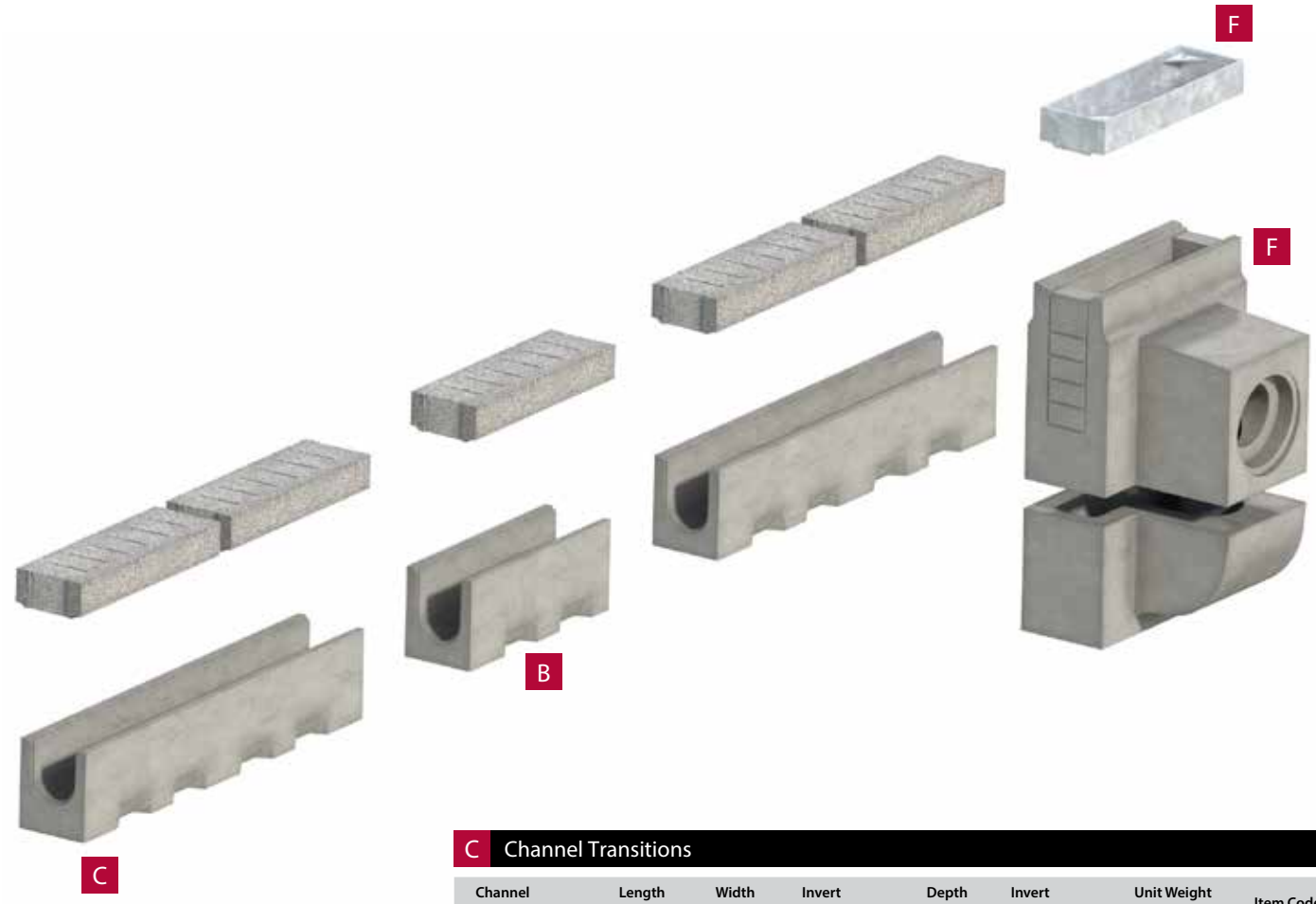
B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	160	100	154	104	37	**DR541015**
Channel 5/0	1000	160	100	179	129	45	**DR541025**
Channel 10/0	1000	160	100	204	154	53	**DR541035**
Channel 15/0	1000	160	100	229	179	61	**DR541045**
Channel 20/0	1000	160	100	254	204	69	**DR541055**
Channel 0/0	500	160	100	154	104	18.5	DR541515
Channel 5/0	500	160	100	179	129	22.5	DR541525
Channel 10/0	500	160	100	204	154	26.5	DR541535
Channel 15/0	500	160	100	229	179	30.5	DR541545
Channel 20/0	500	160	100	254	204	34.5	DR541555

Drexus Pave Drain with reference numbers indicated in **bold** black are available ex-stock.
Drexus Pave Drain with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requirements.

D Junction Channels

Junction Channels	Unit Weight (kg)	Item Code
Junction Channel 0/0 LH	19	DR543750
Junction Channel 0/0 RH	19	DR543755
Junction Channel 10/0 LH	27	DR543760
Junction Channel 10/0 RH	27	DR543765
Junction Channel 20/0 LH	35	DR543770
Junction Channel 20/0 RH	35	DR543775



C Channel Transitions

Channel Transitions	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
0/0 - 5/0	1000	160	100	154/179	104/129	39	**DR542110**
5/0 - 10/0	1000	160	100	179/204	129/154	43	**DR542120**
10/0 - 15/0	1000	160	100	204/229	154/179	46	**DR542130**
15/0 - 20/0	1000	160	100	229/254	179/204	50	**DR542140**

Drexus Pave Drain Channels are available with transitions. Transition Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition channels are 1000mm long.

E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
End Cap 0/0	1	**DR543210**
End Cap 5/0	1.2	**DR543220**
End Cap 10/0	1.4	DR543230
End Cap 15/0	1.6	DR543240
End Cap 20/0	1.8	**DR543250**
Cap Outlet 0/0	1	**DR543505**
Cap Outlet 5/0	1.2	**DR543515**
Cap Outlet 10/0	1.4	DR543525
Cap Outlet 15/0	1.6	DR543535
Cap Outlet 20/0	1.8	**DR543545**

F Outfall & Access Covers

Outfall & Access Covers	Unit Weight (kg)	Item Code
Side Outfall	137	**DR543020**
End Outfall	101	DR543025
Pave Drain Acess Cover (Low)	10	**DR544770**
Pave Drain Acess Cover (Nat Stone)	12	DR5447750

Standard Details

Drawing 1 of 2

Drexus Pave Drain - Block paving / Paving flags

Loading class up to D400

Drexus Pave Inline End Outfall

Drexus Pave Inline Side Outfall

Standard Details

Drawing 2 of 2

Drexus Pave (Natural Stone) - Paving flags

Loading class up to D400

Drexus Pave (Natural Stone) Inline End Outfall

Drexus Pave (Natural Stone) Inline Side Outfall

Standard Details

Notes for Drexus Pave Drain

Drawings 1 to 2

1. All dimensions are in millimetres.
2. All loading applications are as defined in BS EN 1433:2002 "Drainage Channels for Vehicular and Pedestrian Areas - classification, Design, Testing Requirements, and Evaluation of Conformity'".
3. Outfall sections shall be jointed using Marshall's' M-Flex sealant.
4. Vertical joints shall be jointed using Marshall's M-Flex sealant.
5. The concrete grade and dimensions for bed, haunch and surround are shown in the Drexus Pave Drain section of the Design Guide.
6. Where the concrete surround is taken to the surface; the concrete should have the appropriate freeze thaw resistance.
7. In applications with poor native ground conditions, consideration may be given to the local thickening of the sub-base.
8. Movement joints details that fully isolate the Drexus Pave Drain system whilst maintaining restraint shall be provided adjacent to all concrete slabs even when the slab is covered by another material. The use of dowel bars in concrete slab joints is common and should be considered especially for higher loading applications.
9. The top surface of the grating shall be 5mm below the finished pavement level.
10. Mortar shall be Class 12 to BS EN 988-2:2003
11. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes. These may differ from customer requirements and site conditions and should be checked and accepted by the Engineer for project use.

Specification

Introduction

The following specification covers the complete Drexus Pave Drain linear drainage system including ancillary fittings and is compatible with the standard detail drawings.

Drexus Pave Drain

1. The linear drainage system shall be Drexus Pave Drain supplied by Marshalls plc. All channel materials and ancillary products detailed in this specification shall be supplied by Marshalls.
2. All components of the system shall be type tested and be fully compliant with the requirements of BS EN 1433:2002: Drainage channels for vehicular and pedestrian areas – Classification, design and testing requirements, marking and evaluation of conformity' when installed as per manufacturers recommendations.
3. The linear drainage system shall be Drexus Pave Drain manufactured in pre-cast concrete, with the exception of certain fitments manufactured in steel or cast iron, as supplied by Marshalls in accordance with Standard Detail Sheets.
4. The linear drainage shall be a two part system consisting of ***natural stone/precast concrete*** covers bonded to precast concrete drainage channels reference ***(0/0; 5/0; 10/0; 15/0; 20/0)**** deep.
5. All components of the Marshalls' Drexus Pave Drain System shall comply with minimum Load Classification B125/C250/D400* in accordance with BS EN 1433:2002 and the following:
   i. The cover shall be ***natural precast concrete/granite/yorkstone****.
   ii. The cover shall have a nominal ***horizontal/diagonal**** slot width of ***10/6 mm****
   iii. The system shall have a minimum of ***11,100/8,300 **** mm^2/m water inlet aperture area.
   iv. The drainage channels shall have an invert width of 100 mm.
   v. The overall width of the channel shall be 160 mm.
   vi. The vertical channel surfaces and joints shall be made water tight using Marshalls' M-Flex sealant.
   vii. The covers shall be bonded to the drainage channel with ***Marshall's' M-Bond/Mortar Class 12***.
   viii. The distance between access points shall be no more than ***15/25/50m****.
6. The linear drainage system comprising covers, constant depth and transition channels, outfalls, T junctions channels, end caps, cap outlets, and sealants shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.
7. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or ***as detailed in the contract/WRc Sewers for Adoption; 7th Edition: 2012/BS EN 752:2008/BS 8000: Part 14:1989****

Note: * delete as required

Construction

Excavation

1. Sufficient material should be excavated to accommodate the drainage channel, concrete bedding and haunching.
2. Any 'soft spots' or poorly compacted formation should be made good.

Setting Out

1. The top of the Drexus Pave Drain should be 5mm below the finished pavement surface.
2. It may be advantageous to use setting out pins and string lines to achieve the desired level for the channels.

Outfalls

1. Drexus Pave Drain outfalls should be installed first.
2. Sufficient material should be excavated to accommodate the trapped Drexus Pave Drain outfall units
3. 150mm of C25/30 mix (BS 8500-1&2) concrete is placed in the bottom of the excavation
4. The bottom section of the two part outfall is lowered into position
5. Sufficient M-Flex sealant is gunned onto the top horizontal surface of the bottom section of the two part Drexus Pave Drain outfall so as to provide a seal between the top and bottom sections
6. The bedding concrete should be laid and brought up level with underside of the pavement bedding course.
7. The Access Cover & Frame Units should be set directly onto a 10mm bed of mortar with mortar Class12 to BS EN 998-2:2003 along each side of the outfall unit

Channel Installation

1. Bedding concrete (C25/30 to BS 8500-1&2) of the appropriate thickness and depth shall be laid
2. Channels shall be laid onto the freshly mixed bedding concrete, starting at the outfall, i.e. working uphill, channel ends should about as tightly as possible.
3. Alternatively, the channels may be bedded on to a layer of 10 to 40mm cement mortar (M12 mortar to BS EN 998-2) on a previously prepared concrete foundation.
4. Where cutting is necessary, channels shall be cut so that no single Unit is less than 350mm in length.
5. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter.

Channel Joint Sealant

1. Jointing of channels shall occur prior to the fixing of the top units. A bead of M Flex sealant should be gunned in to the groove formed when adjacent channels abut.
2. Surplus sealant shall be removed from the inner surface of the Units as work proceeds.

Top Block Installation

1. The string line should be set to the level of the top corner of Units.
2. Again, starting at the Outfall, the Units should be set directly onto a 10mm bed of mortar to mortar class 12 BS EN 998-2:2003.
3. The Top Blocks should be tamped into position close to previously laid Units and the alignment checked.
4. The levels should be checked using the string line and a spirit level.
5. In addition, the general alignment should be checked from all directions as each Block is laid. Any Unit deviating by more than 3mm in 3m from line and level shall be made good by lifting and relaying.
6. The joints between adjacent top units are dry and units should be laid hand tight to achieve either a 6mm or 12mm opening as detailed on drawing.
7. Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 200mm in length. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter.
8. The Drexus Pave Drain top units should be protected during the construction phase to prevent debris entering the slots.

End Caps

1. Where the Drexus Pave Drain run does not terminate at an outfall, the base unit shall be sealed using the correct sized Drexus Pave Drain End Cap.
2. The End Cap shall be securely placed against the vertical end of the base unit and haunched with fresh concrete (C25/30 mix to BS 8500-1&2).

