THE HIGHWAYS AGENCY

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
Y SWYDDFA GYMREIG

THE DEPARTMENT OF THE ENVIRONMENT FOR NORTHERN IRELAND

EDGE OF PAVEMENT DETAILS

Summary: This Advice Note provides guidance on the use of the various types of edge of pavement drainage details which are depicted in the 'B' and 'F' series of the Highway Construction Details (HCD): Manual of Contract Documents for Highways Works (MCHW 3).

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

VOLUME 4
SECTION 2

PART 1

HA 39/98

EDGE OF PAVEMENT DETAILS

SUMMARY

This Advice Note provides guidance on the use of the various types of edge of pavement drainage details which are depicted in the 'B' and 'F' series of the Highway Construction Details (HCD): Manual of Contract Documents for Highways Works (MCHW 3).

INSTRUCTIONS FOR USE

1. Remove HA39/89, which is superseded by HA39/98, and archive as appropriate.

2. Insert HA39/98 into the correct place.

3. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

VOLUME 4 EDGE OF PAVEMENT
SECTION 2 DETAILS

PART 1

HA 39/98

EDGE OF PAVEMENT DETAILS

Contents

1. INTRODUCTION

1.1 This Advice Note describes the various types of edge of pavement drainage details which are depicted in the 'B' and 'F' Series of the Highway Construction Details: Manual of Contract Documents for Highway Works (HCD) (MCHW 3) and provides guidance on the use of the details. It also includes details of additional information required for contract documentation.

1.2 The HCD are intended for use on all contracts for an Overseeing Organisation. The 'B' Series of HCD (MCHW 3) depict pavement edge details dealing principally with drainage aspects of highway verges and central reservations. Some drainage components in the 'B' Series are shown in detail in the 'F' Series Drawings. The 'B' Series also detail the Earthworks Outline which is needed for measurement purposes.

1.3 The Advice Note augments the advice given in TA 57, "Roadside Features" (DMRB 6.3) but it does not cover Road Geometry, Pavement Design, Signing, Lighting and Road Layout Aspects. Safety aspects of the juxtaposition of surface water channels and safety fences are considered in HA 37, "Hydraulic Design of Road Edge Surface Water Channels" (DMRB 4.2). Design details of outfalls to surface water channels are given in HA 78, "Design of Outfalls for Surface Water Channels" (DMRB 4.2). HA 79, "Edge of Pavement Details for Porous Asphalt Surface Courses" (DMRB 4.2) extends the guidance given in this Advice Note to the particular requirements for porous asphalt. The principles of drainage design are contained in the Standard HD 33, "Surface and Sub-Surface Drainage Systems for Highways" (DMRB 4.2).

2. DEFINITIONS

2.1 The following definitions are used and shall apply in this Advice Note.

2.2 **Channel:** A narrow longitudinal strip generally near the edge of the carriageway specially constructed to collect and lead away water. The 'B' and 'F' Series Drawings of the HCD (MCHW 3) show four particular types:

a. **Surface Water Channel:** A triangular, trapezoidal or rectangular cross section channel as depicted in Drawing B14.

b. **Edge Channel:** channel formed by the surface of the carriageway and a kerb as depicted in Drawings B9 and B10.

c. **Drainage Channel Block:** A precast concrete unit with cross sectional shapes as depicted in Drawings B4, B8, B10, F15 and F16.

d. **Linear Drainage Channel:** A longitudinal sub-surface closed profile hydraulic conduit with slots located in and above the conduit, as depicted in Drawing B17.

2.3 **Filter Drain:** A drain constructed using permeable materials which allow the entry of water whilst retaining the surrounding material.

The 'B' and 'F' Series Drawings show three particular types:

a. **Combined Surface and Ground Water Filter Drains:** Depicted in Drawings B1, B5 and B15 (previously termed French Drains).

b. **Fin Drain:** A planar geocomposite structure designed to perform the same function as a filter drain. Three types are shown in Drawing F18.

c. **Narrow Filter Drain:** A filter drain with a maximum trench width of 200 mm where either the filter material and pipe together or the pipe alone is enclosed within a layer of geotextile. Two types are shown in Drawing F18.

2.4 **Combined Drainage and Kerb System:** A kerb combining a closed profile hydraulic conduit with slots as depicted in Drawing B16.