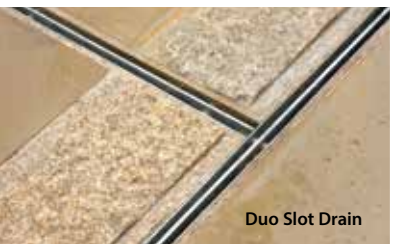
In accordance with the Health and Safety at Work etc Act 1974, the Manual Handling Operation Regulations 1992 (as amended 2004) and the Construction (Design and Management) Regulations 2015, risk assessments should be carried out to protect workers from risks associated with musculoskeletal disorders and work related upper limb disorders.

This may require the use of lifting aids to assist installation.

Drexus Slot Drain

Drexus Slot Drain

D400



Duo Slot Drain

Mono Slot Drain

Drexus Slot Drain

Slot Drainage System

Marshalls Drexus Slot Drain is a highly effective yet beautifully discreet solution for surface water removal on premium landscapes. Marshalls Drexus 100 channel is hidden beneath a slimline galvanised steel slot which features a mono or duo linear aperture.

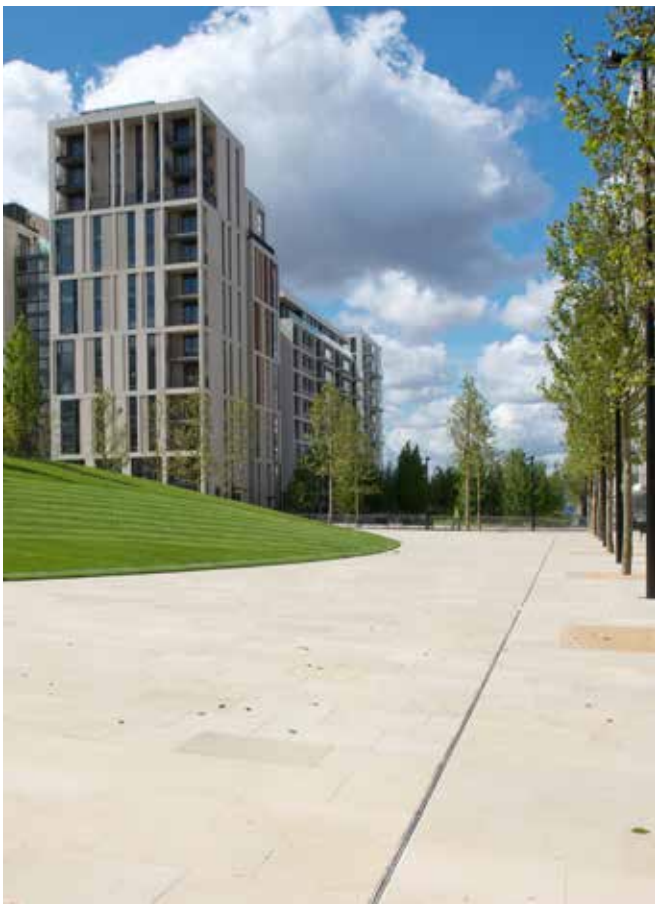
Perfect for complementing block or flag installations and particularly suited to Natural Stone landscapes, Drexus Slot Drain is suitable for an array of applications and public realm developments.

NBSPlus

Q10 170

Drexus Slot Drain

Slot Drainage System

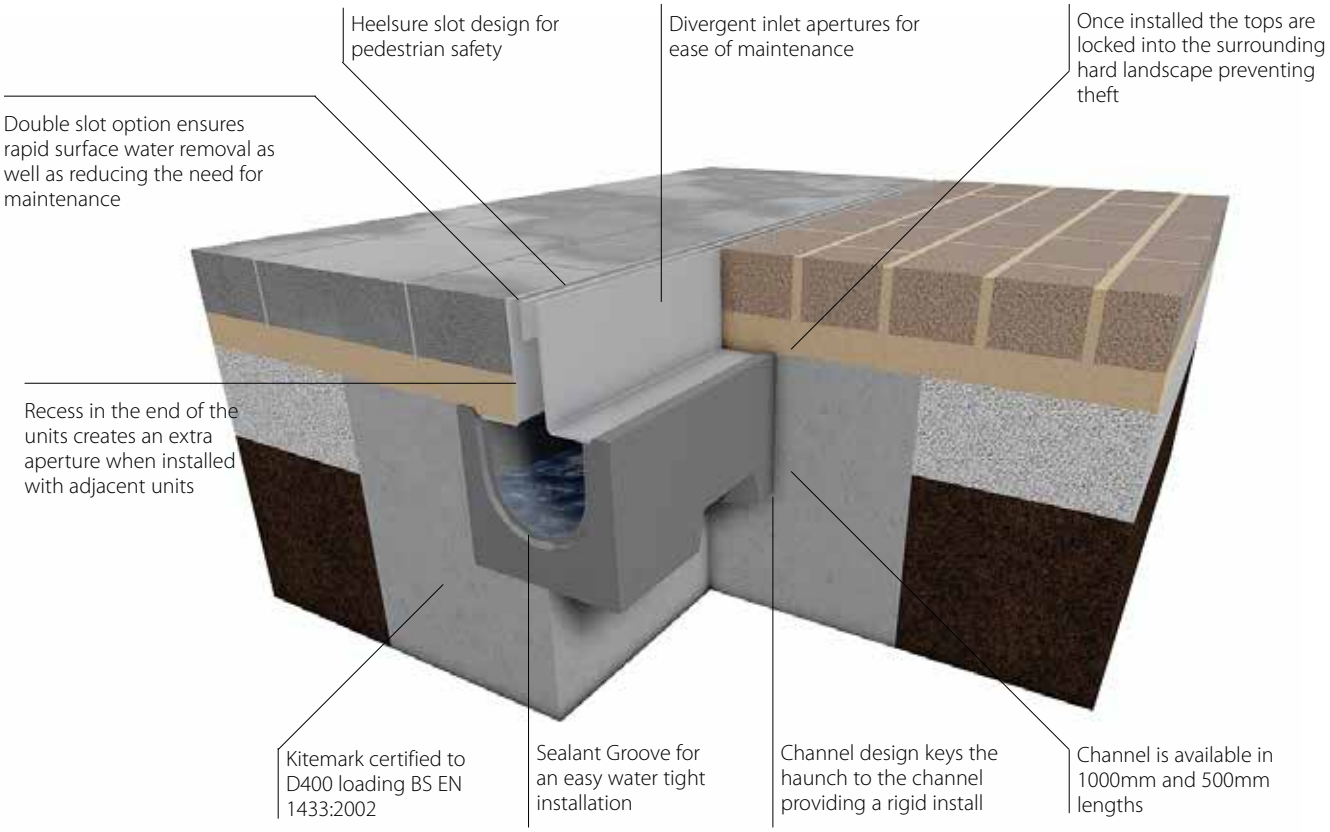


Drexus Slot Drain Mono, Olympic Village, London

- Discreet linear drainage system.
- Single or double slot entry with offset duo option.
- Constant and transition fall bases available.
- Bespoke solutions available, including stainless steel radius units.
- Drexus Slot Drain Mono load classification D400.
- Drexus Slot Drain Duo load classification D400.
- Ideally suited for all paved areas where discreet yet efficient drainage is required, from prestigious pedestrian areas to motorway crossovers.
- Fully compatible with Marshalls range of paving materials and with extra care, other surfacing materials such as tarmac or in-situ concrete.
- Drexus Slot Drain Duo offset top available for threshold drainage applications.

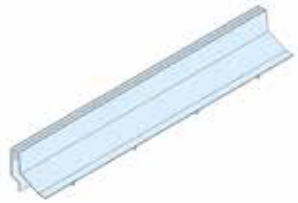
How It Works

- An innovative solution that combines a fabricated, galvanised steel slot drain top to a base channel unit.
- The Drexus Slot Drain top seats itself on a Drexus Channel unit.
- Access units allow for maintenance of the channel system.
- Bespoke solutions can be manufactured including alternative depth of top units, use of stainless steel and increased width, i.e. 150 or 200mm enabling solutions to suit your project demands.



Components

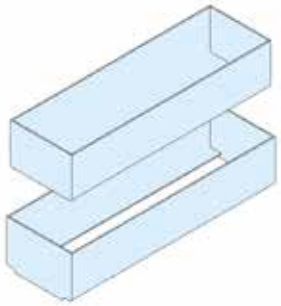
TOP COMPONENTS



Offset Duo Slot Top

Duo Slot Top

Mono Slot Top



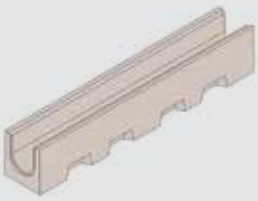
Access Cover

BASE COMPONENTS

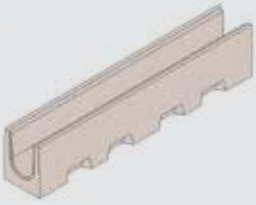
Base channels are available in 1000mm or 500mm lengths

BASE CHANNELS

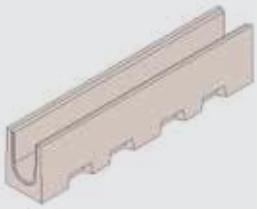
0/0 Channel



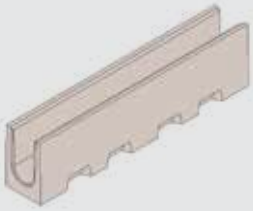
5/0 Channel



10/0 Channel

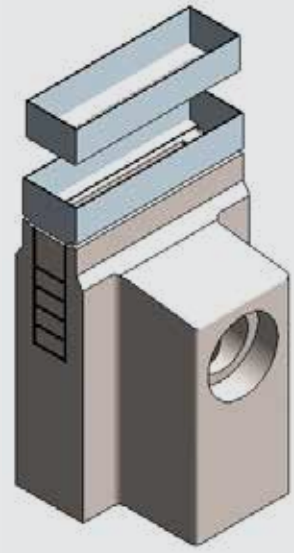


15/0 Channel



20/0 Channel

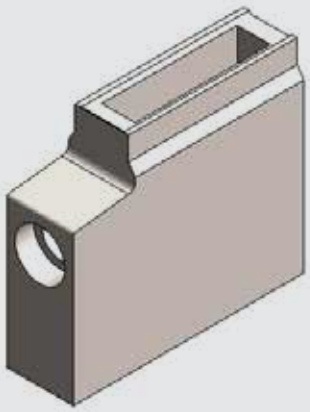
OUTFALLS



Inline Side Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- Side outlet for 150mm diameter pipework with universal sea.
- Cut-out panels in the silt box allows Drexus Slot Drain runs from both sides

Note: Drexus Slot Drain Access Cover and Frame available separately.



Inline End Outlet Outfall

- A 2 section concrete trapped outfall, with an inlaid access cover and frame.
- End outlet for 100mm diameter pipework with universal seal.
- Cut-out panels in the silt box allows Drexus Slot Drain runs from both side.

Note: Drexus Slot Drain Access Cover and Frame available separately.

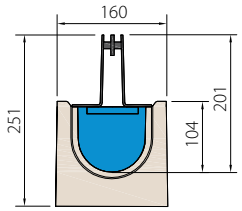
Drexus Slot Drain channels are available with transition falls. Transition fall channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition falls are 1000mm long

Fig.11
Stepped constant depth channels laid on sloping ground

Hydraulic Data

FLOW CAPACITY

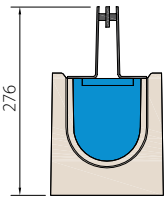
Drexus Slot Drain 0/0 Channel Unit



0/0 Channel

Equivalent Pipe Diameter (mm) 100

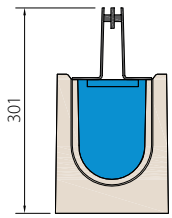
Drexus Slot Drain 5/0 Channel Unit



5/0 Channel

Equivalent Pipe Diameter (mm) 115

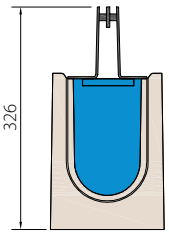
Drexus Slot Drain 10/0 Channel Unit



10/0 Channel

Equivalent Pipe Diameter (mm) 120

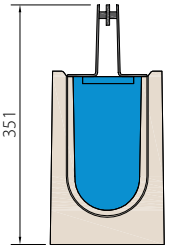
Drexus Slot Drain 15/0 Channel Unit



15/0 Channel

Equivalent Pipe Diameter (mm) 140

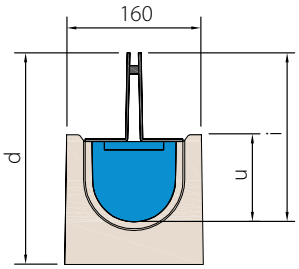
Drexus Slot Drain 20/0 Channel Unit



20/0 Channel

Equivalent Pipe Diameter (mm) 150

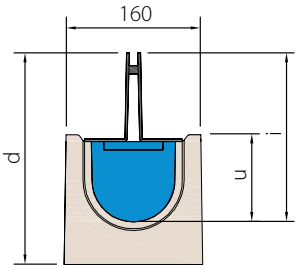
Drexus Slot Drain Mono



ref.	d	i	u
0/0	251	201	104
5/0	276	226	129
10/0	301	251	154
15/0	326	276	179
20/0	351	301	204

*-dimensions at downstream end; deduct 10mm for upstream end.
All dimensions measured from top unit surface, pavement should be 5mm above this level.

Drexus Slot Drain Duo



ref.	d	i	u
0/0	251	201	104
5/0	276	226	129
10/0	301	251	154
15/0	326	276	179
20/0	351	301	204

*-dimensions at downstream end; deduct 10mm for upstream end.
All dimensions measured from top unit surface, pavement should be 5mm above this level.

Hydraulic Data

The Drexus Slot Drain hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using the Colebrook-White formulae.

Slot Drain Mono

Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	25	3	34	3.15	43	3.24	52	3.31	60	3.36
20	18	2.12	24	2.22	30	2.29	36	2.33	42	2.37
30	14	1.73	20	1.81	25	1.87	30	1.9	35	1.93
40	12	1.49	17	1.57	21	1.61	26	1.65	30	1.67
50	11	1.33	15	1.4	19	1.44	23	1.47	27	1.5
75	9	1.09	12	1.14	16	1.17	19	1.2	22	1.22
100	8	0.94	11	0.99	13	1.02	16	1.04	19	1.05
150	6	0.76	9	0.8	11	0.83	13	0.84	15	0.86
200	5	0.66	7	0.69	9	0.71	11	0.73	13	0.74
300	4	0.54	6	0.56	8	0.58	9	0.59	11	0.6
400	4	0.46	5	0.49	7	0.5	8	0.51	9	0.52
500	3	0.41	5	0.43	6	0.45	7	0.46	8	0.46
750	3	0.33	4	0.35	5	0.36	6	0.37	7	0.38
1000	2	0.29	3	0.3	4	0.31	5	0.32	6	0.32
1500	2	0.23	3	0.25	3	0.25	4	0.26	5	0.26
2000	2	0.2	2	0.21	3	0.22	3	0.22	4	0.23
Equivalent pipe diameter	100mm		115mm		130mm		140mm		150mm	

Slot Drain Duo

Channel Type	**0/0**		**5/0**		**10/0**		**15/0**		**20/0**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	25	3	34	3.15	43	3.24	52	3.31	60	3.36
20	18	2.12	24	2.22	30	2.29	36	2.33	42	2.37
30	14	1.73	20	1.81	25	1.87	30	1.9	35	1.93
40	12	1.49	17	1.57	21	1.61	26	1.65	30	1.67
50	11	1.33	15	1.4	19	1.44	23	1.47	27	1.5
75	9	1.09	12	1.14	16	1.17	19	1.2	22	1.22
100	8	0.94	11	0.99	13	1.02	16	1.04	19	1.05
150	6	0.76	9	0.8	11	0.83	13	0.84	15	0.86
200	5	0.66	7	0.69	9	0.71	11	0.73	13	0.74
300	4	0.54	6	0.56	8	0.58	9	0.59	11	0.6
400	4	0.46	5	0.49	7	0.5	8	0.51	9	0.52
500	3	0.41	5	0.43	6	0.45	7	0.46	8	0.46
750	3	0.33	4	0.35	5	0.36	6	0.37	7	0.38
1000	2	0.29	3	0.3	4	0.31	5	0.32	6	0.32
1500	2	0.23	3	0.25	3	0.25	4	0.26	5	0.26
2000	2	0.2	2	0.21	3	0.22	3	0.22	4	0.23
Equivalent pipe diameter	100mm		115mm		130mm		140mm		150mm	

Theoretical Outfall Capacities

Outfall Type	**Outlet Pipe Diameter**	**m/s**	**l/s**
Drexus Slot Drain Mono Inline End Outlet Outfall	100mm	2.23	11
Drexus Slot Drain Mono Inline Side Outlet Outfall	150mm	2.39	26

Drexus Slot Drain Component Codes

A Top Units

Top Units	Loading	Length (mm)	Width (mm)	Depth (mm)	Unit Weight (kg)	Item Code
Drexus 100 Duo Slot	D400	1000	116	105	8.5	**DR544510**
Drexus 100 Offset Duo	D400	1000	140	105	11.4	**DR544530**
Drexus 100 Mono Slot	D400	1000	116	105	6	**DR544520**
Drexus 100 Duo Slot	D400	500	116	105	4.25	**DR544610**
Drexus 100 Offset Duo	D400	500	140	105	5.7	**DR544630**
Drexus 100 Mono Slot	D400	500	116	105	3	**DR544620**

B Constant Depth Channels

Constant Depth Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
Channel 0/0	1000	160	100	154	104	37	**DR541015**
Channel 5/0	1000	160	100	179	129	45	**DR541025**
Channel 10/0	1000	160	100	204	154	53	**DR541035**
Channel 15/0	1000	160	100	229	179	61	**DR541045**
Channel 20/0	1000	160	100	254	204	69	**DR541055**
Channel 0/0	500	160	100	154	104	18.5	DR541515
Channel 5/0	500	160	100	179	129	22.5	DR541525
Channel 10/0	500	160	100	204	154	26.5	DR541535
Channel 15/0	500	160	100	229	179	30.5	DR541545
Channel 20/0	500	160	100	254	204	34.5	DR541555

D Junction Channels

Junction Channels	Unit Weight (kg)	Item Code
Junction Channel 0/0 LH	19	DR543750
Junction Channel 0/0 RH	19	DR543755
Junction Channel 10/0 LH	27	DR543760
Junction Channel 10/0 RH	27	DR543765
Junction Channel 20/0 LH	35	DR543770
Junction Channel 20/0 RH	35	DR543775

Drexus Slot Drain with reference numbers indicated in **bold** black are available ex-stock.
Drexus Slot Drain with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requrements.

D Channel Transitions

Channel Transitions	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	Item Code
0/0 - 5/0	1000	160	100	154/179	104/129	39	**DR542110**
5/0 - 10/0	1000	160	100	179/204	129/154	43	**DR542120**
10/0 - 15/0	1000	160	100	204/229	154/179	46	**DR542130**
15/0 - 20/0	1000	160	100	229/254	179/204	50	**DR542140**

Drexus Slot Drain Channels are available with transitions. Transition Channels increase drainage discharge capacity by improving flow rates and thereby increasing the overall discharge capacity of the system. Transition channels are 1000mm long.

E End Cap/Cap Outlets

End Cap/Cap Outlets	Unit Weight (kg)	Item Code
End Cap 0/0	1	**DR543210**
End Cap 5/0	1.2	**DR543220**
End Cap 10/0	1.4	DR543230
End Cap 15/0	1.6	DR543240
End Cap 20/0	1.8	**DR543250**
Cap Outlet 0/0	1	**DR543505**
Cap Outlet 5/0	1.2	**DR543515**
Cap Outlet 10/0	1.4	DR543525
Cap Outlet 15/0	1.6	DR543535
Cap Outlet 20/0	1.8	**DR543545**

F Outfall & Access Covers

Outfall & Access Covers	Unit Weight (kg)	Item Code
Side Outfall	137	**DR543020**
End Outfall	101	DR543025
Slot Drain Acess Cover (Low)	10	**DR544640**

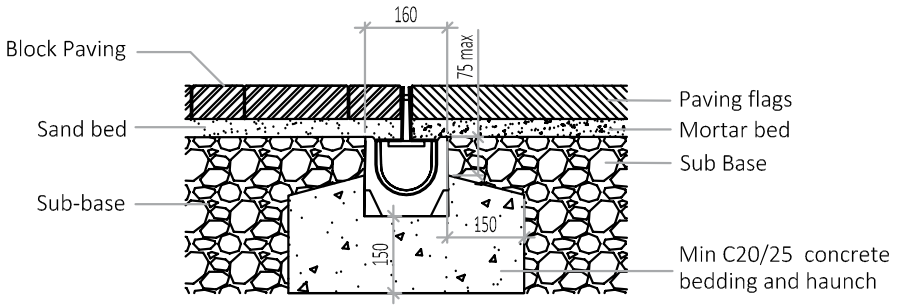
Standard Details

Drexus Slot Inline End Outfall

Drexus Slot Inline Side Outfall

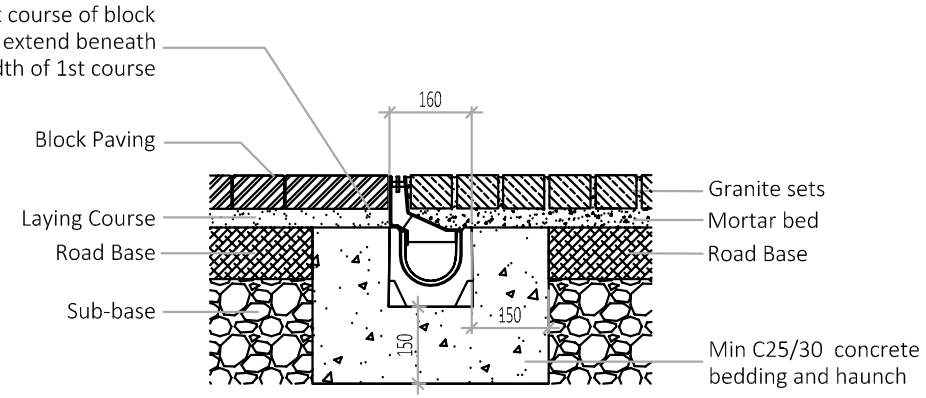
Drexus Slot Drain Duo

Loading class up to D400



Drexus Slot Drain Mono

Loading class up to C250



Drexus Offset Slot Drain Duo

Loading class up to D400

Standard Details

Notes for Drexus Slot Drain

Drawings 1 to 2

1. All dimensions are in millimetres.
2. All loading applications are as defined in BS EN 1433:2002 "Drainage Channels for Vehicular and Pedestrian Areas - classification, Design, Testing Requirements, and Evaluation of Conformity'".
3. Outfall sections shall be jointed using Marshall's' M-Flex sealant.
4. Vertical joints shall be jointed using Marshall's M-Flex sealant.
5. The concrete grade and dimensions for bed, haunch and surround are shown in the Drexus Slot Drain section of the Design Guide.
6. Where the concrete surround is taken to the surface; the concrete should have the appropriate freeze thaw resistance.
7. In applications with poor native ground conditions, consideration may be given to the local thickening of the sub-base.
8. Movement joints details that fully isolate the Drexus Pave Drain system whilst maintaining restraint shall be provided adjacent to all concrete slabs even when the slab is covered by another material. The use of dowel bars in concrete slab joints is common and should be considered especially for higher loading applications.
9. The top surface of the slot shall be 5mm below the finished pavement level.
10. Bedding mortar shall be Class 12, nominal 10 mm thick to BS EN 988-2:2003.
11. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes. These may differ from customer requirements and site conditions and should be checked and accepted by the Engineer for project use.

Note: * delete as required

Specification

Introduction

The following specification covers the complete Drexus Slot Drain linear drainage system including ancillary fittings and is compatible with the standard detail drawings.

Drexus Slot Drain

1. The linear drainage system shall be Drexus Slot Drain supplied by Marshalls plc. All channel materials and ancillary products detailed in this specification shall be supplied by Marshalls.
2. All components of the system shall be type tested and be fully compliant with the requirements of BS EN 1433:2002: Drainage channels for vehicular and pedestrian areas – Classification, design and testing requirements, marking and evaluation of conformity' when installed as per manufacturers recommendations.
3. The linear drainage system shall be Drexus Slot Drain manufactured in pre-cast concrete, with the exception of certain fitments manufactured in galvanised steel as supplied by Marshalls in accordance with Standard Detail Sheets.
4. The linear drainage shall be a two part system consisting of ***galvanised/stainless**** steel slotted cover set on to precast concrete drainage channels reference ***(0/0; 5/0; 10/0; 15/0; 20/0)**** deep or as indicated in the contract documents.
5. All components of the Marshalls Drexus Slot Drain System shall comply with Load Classification ***A15/B125/C250/D400**** in accordance with BS EN 1433:2002 and the following:
   i. The slot channel shall have a nominal longitudinal central ***mono/offset mono/central duo/offset duo**** slot.
   ii. The slot channel shall have a ***clear slot width of 10 mm/combined slot width of 20 mm*.***
   iii. The slot shall be divergent with a nominal depth of 105 mm.
   iv. The system shall have a minimum of ***10,000/20,000**** mm^2/m water inlet aperture area.
   v. The slot channel will have a nominal 3mm thick galvanised/stainless* steel edge.
   vi. The drainage channels shall have an invert width of 100 mm.
   vii. The overall width of the channel shall be 160 mm.
   viii. The vertical channel surfaces and joints shall be made water tight using Marshalls M-Flex sealant.
   ix. Slot channel tops shall be made watertight using Marshalls M-Tape
   x. The covers shall be ***laid dry/bonded*** on to the drainage channel with ***Marshalls M-Bond/Mortar Class 12***.
   xi. The distance between access points shall be no more than ***15/25/50 m****.
6. The linear drainage system comprising gratings, covers, constant depth and transition channels, outfalls, T junctions channels, end caps, cap outlets, and sealants shall be installed to the line and levels indicated in the contract documents and in accordance with the manufacturer's instructions and Standard Details.
7. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or ***as detailed in the contract/ WRc Sewers for Adoption; 7th Edition : 2012/BS EN 752:2008/BS 8000: Part 14:1989****

Construction

Excavation

1. Sufficient material should be excavated to accommodate the drainage channel, concrete bedding and haunching.
2. Any 'soft spots' or poorly compacted formation should be made good.