3. GENERAL NOTES FOR GUIDANCE ON 'B' AND 'F' SERIES HCD

3.1 The HCD (MCHW 3) supplement the Specification for Highway Works (SHW)(MCHW 1) as does the Notes for Guidance on the Specification for Highway Works (NGSHW)(MCHW 2). The role of Guidance for the 'B' and 'F' Series drawings of the HCD is fulfilled by this Advice Note.

3.2 The 'B' Series of the HCD have been developed to deal with three distinct problems:

(a) stone scatter from combined Filter Drains;

(b) incipient surface failure of the embankment slopes caused by the extension of the sub-base as a drainage layer;

(c) possible premature failure of the pavement from relatively large volumes of surface water being introduced into the filter drainage system at road foundation level.

3.3 The general philosophy developed is that surface water should be kept on the surface but clear of the carriageway running surface for as much of its journey to its ultimate outfall as possible and fin or narrow filter drain should be used to drain pavement layers of the road. Combined surface and ground water drainage systems may be used in certain circumstances (see paragraph 3.6 and chapter 5).

3.4 Surface water channel systems have been designed for this purpose and are capable of carrying large volumes of water over long distances reducing the need for carrier pipes. Carrier pipe systems, where needed, are preferable to carrying water in the filter drain system. The principles described here can quite well be served by the use of kerbed systems (B9), over the edge drainage into open ditches (B13), kerbs and outlet channels (B10) and over the edge into channel blocks (B4 and B8). In all cases the filter drain element of the combined drain must be retained to drain the pavement layers and remove small quantities of ground water.

3.5 Filter drain systems which are required to drain pavement layers of roads on embankment should be selected from fin and narrow filter drains shown on Drawing F18. These should always be introduced on the low sides of carriageways on embankment. The selection of a filter drain system to drain pavement layers of a road in cutting should be influenced by considerations of possible ground-water, drainage during construction and whether or not a longitudinal carrier drain facility is necessary to transport surface-water runoff from the carriageways. A carrier drain facility will be necessary as soon as a surface water channel reaches its design capacity or if it is necessary to introduce features such as laybys which require associated kerbing and gully provision.

3.6 A combined surface and ground water drainage system is likely to be the best solution in cuttings where predicted high groundwater flows require provision of filter drains rather than fin or narrow filter drains. The presence of a filter drain within a verge will effectively prevent additional inclusion of a longitudinal carrier drain other than by vertical separation within the same trench which is expensive and likely to give rise to constructional and maintenance difficulties.

3.7 Wherever it is necessary to provide a carrier-drain facility in cutting the Designer should give careful consideration to providing for its function in the form of a combined filter drain, rather than as a surface water drain which would still require provision of a fin or narrow filter drain at the pavement edge to provide for drainage of the pavement layers.

3.8 The heights shown in the HCD for all types of sub-surface drain have been developed on the basis that they shall extend below sub-base or capping for the maximum thickness of pavement construction permitted. This allows all thicknesses of pavement construction to be used without the need to re-design the drainage system or to re-adjust levels and gradients. The function of sub-surface drainage is to remove water from the pavement layers and sub-base, and also from the capping layer if a permeable capping material is used. However, it is not a requirement of capping materials that they should be permeable: wherever possible, the choice of capping material should be left to the Contractor. In certain circumstances it may be possible to increase the strength of the subgrade by installing drains at a greater depth than shown in the B Series drawings. If large ground water flows are expected, supplementary drainage measures should be taken.

3.9 Responsibility for the design of the drainage system rests with the Designer. However, in order to obtain the most cost-effective solution, the design should allow the Contractor to choose, on a commercial basis, from as wide a range of drainage products as possible. For example, all the pipe types and materials given in the Specification for Highway Works and all the drain types 5, 6, 7, 8 and 9 shown in Drawing F18 should normally be allowed. Only where there are sound engineering reasons, should a particular type of drain or material be excluded.

3.10 The adoption of the drainage systems described above is consistent with the move towards hardening verges and central reserves in particular. Hardening central reserves has a number of benefits apart from the obvious drainage one. These include ease of maintenance and providing alternative methods of mounting safety fences, lighting columns and signs.

3.11 Where a drainage feature might be thought to be visually intrusive (eg a prominent concrete-lined ditch) consideration should be given to the use of self-coloured concrete or other methods to minimise this effect.