Setting Out

1. The top of the Drexus Slot Drain should be 5mm below the finished pavement surface.
2. It may be advantageous to use setting out pins and string lines to achieve the desired level for the channels.

Outfalls

1. Drexus Slot Drain outfalls should be installed first.
2. Sufficient material should be excavated to accommodate the trapped Drexus Slot Drain outfall units
3. 150mm of C25/30 mix (BS 8500-1&2) concrete is placed in the bottom of the excavation
4. The bottom section of the two part outfall is lowered into position
5. Sufficient M-Flex sealant is gunned onto the top horizontal surface of the bottom section of the two part Drexus Slot Drain outfall so as to provide a seal between the top and bottom sections
6. The top section of the two part Drexus Slot Drain outfall is lowered into position
7. The bedding concrete should be laid and brought up level with underside of the pavement bedding course.
8. The Access Cover & Frame Units should be set directly onto a 10mm bed of mortar with mortar Class12 to BS EN 998-2:2003 along each side of the outfall unit.

Channel Installation

1. Bedding concrete (C25/30 to BS 8500-1&2) of the appropriate thickness and depth shall be laid
2. Channels shall be laid onto the freshly mixed bedding concrete, starting at the outfall, i.e. working uphill, channel ends should about as tightly as possible.
3. Alternatively, the channels may be bedded on to a layer of 10 to 40mm cement mortar (M12 mortar to BS EN 998-2) on a previously prepared concrete foundation.
4. Where cutting is necessary, channels shall be cut so that no single Unit is less than 350mm in length.
5. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter.

Channel Joint Sealant

1. Jointing of channels shall occur prior to the fixing of the top units. A bead of M Flex sealant should be gunned in to the groove formed when adjacent channels abut.
2. Surplus sealant shall be removed from the inner surface of the Units as work proceeds.

Top Unit Installation

1. The string line should be set to the level of the top corner of Units.
2. Again, starting at the outfall, the units should be dry laid onto the channel, use a mortar bed for levelling purposes if required to class 12 from BS EN 998-2:2003
3. The top units should be tamped into position close to previously laid Units and the alignment checked.
4. The levels should be checked using the string line and a spirit level.
5. In addition, the general alignment should be checked from all directions as each unit is laid. Any Unit deviating by more than 3mm in 3m from line and level shall be made good by lifting and relaying.
6. The joints between adjacent top units should be sealed with Marshalls M Tape to prevent ingress of bedding material from the surrounding pavement.
7. Where cutting is necessary, one or two Units shall be cut so that no single Unit is less than 350mm in length. All cutting and trimming of the Units shall be carried out with a concrete saw or disc cutter.
8. Any cut galvanised steel shall be renovated using Defcon Z or similar approved material.

End Caps

1. Where the Drexus Slot Drain run does not terminate at an outfall, the base unit shall be sealed using the correct sized Slot Drain End Cap.
2. The End Cap shall be securely placed against the vertical end of the base unit and haunched with fresh concrete (C25/30 mix to BS 8500-1&2).

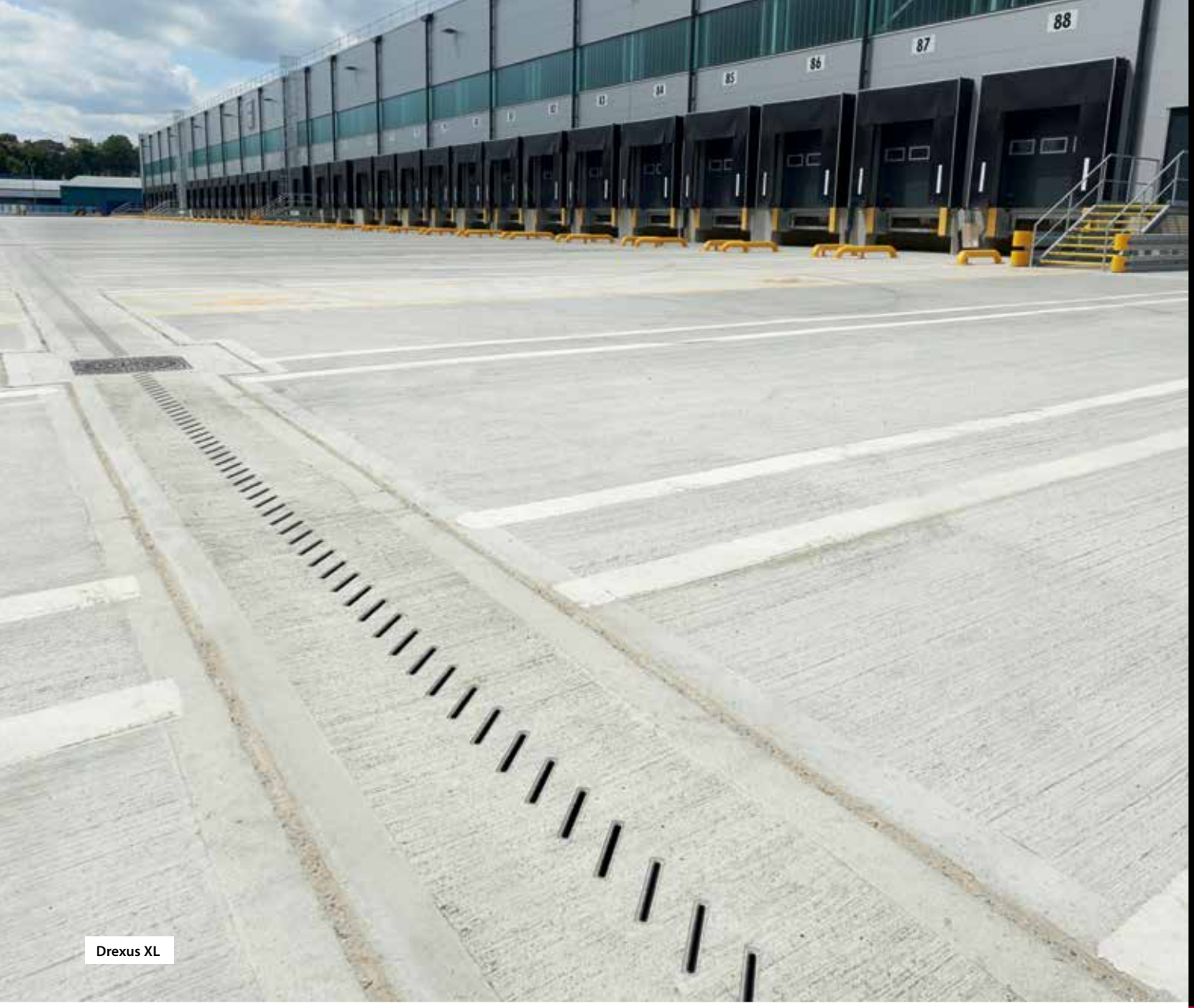
Pavement Installation

1. Where Drexus Slot Drain is being laid adjacent to flexibly laid paving the inlet apertures should be sealed against ingress of bedding or jointing material during the construction phase.

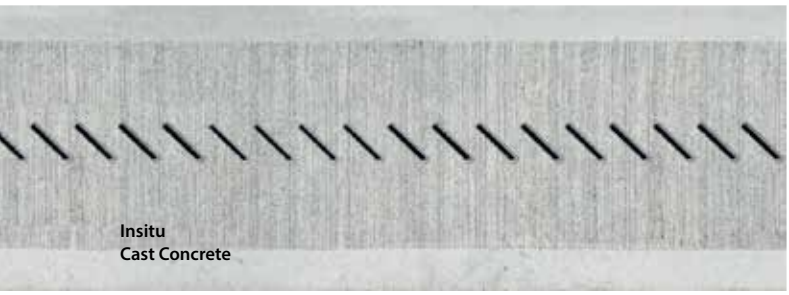
In accordance with the Health and Safety at Work etc Act 1974, the Manual Handling Operation Regulations 1992 (as amended 2004) and the Construction (Design and Management) Regulations 2015, risk assessments should be carried out to protect workers from risks associated with musculoskeletal disorders and work related upper limb disorders.

This may require the use of lifting aids to assist installation.

Drexus XL



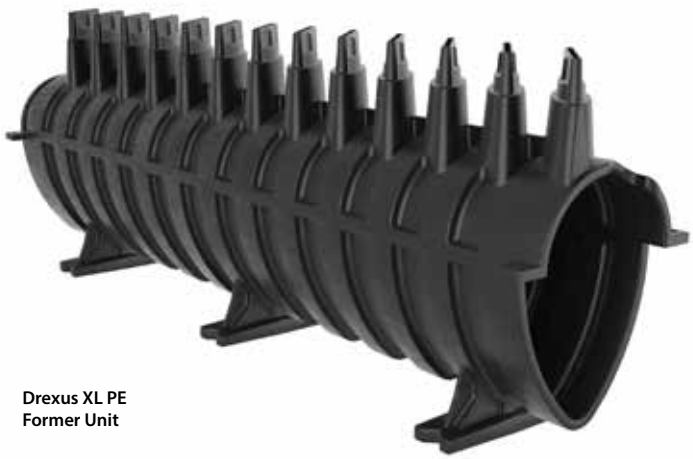
Drexus XL



Insitu
Cast Concrete

Drexus XL

Concrete Drainage System



Drexus XL PE
Former Unit

Marshalls Drexus XL is a recycled polyethylene (PE) high capacity channel, ideally suited for high capacity heavy duty projects covering any load class from busy service yards and rail & docking ports, airports with severe dynamic transport loading to motorways and commercial outlets.

The high capacity system is designed to offer attenuation and storage facilities but also to achieve sufficient flow velocities at low gradient to ensure that the channels require minimal maintenance. Drexus XL's In-Situ surface finish is designed to integrate seamlessly into concrete surfaces.

NBSPlus
Q10 170

Drexus XL

Concrete Drainage System

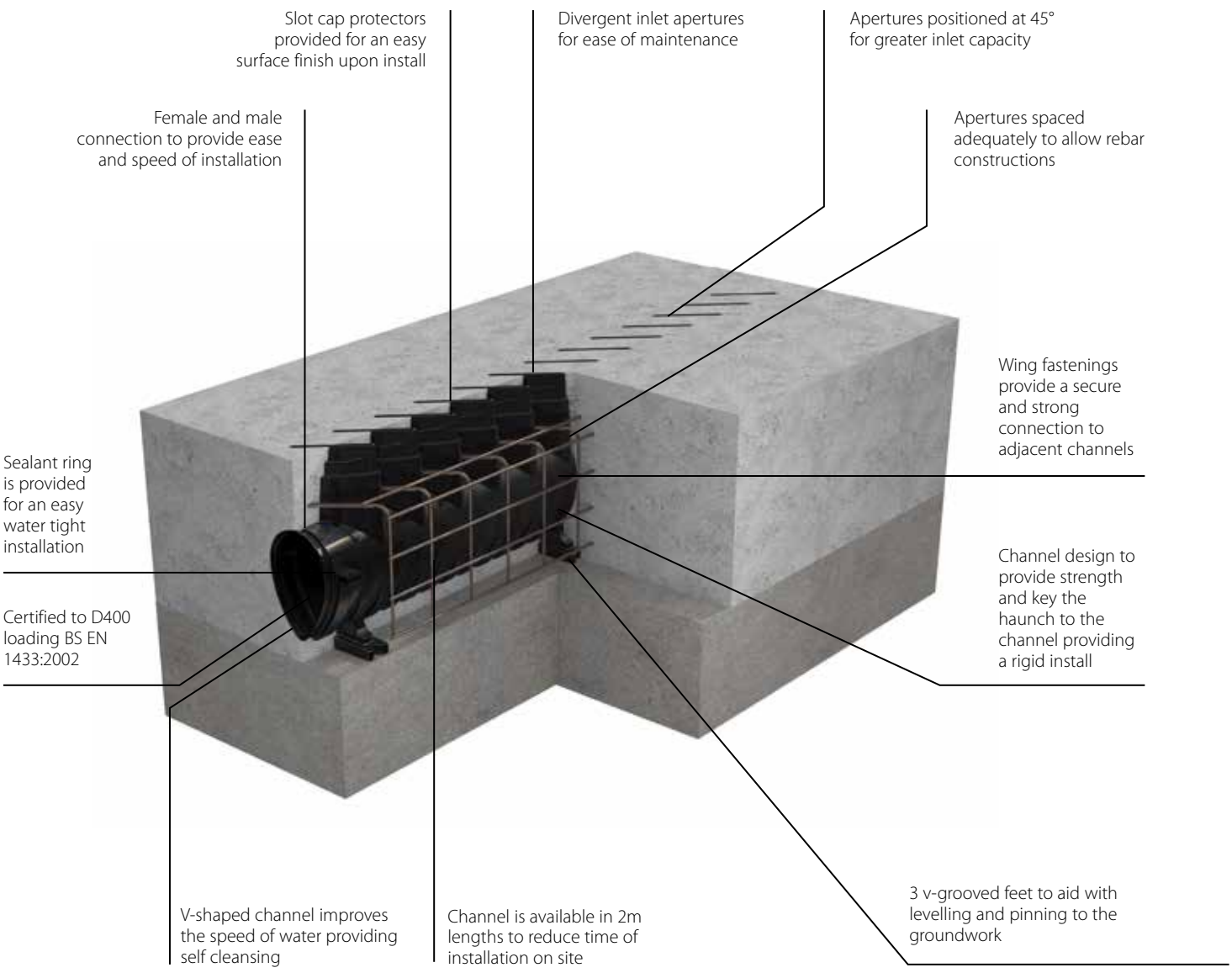
- One of the highest flow capacity system on the market
- Reduced post-installation maintenance
- Extensive applications
- Robust system
- Complies with BS EN 1433:2002
- Sufficient flow velocities can be achieved at low gradient to promote self cleansing
- Straightforward to install
- 5 different channel depths
- High attenuation capacity
- Simple detailing
- Channel and kerb applications
- One-piece channel design with quick and easy installation

Marshalls Drexus XL is a recycled polyethene (PE) high capacity channel system. It's innovative inlet 'fin' design maximises strength at the surface enabling this one piece system to site at surface level without the need for a secondary rail system which helps reduce the cost of installation.

The Drexus XL have been designed with attenuation in mind and will assist with site wide storage becoming an integral part of any sustainable surface water management solution as part of either a SUDS or traditional drainage system.

It is ideally suited for high capacity heavy duty projects covering any load class from busy service yards and rail & docking ports, airports with severe dynamic transport loading to motorways and commercial outlets.

The high capacity system is designed to offer attenuation and storage facilities but also to achieve sufficient flow velocities at low gradient to ensure that the channels require minimal maintenance. Drexus XL's In-Situ surface finish is designed to integrate seamlessly into concrete surfaces.



Components

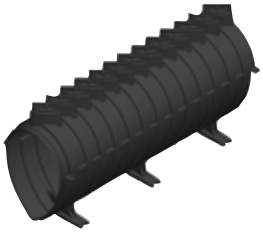
CHANNELS

325 Channel

425 Channel

525 Channel

675 Channel



825 Channel

ACCESSORIES

Access & Outlet Units

- The Access Chambers modular design provides rodding access or outfall and silt trap abilities.
- Each face of the Access Chamber features cutting guides for a series of channel depths allowing multiple connections of differing size channels acting as a junction or interim access point for maintenance.
- F900 rated Access Cover and Frames features a unique patented quick and easy locking and unlocking mechanism for ease of maintenance.

Access Cover & Frame

Access Chamber

Silt Box

Chamber Connector

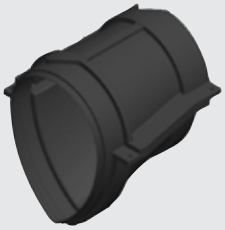
- Provides a connection from the Channel to the Access Chamber
- Available in both Female and Male options to allow either end of Channel to connect into the Access Chamber.

Chamber Connector 425 Female

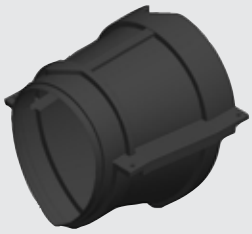
Chamber Connector 425 Male

Transition Units

- 4 different sizes transition units provides uninterrupted flow between the Channels minimizing impact on the hydraulic performance.
- Designed to provide the system with flow control and attenuation capabilities.



Transition Unit 425-525 Female to Male



Transition Unit 425-525 Male to Female

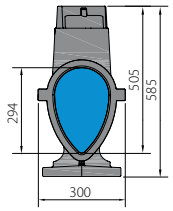
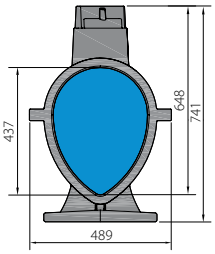
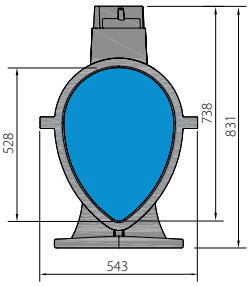
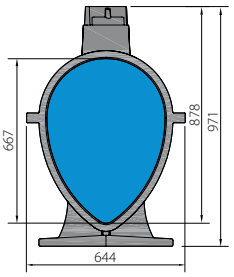
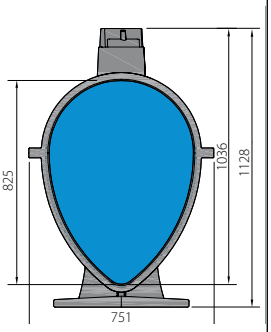
End Caps & Cap Outlets

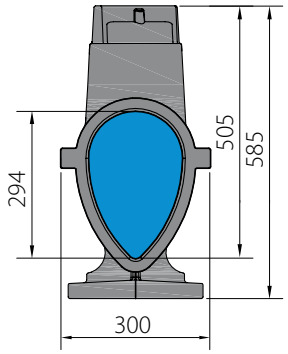
- End caps are designed to be universal to be used for both the Female or Male ends of the Channel.
- Cap Outlets enable the system to connect to standard underground pipes.

End Cap

Hydraulic Data

FLOW CAPACITY

Drexus XL 325	Drexus XL 425	Drexus XL 525	Drexus XL 675	Birco 150 with 825
				
				
Equivalent Pipe Diameter (mm) 225	Equivalent Pipe Diameter (mm) 360	Equivalent Pipe Diameter (mm) 435	Equivalent Pipe Diameter (mm) 550	Equivalent Pipe Diameter (mm) 675

Drexus XL


ref.	d	i	u	W
325	585	505	294	300
425	741	648	437	489
525	831	738	528	543
675	971	878	667	644
825	1128	1036	852	751

Hydraulic Data

The Drexus XL hydraulic data stated in the following tables comprises of flow capacity, in litres per second (l/s) and velocity in metres per second (m/s). This data has been calculated using spatially variable flow design principles.

Drexus XL										
Channel Type	**325**		**425**		**525**		**675**		**825**	
Gradient "1 in"	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s	l/s	m/s
10	232	5.72	807	7.78	1287	8.67	2383	10.01	4066	11.32
20	161	3.96	561	5.41	896	6.04	1662	6.98	2838	7.90
30	130	3.19	453	4.37	724	4.88	1344	5.64	2297	6.39
40	111	2.74	389	3.75	622	4.19	1155	4.85	1976	5.50
50	99	2.43	346	3.33	553	3.72	1027	4.31	1757	4.89
75	79	1.95	278	2.68	446	3.00	829	3.48	1419	3.95
100	68	1.67	239	2.30	382	2.57	711	2.99	1218	3.39
150	54	1.34	192	1.85	308	2.07	573	2.41	982	2.73
200	47	1.15	164	1.58	264	1.77	491	2.06	842	2.34
300	37	0.92	132	1.27	212	1.43	395	1.66	678	1.89
400	32	0.79	113	1.09	181	1.22	338	1.42	581	1.62
500	28	0.69	100	0.96	161	1.08	300	1.26	515	1.43
750	23	0.56	80	0.77	129	0.87	241	1.01	414	1.15
1000	19	0.47	68	0.66	110	0.74	206	0.86	354	0.98
1500	15	0.38	55	0.53	88	0.59	165	0.69	284	0.79
2000	13	0.32	47	0.45	75	0.51	141	0.59	243	0.68
Equivalent pipe diameter	225mm		360mm		435mm		550mm		675mm	

Drexus XL Channel Component Codes

A Constant Depth Channel

Constant Depth Channel	Loading	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	In-situ Top
325	B125 - F900	2000	300	188	585	505	13	**DR537010**
425	B125 - F900	2000	483	319	723	648	20	**DR537020**
525	B125 - F900	2000	543	379	813	738	23	**DR537030**
675	B125 - F900	2000	644	482	949	878	27	**DR537040**
825	B125 - F900	2000	707	586	1106	1036	32	**DR537050**

B Transition Channels

Transition Channels	Length (mm)	Width (mm)	Invert Width (mm)	Depth (mm)	Invert Depth (mm)	Unit Weight (kg)	In-situ Top
425-325 F-M	478	489/300	322/214	542/348	463/292	3.25	**DR538110**
525-425 F-M	478	543/489	379/322	592/542	527/463	4.5	**DR538120**
675-525 F-M	478	644/543	476/379	732/592	664/527	5.8	**DR538130**
825-675 F-M	478	706/644	582/476	890/732	821/664	7.5	**DR538140**
325-425 M-F	478	300/489	214/322	348/542	292/463	3.5	**DR538010**
425-525 M-F	478	543/489	322/379	542/592	463/527	4.6	**DR538020**
525-675 M-F	478	543/644	379/476	592/732	527/664	5.9	**DR538030**
675-825 M-F	478	644/706	476/582	732/890	664/821	7.6	**DR538040**

Drexus XL with reference numbers indicated in **bold** black are available ex-stock.
Drexus XL with reference numbers indicated in light are manufactured to order.
Contact our sales office to discuss your requrements.

C End Cap/Cap Outlets

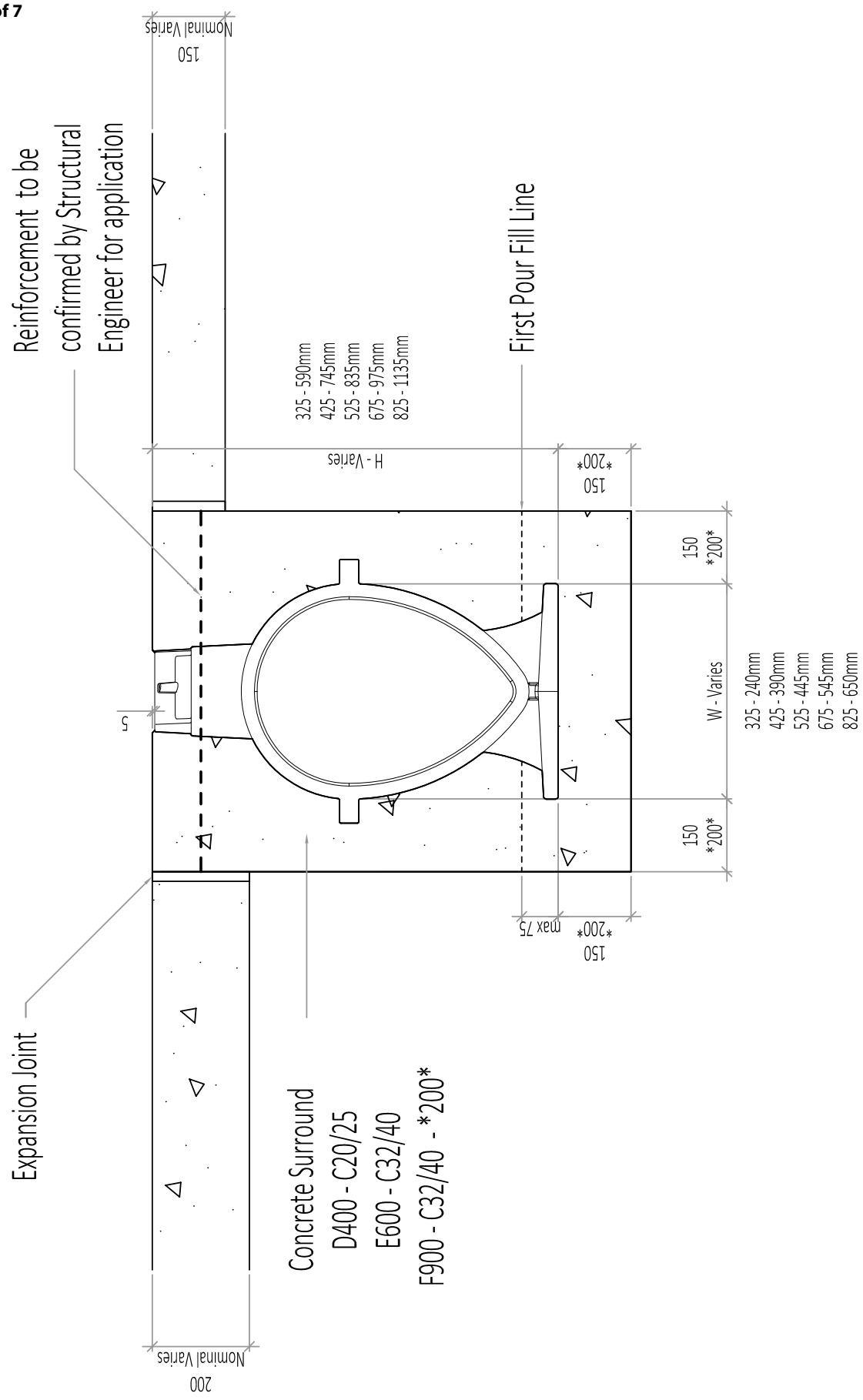
End Cap/Cap Outlets	Unit Weight (kg)	Item Code
325 End Cap	1	**DR537910**
425 End Cap	2.5	**DR537920**
525 End Cap	3	**DR537930**
675 End Cap	4.5	**DR537940**
825 End Cap	5.5	**DR537950**
325 Cap Outlet - M	1.9	**DR537955**
425 Cap Outlet - M	3.1	**DR537956**
525 Cap Outlet - M	4.2	**DR537957**
675 Cap Outlet - M	5.8	**DR537958**
825 Cap Outlet - M	9.4	**DR537959**
325 Cap Outlet - F	2.0	**DR537960**
425 Cap Outlet - F	3.3	**DR537961**
525 Cap Outlet - F	4.4	**DR537962**
675 Cap Outlet - F	6.0	**DR537963**
825 Cap Outlet - F	9.7	**DR537964**