4. EARTHWORKS OUTLINE AND MEASUREMENT

4.1 The Earthworks Outline (EO) is defined in the Method of Measurement for Highway Works: Section 6: Earthworks (MMHW) (MCHW 4). The EO has been developed purely for measurement purposes and is shown in the 'B' Series Drawings of the HCD (MCHW 3) to illustrate the written text of the MMHW in areas of complex detail. It is therefore shown for each variant of edge detail. However for any given section of the road, the EO will apply only to the thinnest form of pavement construction permitted.

4.2 For highway drainage the design, if affected by the depth of pavement construction, should be prepared assuming the maximum thickness of construction. For combined surface water and filter drains, and sub-surface drains, Drawings B1 to B12 inclusive indicate minimum depths of drain below sub-base or capping. These dimensions should be taken from the lowest datum for the range of permitted pavement alternatives.

4.3 In the Bill of Quantities the depths of drains will therefore be based on the EO for the thinnest permitted alternative pavement with the highway drainage designed to allow for the thickest alternative. Measurement will also be made between these same datum levels irrespective of the thickness of pavement actually constructed.

5. COMBINED SURFACE AND GROUND WATER FILTER DRAINS (DRAWINGS B1, B5 AND B15)

5.1 Combined surface and ground water filter drains alongside the carriageway have been in use for many years and due to the very open texture of the filter material provide for the rapid removal of rainwater from the road and verge surface. Also because pipe diameters are relatively large, there is, except in rare instances, exceptionally large groundwater capacity which extends as a cut-off to below the capping layer.

5.2 They have however many disadvantages. These principally are the increasing cost of suitably graded stone in some regions, the need for regular maintenance to prevent a build up of grass kerbs, replacement or recycling of the filter materials about every 10 years, and the problem of stone scatter. More importantly, experience suggests it may be unwise to put large quantities of water into the ground at pavement foundation level where malfunctioning of the drainage system is less easily noticed and the inherent risk to the pavement foundations could be serious. This risk also applies to systems where, although positive provision is made at the surface, gully connections are made directly into an edge of pavement filter drain pipe. For these reasons combined filter drains are no longer advocated for general use in new construction. They are retained in the HCD (MCHW 3) for reconstruction work and for situations where large ground water flows from cuttings are to be dealt with and where a combined system can show significant cost savings. They may also be necessary when the road has long lengths of zero longitudinal gradient. Filter drain costs increase more rapidly than for other systems with increasing pipe diameter because of the cost of stone. Also large diameters mean long drain runs with greater risk of saturated conditions downstream. Pipe diameters should therefore be limited to 250 - 300 mm.

5.3 Combined surface and ground water filter drains (French Drains) (B1, B4 and B15) are still permitted in the HCD, but the standard details no longer allow type B material at the surface. [In Regions where type B has not caused stone scatter problems, the Overseeing Organisation may permit a variation to these details allowing the material to be used up to the surface.] Whilst the details in B15 indicate materials that will allow low flows to permeate into the filter media, high flows are designed to flow to catchpits by a channel shaped surface profile.

5.4 Where combined filter drains are to be used, measures should be taken to avoid stone scatter. Over the years a number of methods of providing a permeable and stable material in the top layer of the drain have been tested. The results of these tests indicate that the high degree of porosity obtained from type B material at the surface is not an overriding requirement for satisfactorily draining of surface water. Drawing B15 details suitable treatments where topsoil or granular sub-base material is placed as a stable material above the filter. During construction, sufficient care should be taken to ensure that seemingly minor but important details in B15 are achieved. These are:

a. The provision of a lip between the edge of carriageway and the top surface of the drain to enable continuous over the edge drainage to be maintained and to reduce the effect of build up of vegetation.

b. Slight dishing of the top surface to allow water to be channelled along the surface and into the catchpits during heavy rainfall. It should be noted that in type W a greater fall towards the centre of the drain is specified because the reduced permeability of the thicker layer will require greater flows along the surface. Catchpit grating levels should be calculated to suit these falls and specified in the Contract. Note 7 on Drawing F11 may require amending depending on the required level difference from the carriageway.

5.5 Drain type Y maintains the rapid vertical drainage features of conventional combined filter drains with very much reduced hazard of scatter by using lightweight aggregate as filter material and locating it away from the edge of carriageway. This type is suitable for flatter gradients where flow along the surface into catchpits is less assured.