D Outfalls Accessories

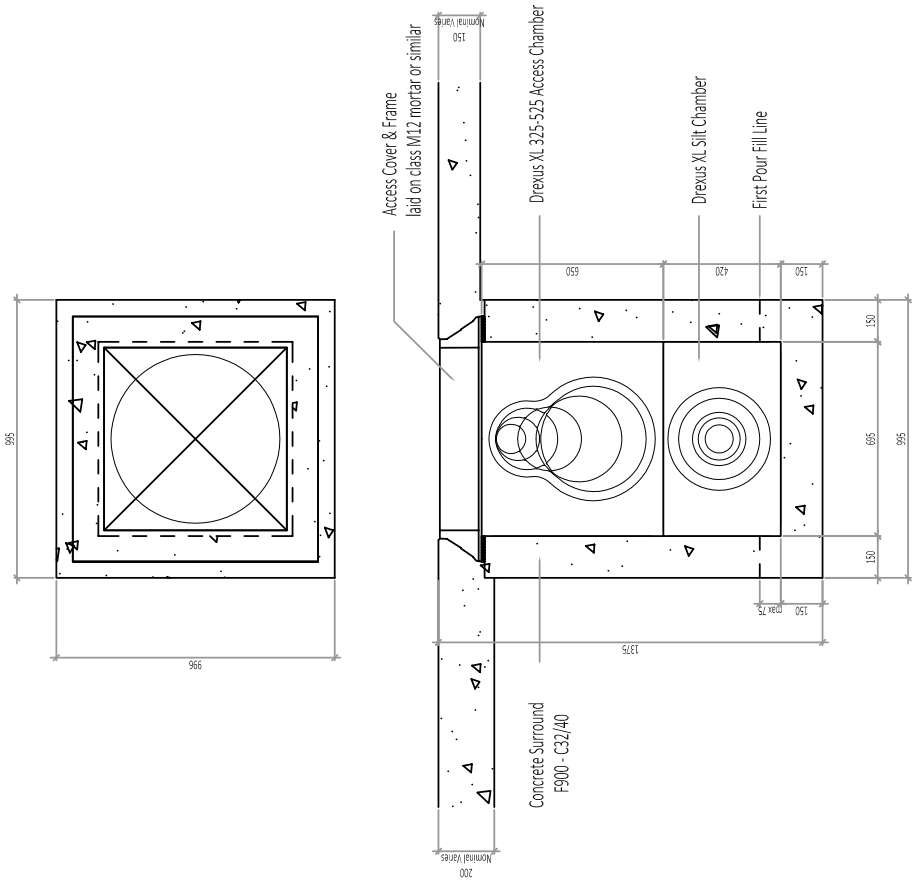
Outfall Accessories	Unit Weight (kg)	Item Code
325 AC Connector - M	2.6	**DR538410**
425 AC Connector - M	3.9	**DR538420**
525 AC Connector - M	5	**DR538430**
675 AC Connector - M	7	**DR538440**
825 AC Connector - M	9	**DR538450**
325 AC Connector - F	2.5	**DR538510**
425 AC Connector - F	3.9	**DR538520**
525 AC Connector - F	4.9	**DR538530**
675 AC Connector - F	6.9	**DR538540**
825 AC Connector - F	9	**DR538550**
325 - 525 Access Chamber	11.5	**DR538905**
675 - 825 Access Chamber	15	**DR538920**
Universal Access Cover F900	159	**DR538930**
Universal Silt Chamber	8.5	**DR538915**