5.6 For contract purposes where combined surface and ground water drains are to be used, one or more of the types V, W, X or Y in B15 should be specified for the upper section of the drain. The lower section filter would normally be type B material. Drain types G, H or I in Drawing F2 would be applicable with the choice left to the Contractor. In fine sands and silts, to avoid soil migration into the drain, type A or C (designed filter) material should be used. Types J or K in Drawing F2 would be applicable for the lower drain. The type C

grading requirements should be specified in Appendix 5/1 of NGSHW (MCHW 2). Similarly any requirements for sealing of the trench base in water soluble soils should be included in Appendix 5/1. Sub-base material for the upper layer of the drain should consist of type 1 material to Clause 803 of the SHW (MVHW 1). A separating layer between the sub-base layer at the top and the filter material below may be provided with type B filter material. There is little experience on whether a separating membrane is strictly necessary but its use will have undoubted advantage in prolonging the life of the filter by retarding clogging. If used, the geotextile membrane may be specified in accordance with clause 609 of the SHW. It may be possible to consider lightweight aggregate for drainage filter material, but there is little experience of its use. Consultation with the Overseeing Organisation is advised before its specification in a contract.

6. SURFACE WATER CHANNELS (DRAWINGS B2, B3, B6, B7, B11, B12, B14 AND B18)

6.1 Surface water channels are normally of concrete construction, usually slip-formed set at the edge of the hard strip or hard shoulder and flush with the road surface. They provide an economical alternative to edge channels for positive drainage and are normally intended for use in rural roads. They may not be appropriate for roads with long stretches of zero longitudinal gradient.

6.2 Three cross-section profiles are acceptable: Triangular, trapezoidal and rectangular. Details of triangular and trapezoidal profiles are given in Drawing B14. and dimensions for the variables T, U, V, W, X, Y and Z should be specified in Appendix 5/3 of the NGSHW (MCHW 2). Rectangular channels are indicated in HA 37 (DMRB 4.2) and the appropriate dimensional details shall be included in Appendix 5/3. The hydraulic capacity of channels should be designed in accordance with HA 37.

6.3 Cross sectional details for surface water channels and the location of such channels relative to the position of safety fences shall be determined with due consideration to safety aspects. Guidance on this is given in HA 37. Channels with crossfalls steeper than 1:4 or deeper than 150 mm, and all rectangular channels, can only be used behind safety barriers because of safety requirements. Typical details are given in Drawing B18. In some circumstances, there will be insufficient space within the highway cross sections shown in HCD (MCHW 3) to comply with the above. In these cases, alternative types of positive surface water drainage, as described in this Advice Note, should be used. Designs should allow for these alternatives at an early stage to prevent complications later on.

6.4 The dimension Z in Drawing B14 should be a minimum of 200 mm in order to provide a robust section capable of withstanding occasional vehicle overrun. This may be reduced to the carriageway slab thickness in rigid construction where the channel and slab are slip-formed together. Depending on the pavement alternative chosen, the contractor may elect to increase the value of Z to found it on a convenient pavement layer. Channels greater than about 300 mm thick are difficult to slip-form with a vertical edge and a tolerance (angle α in B14) should be allowed. With rigid carriageway construction, a tie bar is required to limit differential movement between the channel and pavement. A drainage path is also required for any water retained by the separation membrane. This detail is shown in Drawing F21.

6.5 The hydraulic capacity of the channel should be based on a 1 in 1 year storm with flow contained within the channel cross section. For greater flows the extent of surcharging should be checked and the width of flooding limited as described below.

6.6 In verges, flooding of the hard shoulder of up to 1.5 m and hard strips of up to 1.0 m may be permitted under a 1 in 5 year storm. The checks should normally be made adjacent to outfalls where the depths of flow in the channel will be greatest. However depending on variations in cross fall, maximum flooding could sometimes occur some distance upstream. On the basis that in general crests will occur in cutting and sags in embankments, critical sections for flooding will occur on the latter. Thus the level of the back of the channel (dimension 'Y' in Drawing B14) may be set so that any further flooding is avoided by allowing the water to flow onto the verge and down the embankment slope. This optimum value of Y will vary with road geometry and discharge volumes for each outfall. Hence for uniformity of channel cross section over the scheme, dimension Y may be set at the level required for the most vulnerable flood section.