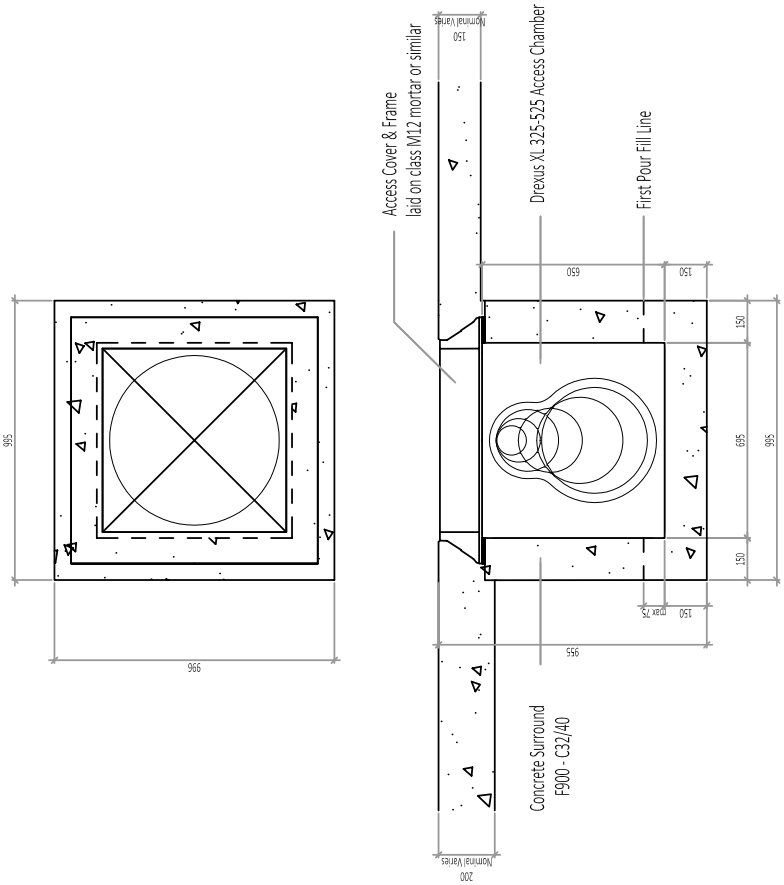
Standard Details

Drawing 1 of 7



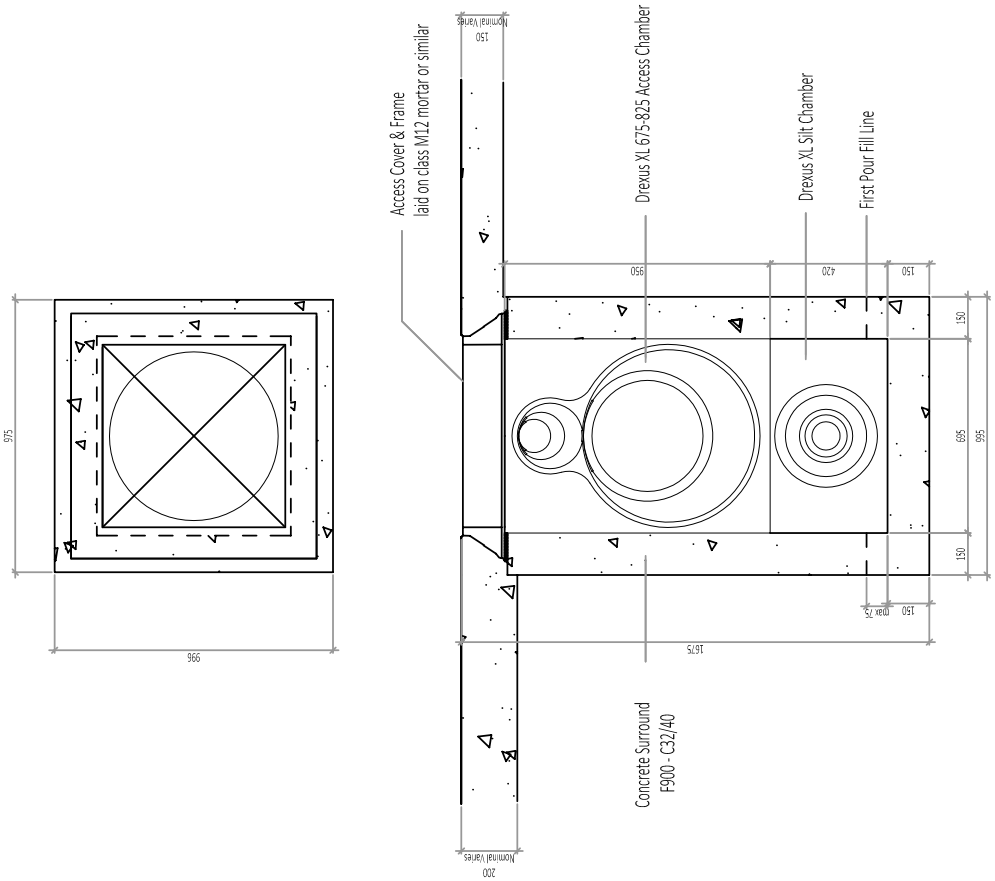
Drawing 2 of 7

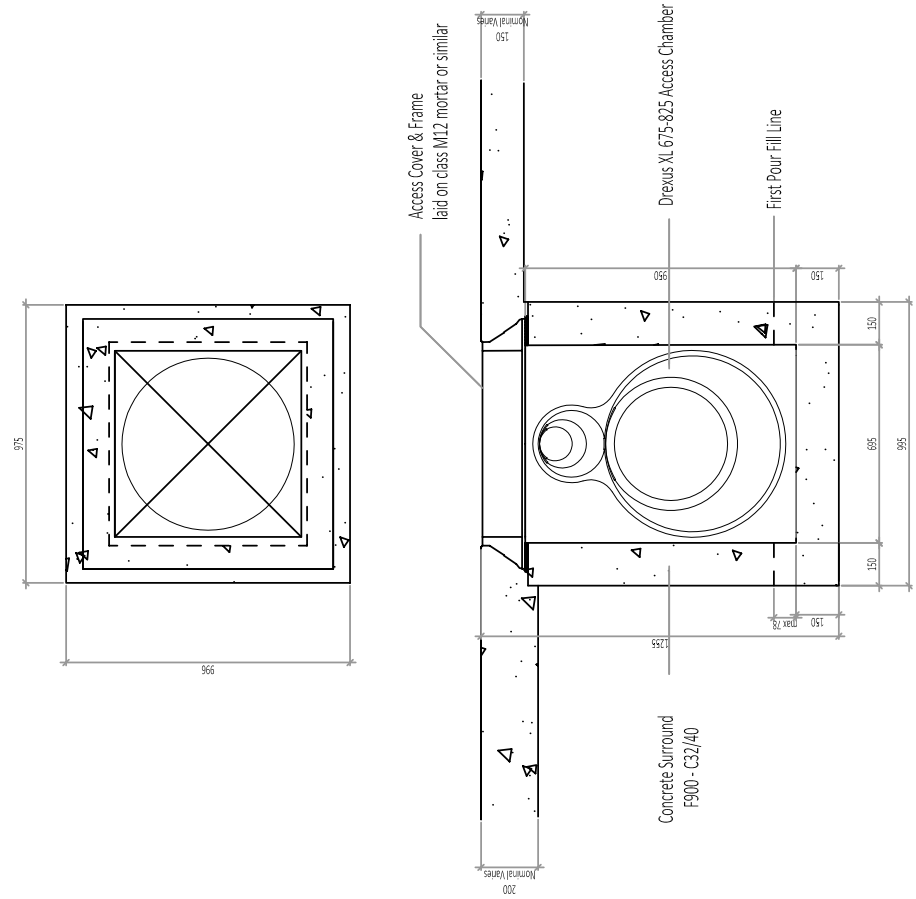




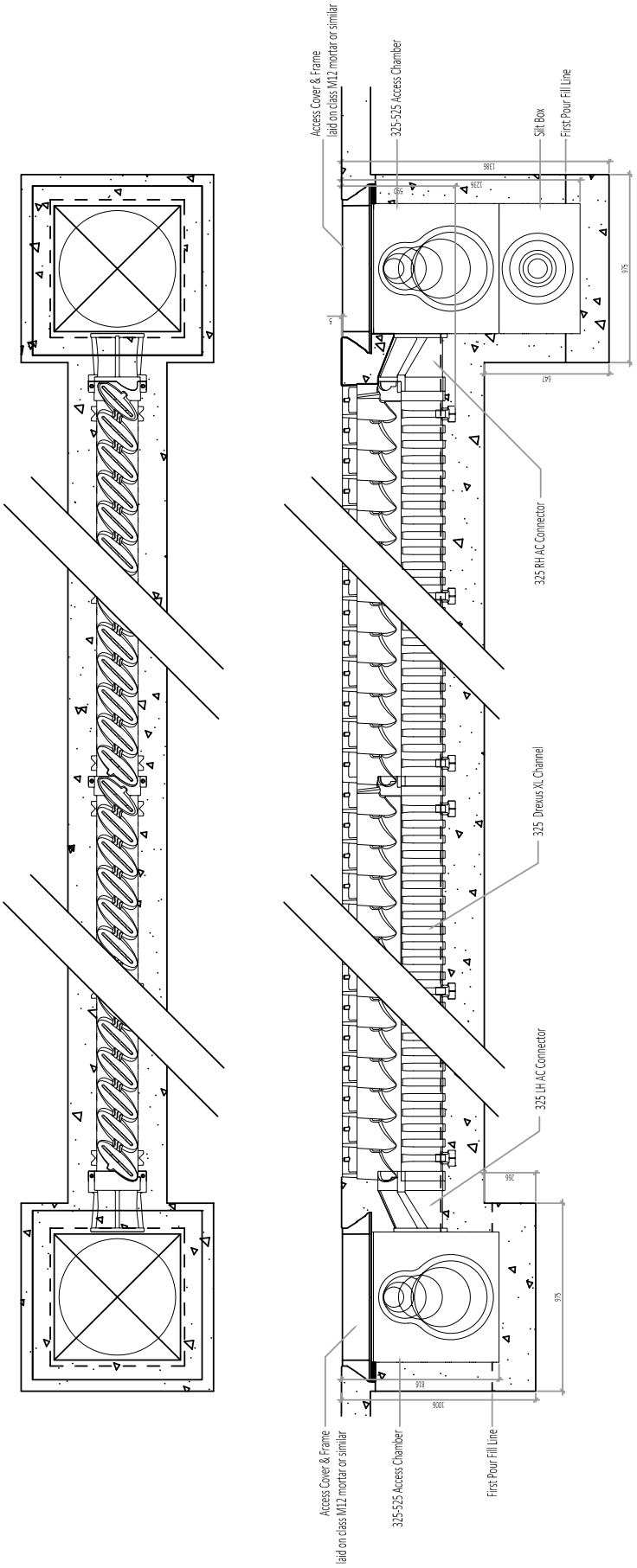
Standard Details

Drawing 3 of 7



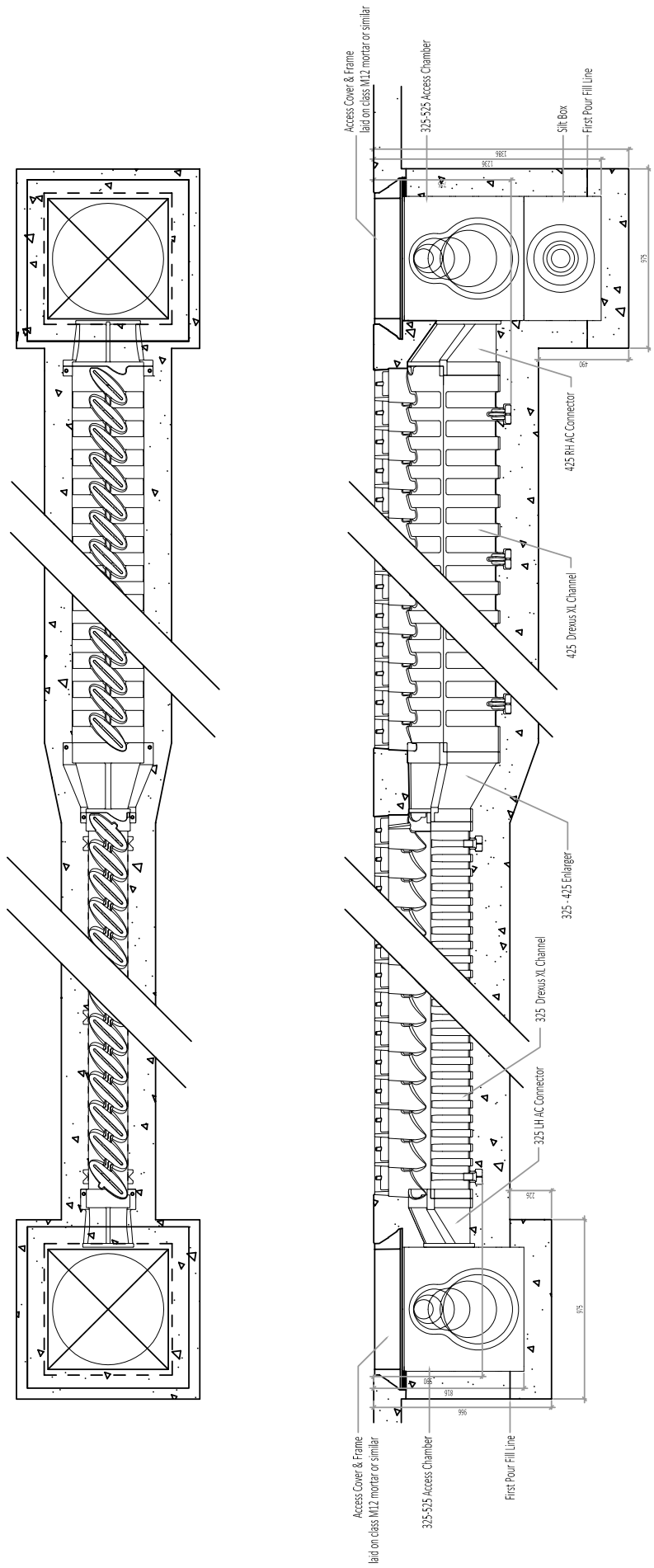


Drawing 4 of 7

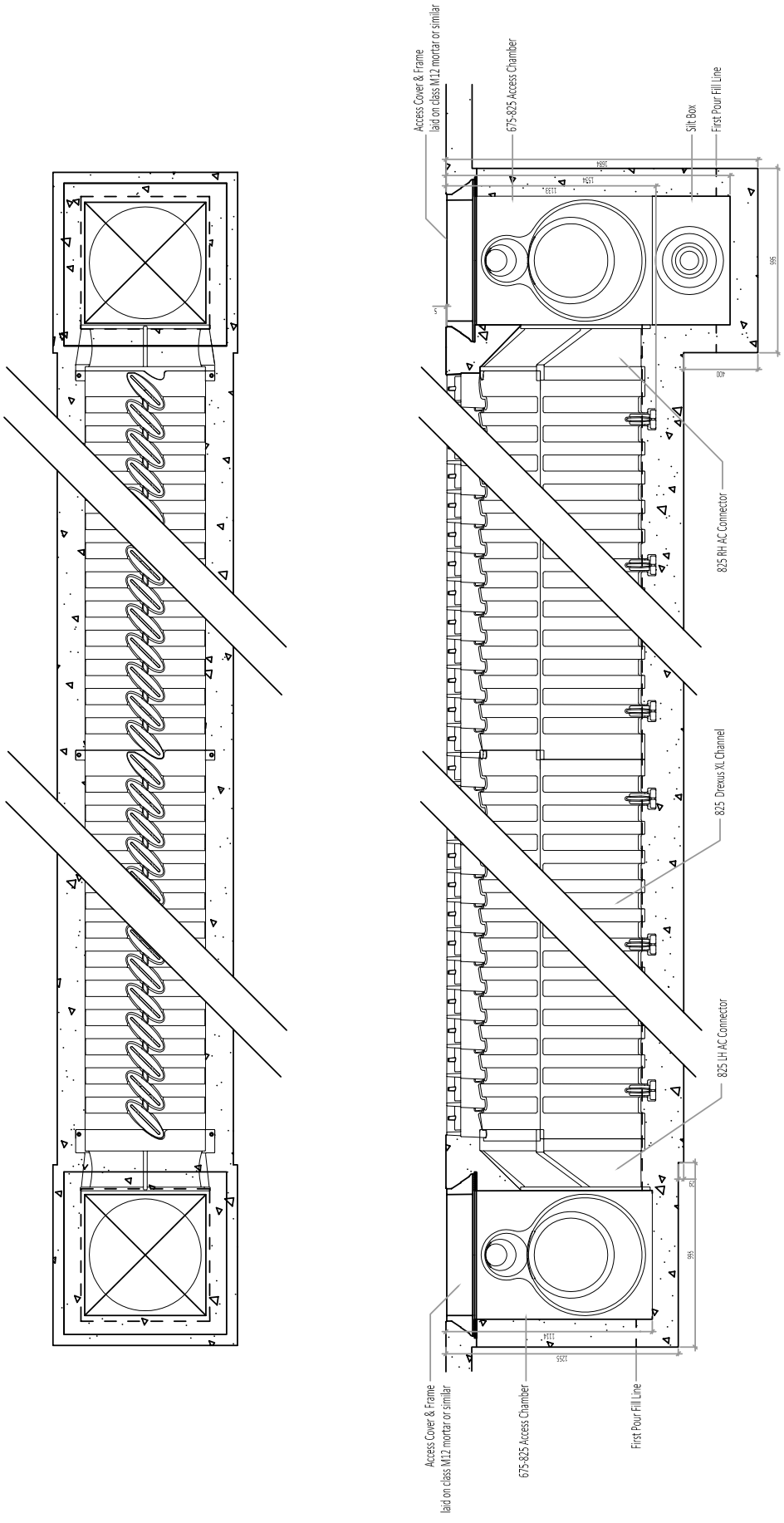


Standard Details

Drawing 5 of 7

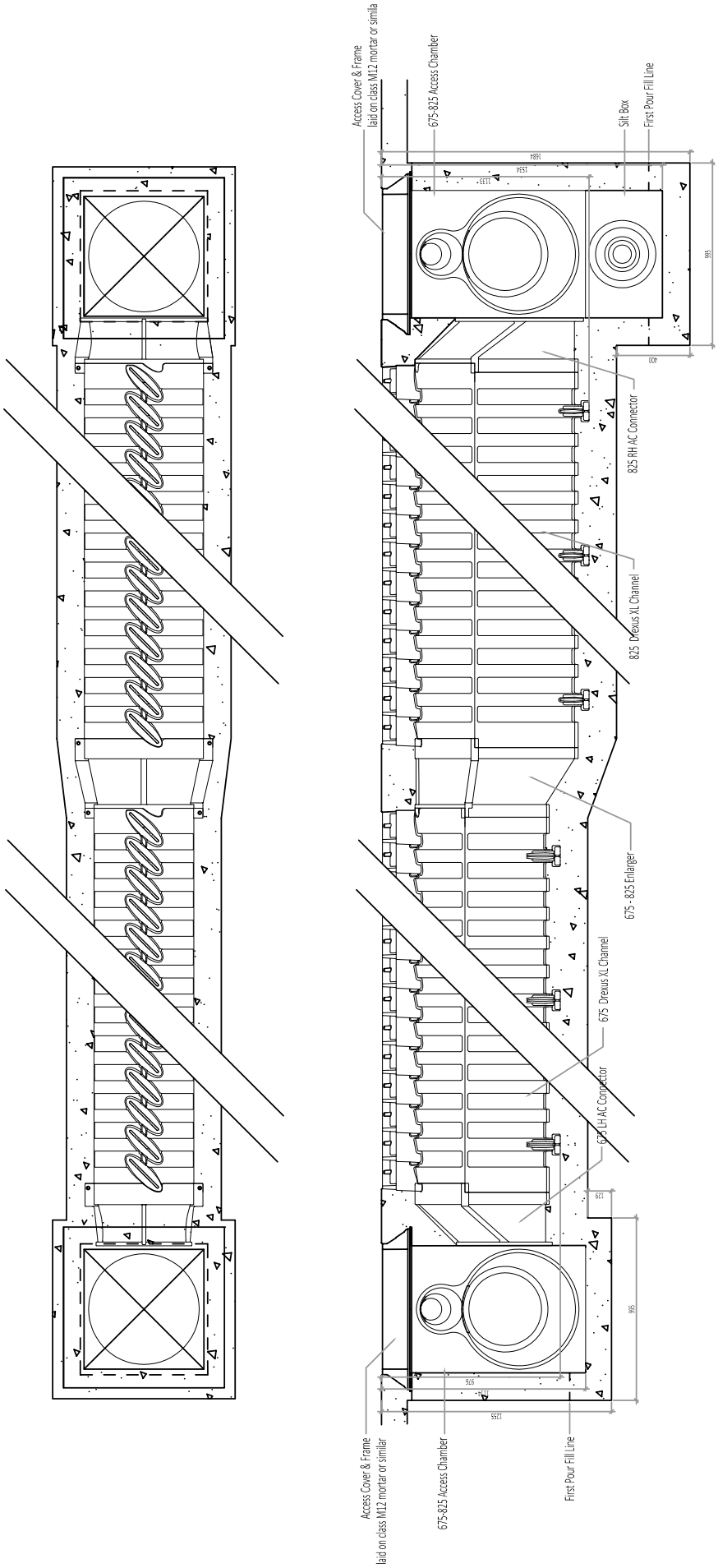


Drawing 6 of 7



Standard Details

Drawing 7 of 7



Standard Details

Notes for Drexus XL

Drawings 1 to 7

1. All dimensions are in millimetres
2. 5 mm Allowance made for pavement settlement
3. Mortar shall be Class 12 to BS EN 988-2:2003
4. Reinforcement shall have a minimum 60 mm cover unless otherwise stated by the Engineer
5. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes which may differ from customer requirements and site conditions. Reinforcement and concrete surrounds should be checked and accepted by the Engineer for project use

Specification

Introduction

The following specification covers the complete Drexus XL system including ancillary fittings and is compatible with the standard detail drawings.

Where the Manual of Contract Drawings for Highways Works is used, information for 'Appendix 5/6: Linear Channels'.

Drexus XL

Drexus XL has PE channel which is surrounded in concrete to form a high capacity linear drainage system. The system is a constant depth channel and is laid flush with the pavement surface. The system reference number relates to the channel depth.