6.7 In central reserves, flooding should not be permitted to encroach into the offside lane. The permitted width of flooding will vary with the type of road. In central reserves the level of the back of channel is set below the carriageway allowing flooding to occur within the non-pavement width of the central reserve. To safeguard against flows from the surcharged channel overtopping the central reserve and flowing into the opposing carriageway, a margin of at least 25 mm between the level of the edge of the opposite carriageway and the surcharged channel level should be maintained. Where carriageway levels differ appreciably, the channel and central reserve profile will need to be modified from that shown in Drawings B6, B7 and B8. Advice on this should be sought from the Overseeing Organisation.

6.8 The most economic use of channels will be obtained when the road geometry and outfall locations permit them to be designed to carry water over entire

lengths of cuttings and embankments directly to outfalls, thus minimising lengths of piped drainage. While such channels will have excess hydraulic capacity for most of their length, for practical and constructional reasons frequent changes in channel cross section are inconvenient and will incur a cost penalty. The design should therefore seek a balance between the saving in material costs (concrete) and the added cost of providing more outlets and/or cost of changing of the slip-former mould. With a view to eventual standardisation of sizes, channel sections generally should be specified in width increments of 100 mm. On embankments with flattish gradients the effects of settlement on channel hydraulics should be considered. If substantial settlements are expected, additional outlets to offset possible reduction or reversal of channel gradients may be necessary over the critical lengths.

6.9 In central reserves (Drawings B6 and B7) of standard width with lighting columns it may not be possible to keep the channel clear of safety fencing posts. Safety aspects of the juxtaposition of surface water channels and safety fences are considered in HA 37. Posts in a channel can be allowed for in capacity calculations (Ref 6) but to minimise their effect, posts should not be located in the invert. However if the posts are placed in sockets set into the channel it will have to be structurally designed to withstand the loading requirements of the posts. Driven posts inserted through openings formed in the channel invert are not acceptable. Where the central reserve is hardened it will be more economic to combine the drainage and structural function rather than separately construct a B14 profile channel. The channel profile will then be dictated by carriageway level differences but the triangular shape should preferably be retained.

6.10 Where there are frequent at-grade junctions or accesses, the channel lengths will need to be terminated except in the case of little used private accesses. In these situations unless regular outfalls, such as to soakaways, are available near the junction the use of channels may be uneconomic.

6.11 Details of the design of outfalls for surface water channels are given in HA 78 (DMRB 4.2). The Advice Note gives guidance on suitable outlet layouts for different types of surface water channel and provides methods for designing each type according to the flow rate in the channel. Some typical outlet details are given in Drawings F22, F23 and F24.

7. DRAINAGE CHANNEL BLOCKS (DRAWINGS B4, B8, B10, F15 AND F16)

7.1 The HCD (MCHW 3) show six shapes of channel block and they are detailed in Drawings F15 and F16.

7.2 Block types A & B (B4, B8 and F15) are intended as a relatively inexpensive solution in situations where positive drainage is desirable for dealing with smaller volumes of flow and which would not justify the use of the larger surface water channel. Their use in B4 for verge and slope drainage in cuttings would normally be necessary only in very impermeable soils or where fairly high flows occur such as from rock faces. They may also be used (B8) in the central reserve for carriageway surface water drainage where the distance between outfalls is small rather than using surface water channels. The blocks, having small capacity, will flow full in average rainfall conditions. For the designed rainfall condition, additional waterway area will be provided by the cross falls within the central reserve and may be checked by approximating the profile to a triangular shape. The surcharged levels for a 1 in 5 year storm should comply with the criteria given for surface water channels in Chapter 6. The falls shown in B8 may be increased to provide the required capacity. The distance of the channel block from the edge of carriageway (dimensions W, X in B4 and B8) will depend on the road type but should not be less than 1 m.

7.3 Rectangular channel block types E and F (F16) in combination with block type C (F15) are intended as an alternative to gullies on embankments where kerbs are used. They have a distinct advantage on high embankments, avoiding the difficulty of construction of long gully connections down the embankment slope. Drawing F16 gives typical dimensions for block types E and F but their capacity should be checked and if necessary increased. Safety aspects of rectangular channels are considered in HA 37 (DMRB).