1. The linear drainage system shall be Drexus XL manufactured and supplied by Marshalls plc. All channel materials and ancillary products detailed in this specification shall be supplied by Marshalls.
2. All components of the system shall be type tested and be fully compliant with the requirements of BS EN 1433:2002: Drainage channels for vehicular and pedestrian areas – Classification, design and testing requirements, marking and evaluation of conformity' when installed as per manufacturers recommendations.
3. The linear drainage system shall be a one-piece unit manufactured in a single material (Density Polyethylene PE) with the exception of certain ancillary products as supplied by the manufacturers in accordance with standard details.
4. The linear drainage channel:-
   i. Shall be of a constant depth between transitions or access points
   ii. Shall have a 3:2 ratio egg shape cross section as described in HR Wallingford: Tables for the hydraulic design of pipes, sewers and channels: 6th Edition: Vol 1
   iii. Shall have multiple slot openings set at a transverse angle of 45° to the length of the channel and each slot shall be 150 mm in overall length, 10 mm wide and have an end radius of 5 mm
   iv. Shall have a minimum inlet area of 13,800 mm^2/m
   v. When installed shall have slot openings set below the final pavement surface
   vi. Shall fully comply with the requirements of 'BS EN 13501-1:2007+A1:2009: cl (8) & (9): Fire classification of construction products and building elements. Classification using test data from reaction to fire tests'.
5. The linear drainage shall be installed to line and level indicated in the contract and in accordance with manufacturer's instructions and standard details.
6. The drainage system shall be installed in accordance with manufacturers recommendations, industry best practice or as detailed in the contract ***/ WRc Sewers for Adoption; 7th Edition : 2012 / BS EN 752:2008 / BS 8000: Part 14:1989****

Note: * delete as required

Construction

Introduction

Installation of the Drexus XL linear drainage system should be carried out in accordance with Marshall's specification and standard detail.

The following method of installation is recommended by Marshalls and it is based on conventional UK best practice construction techniques and installation and testing trials and if applicable, installation shall comply with the recommendations in the Construction Phase Plan as defined by the 'Construction (Design and Management) Regulations 2015'.

Should your application differ from standard installation guidance you should consult with your Engineer or Marshalls Technical Advice Team.

Excavation

1. Sufficient material should be excavated to accommodate the channel unit, concrete bed and haunch and working areas.
2. Place excavation support as required depending on channel size, native ground conditions and method of working. Any 'soft spots' or poorly compacted formation should be made good.

Setting Out

1. Setting out pins should be accurately located in accordance with the contract drawings, with a string line level with the top and end of the channel slots. Pins should be located to avoid having to lift the channel units over the string line. The slots should be set so as to follow the longfall and crossfall of the final surface as required by the contract drawings.
2. Alternatively, a pipe laser placed at surface level may be used. It is not recommended that line and level is set using internal channel faces.
3. Line and level should be checked at regular intervals and channels adjusted as required. Marshalls recommend as a minimum that line and level are checked at the end of each concrete pour and before initial set has taken place.

Site Storage, Handling and Placing

1. Marshalls recommend that units are stored in their original packaging until required to help reduce the risk of damage and to help with movement around site.
2. It is the site contractor's responsibility to ensure that units are stored on solid level ground and in a clean and protected area away from potential site damage. Care should be taken when removing units from secure packaging and pallets and units should not be stacked more than one pallet high. Units shall not be stored close to sources of heat such as engine exhaust outlets or hot works areas such as welding and cutting.
3. Should the units be put in long term storage Marshalls recommend that the units are covered to protect mating surfaces and slot opening from dirt and debris until such time that they are required. Additional protection may be required to prevent accidental damage.
4. Marshalls advise that all drainage components should be installed by a safe method of working. The use of mechanical handling equipment such as lifting strops have proven to be of benefit and will eliminate manual handling. Whilst the smaller units are relatively light in weight, Marshall's do not recommend manual handling due to the size and shape of units.

Outfalls

1. Outfalls are formed using the Marshalls plastic outfall chamber and silt box units as required. The small access chamber is suitable for the channel unit up to size 525, the large access chamber is suitable for channel units 675 & 825.
2. The access chamber shall be cut to accept a chamber connector using the preformed template as a guide. The outfall chamber shall be bedded on semi-dry concrete (class S1) and concrete surround formed as per the standard details. The top surface of the surround shall finish flush with the top surface of the chamber. Provision should be made for the chamber connector to be cast monolithically in to the concrete surround or placed during installation of the channel units.
3. If a silt trap is required, it can be placed below the access chamber and the chamber base can be cut and removed using the preformed circular template as a guide. The silt box can be rotated to any orientation to receive the outlet pipe. For the best results and to maintain a watertight connection between the silt box and chamber, the concrete surround shall be cast monolithically. Depending on the method of installation the chamber may require bracing or support to avoid movement during the placement of concrete.
4. Access chambers shall have cast iron access covers and frames load rated to their intended application and shall be bedded and haunched on class 12 mortar (or as specified in the contract). When placed correctly, the frame will sit centrally over the chamber opening and directly on the concrete surround. The cover and frame can be placed after the concrete has

Channel Units

1. Drexus XL units are installed using the same principles of conventional pipe laying techniques.
2. Starting at the outfall chamber, i.e. working uphill, Marshalls recommend the following installation technique:-
3. Place the concrete bed to the correct line and level allowing the channel units to be placed on to the upper surface.
4. Place the chamber connector and first unit to the chamber. Minor adjustment to line and level can be made by placing non-compressible wedges beneath the feet. Subsequent channels are placed end to end in the same manner.
5. Units should be connected (or jointed) together using a mechanical pipe puller to form the joint and a propriety pipe lubricant may be used to aid jointing operations as required. Do not use soaps, grease or oils which are not designed for use with flexible pipe jointing gaskets.
6. Marshalls recommend the use of full channels and do not recommend cutting or alteration of channels and designs are be produced to accommodate full lengths with ancillaries.
7. To maintain water tightness, channels shall be sealed at each joint using Marshall's flexible rubber pipe seal and adjacent channels shall be connected at each connection tab with cable ties, a peg, a nut and bolt or similar to maintain the integrity of each drainage run during installation runs.
8. Channels shall be regularly checked and adjusted for line and level and where channel units do no terminate in an access chamber, end caps shall be use to seal the drainage run.

Concrete bed and surround

1. Marshalls recommend a multi-layered pour sequence to avoid movement during placement of the concrete surround (see standard details). However, depending on the method of working, the size of the channel, the workability class of the concrete, the thickness of the surround and the size of the excavation, the channels may require additional support to avoid movement of the units or may require the use of temporary formwork to form the concrete surround to the correct size for each channel unit. The concrete thickness shall be as the minimum stated in the standard detail for each load class.
2. To help maintain channel alignment during the placement of the concrete bed and surround, channels can be secured in position with 'pins' or 'U' bars using the 'V' notch in the feet of each channel; retaining straps over the units fixed to the base concrete; kentilage or timber props.
3. Place and compact semi-dry concrete (class S1) to form base and to anchor the unit in position and avoid the risk of flotation. Check line and level and adjust to suit and ensure no voids are present to maintain load bearing strength. Refer to Marshalls Specification for concrete grades and depths. Allow a minimum 12 hrs to allow the concrete base to achieve an acceptable working strength before subsequent concrete is placed.
4. Place and compact the semi-dry concrete surround (class S1) in layers not exceed 150 mm on alternating sides of the channel to avoid movement and deformation. Check line and level, adjust to suit and ensure no voids are present to maintain load bearing capacity. The top surface shall be

no greater than the underside of the final surface pavement. Allow a minimum 12 hrs to allow the concrete surround to achieve an acceptable initial strength before subsequent concrete is placed.

5. If the channel is to be backfilled before placement of the final surface pavement, a minimum of 72 hrs shall pass before removal of formwork and backfilling commences. Care shall be taken during backfilling operations not to traffic or place loads on the channel surround.
6. The pipes may be used for the transportation of water when the concrete surround and backfill is up to the underside of the final pavement level and following a minimum of 72 hrs after installation.

Concrete pavement (final surface)

1. Place and compact final pavement concrete (class S2) to form final surface. Ensure plastic slot bungs are in place to prevent concrete ingress. If there are no specific Engineers specification, refer to Marshalls Specification for concrete grades, depths and reinforcement requirements.
2. The final surface shall be finished using float or beam to the required texture and the flat slot top shall provide a reference level for the final upper surface. The Customer may decide to change the shape and nature of the final pavement subject to their design and installation preferences. Specialist engineering advice may be required.

Reinforcement

1. Marshalls recommend the use of reinforcement for certain channel sizes and particular load classes.
2. If required, steel reinforcement shall be placed and spaced using non-compressible pcc setting blocks and tied using mild steel tie wire and shall be generally installed as conventional UK best practice. Refer to Marshalls standard specification for the typical arrangement for each application.
3. Final surface pavement only - Straight lacer bars shall be placed parallel over the channel body between the slot fins and spaced and tied to the main longitudinal steel or mesh to form a composite reinforcement mat.
4. Upper and side reinforcement – 'L' bars shall be placed parallel over the channel body between the slot fins. One leg shall be placed in the horizontal position and one leg shall be placed vertically down the side of the channel body. They shall be spaced and tied to the longitudinal main steel to form a composite steel cage.
5. Base reinforcement – for extreme load classes, base reinforcement is required which may be a structural mesh sheet placed and spaced using pcc setting blocks.
6. Concrete shall be placed so as not to damage the reinforcement. Dependant on the workability class concrete shall be vibrated or carefully placed so as to ensure full compaction and encasement of reinforcement to eliminate voids and maintain structural capacity. Consideration shall be given to the sequence of installation for reinforcement and placement of concrete.
7. The standard details show the general arrangements used by Marshalls for product evaluation and load test classification purposes which may differ from customer requirements and site conditions. The Customer may decide to change the reinforcement requirements subject to their installation preferences and ground conditions and specialist engineering advice may be required.

Expansion joints

1. Make provision for transverse expansion joints at the same frequency as adjacent concrete bays. If the drainage run is to be isolated from adjacent in-situ concrete slabs, then full depth contraction joints across the channel should be formed at between 5 and 8 metre centres. Movement joints parallel to the channel run should be formed either side of the channel surround to the full depth of the adjacent concrete slab and the joint should be designed to fully isolate the channel from any movement of the structural slab. Similarly, access chambers should also be isolated from the adjacent structural concrete slab by incorporating movement joints around the access chamber.
2. The design of the structural concrete slab and flexible joint with regard to the introduction of crack inducers, bay size and movement joint sealants is by others and specialist engineering advice may be required.

Commissioning

1. Do not load or traffic over the channel until the concrete has fully cured and reached full strength.
2. If the strength is unknown, then this should be a minimum 28 days. Loading or trafficking the channel before 28 days has lapsed, concrete strength should be confirmed by a concrete strength test. Particular care should be taken during the construction phase when load conditions may be more onerous due to construction plant and machinery movements and/or incomplete construction.
3. When the pavement has cured sufficiently to allow careful foot traffic (approx 48hrs), the slot bungs can be struck and removed or struck and left in place to avoid site debris entering the channel. The slots can be removed with a hooked or pointed tool (such as a bladed screwdriver or pry bar) by piercing the top surface. Move the tool from side to side before levering out in the direction of the slot length. The slot opening is designed such that on removal of the bung, the final pavement forms the lip of the slot opening. No plastic slot should be exposed at the upper surface level.

Notes

1. In order to obtain a good line and level, it is important to follow the installation guidance and check frequently as concrete is laid. The slot bungs provide a reference for the final surface level.
2. It is not recommended that channels are cut to length on site, drainage runs will be calculated and supplied to multiples of whole units with ancillaries.
3. Outfalls, access chambers and silt traps shall be constructed in accordance with the Standard Details. Silt traps and access chambers should be located at no more than 50m centres in long runs.
4. To help avoid the chamber and silt box units moving out of alignment during installation, screws can be fixed through the chamber base. To help avoid deformation of the chamber sides during placement of the concrete surround, internal cross bracing may be used.
5. Access chambers have been designed to be non-man entry.
6. Installation operations should be discontinued if weather conditions are such that the performance of the channel system may be compromised. Installation should not be undertaken when the temperature is below 3ºC on a falling thermometer or below 1ºC on a rising thermometer.
7. Concrete strengths, dimensions and reinforcement details indicated on typical arrangement drawings were determined to undertake product evaluation, installation and load testing trials to fully comply with BS EN 1433:2002 (Drainage channels for vehicular and pedestrian areas). These may vary to actual site conditions and specialist engineering advice may be required especially in unusual ground or load conditions.
8. Concrete base and surrounds have been designed to be semi-dry (class S1) to allow the units to be adjusted to maintain line and level and to avoid movement during installation.
9. Concrete chemical exposure class shall be determine by the Engineer.
10. All necessary Personal Protective Equipment (PPE) should be worn on site, as site rules stipulate. Goggles, ear defenders, dust masks and protective footwear must always be worn whenever cutting operations are undertaken.
11. COSHH - All relevant health and safety information, including COSHH data sheets, can be obtained from Marshalls Advisory Services, or the Marshalls Design Team on 0845 3020606.