7.4 Block type D (F16) is articulated and is particularly suited to use on steeply sloping ground such as down embankment slopes where some settlement may be expected. The units fit into each other and will need a suitable anchorage and bedding support at the top and bottom. They are suitable as outfalls for surface water channels and for block types E and F.

8. KERBED EDGE CHANNELS (DRAWINGS B9 AND B10)

8.1 General advice concerning the provision and placement of kerbs is given in TA 57 (DMRB 6.3) and concerning materials and construction in Clause 1100 of the NGSHW (MCHW 2). Reference should be made to these two documents. Kerbs are not recommended for general use on rural trunk roads without adjacent footways (Ref 2). The predominant consideration for providing kerbs should therefore be road layout requirements; kerbs should normally be chosen from drainage considerations only when other systems are unsuitable or uneconomic (see paragraph 11.1).

8.2 Drawings B9 and B10 of the HCD (MCHW 3) combine edge channels for positive drainage with a sub-surface drain. The channel outlets use gullies in B9 and drainage channel blocks in B10. Where gullies are used, the connections to the carrier drain may need to pass through the sub-surface drain. This may preclude the use of drain type 5 in Drawing F18. For the remaining types of sub-surface drain in F18 a short interruption in the downward drainage path through the filter will not affect performance provided the carrier pipe is unaffected. The kerbs shown in B9 and B10 are of the extruded type, bedded on to the carriageway surface, but it is not intended to exclude the range of kerb/bedding combinations permitted in the SHW (MCHW 1).

8.3 Where kerbs are used, flooding widths for rural roads without adjacent footways should be designed using the same basis as that given in paragraph 6.5 for limiting the surcharging of surface water channels. The design of outlet spacings should be in accordance with the methods in Refs 3 and 4.

9. OVER THE EDGE DRAINAGE (DRAWING B13)

9.1 Drawing B13 of the HCD (MCHW 3) details verge drainage over embankment slopes. However, the detail can also be used to drain carriageway surface water over the edge of shallow embankments directly into open ditches where appropriate. In this case sub-surface drainage to Drawing F18 should be included in the same manner as for Drawings B9 to B12 inclusive and the detail in B13 amended to show a 40 mm drop from the edge of carriageway to the verge.

9.2 Over the edge drainage can cause soil erosion, topsoil slippage, softening of the side slopes and embankment instability. Its use is therefore only advocated in situations where this method has not led to difficulties in the past. Such situation may include low height embankments constructed from particularly stable materials, such as rock fills. In addition, the slope angle will need to be small enough to preclude topsoil instability.

Over the edge drainage is not appropriate:

(i) Where footways abut the carriageway;

(ii) On some structures.

10. SUB-SURFACE DRAINAGE (DRAWINGS B2-B4 AND B6-12 INCLUSIVE)

10.1 Sub-surface drainage is shown as a general requirement in all the relevant HCD (MCHW 3) drawings. It may be deleted only when free draining subgrade material is assured. In order to obtain the most cost-effective solution, the design should allow as wide a range of sub-surface drain types as possible (see paragraph 3.9).

10.2 Types of fin and narrow filter drain are shown in Drawing F18. Their purpose is to drain the pavement layers to ensure that the road does not fail prematurely through water-related deterioration.

10.3 Fin and narrow filter drains which form part of the permanent works may not be used for the disposal of surface water run-off during construction.

10.4 The under channel drainage layer shown in Drawing F21 is specified for use with rigid carriageways in B11 but it may also be used in conjunction with flexible carriageways. Its purpose is to drain any water which percolates through the road surface or edge of carriageway seal into the pavement layers and sub-base. Where it proves impractical to use this detail, other drainage methods (eg. a layer of free-draining granular material) below the channel should be considered.

11. COMBINED DRAINAGE AND KERB SYSTEMS (DRAWING B16)

11.1 Combined kerb and drainage systems comprise a wide kerb unit within which is an hydraulic conduit. The system is placed adjacent to the pavement which is to be drained. Preformed openings within the system allow surface water to enter the conduit. Water is discharged along the conduit to suitable outfall points. The combined function offers cost savings in certain circumstances and guidance is given in HD 33 (DMRB 4.2). Advice on the use of such systems with porous asphalt is given in HA 79 (DMRB 4.2). The advice given in paragraph 8.1 for kerb edge channels should also apply for this type of kerb system.

11.2 The Contractor is required to design the system in accordance with Clause 516 of the SHW (MCHW 1) with the design requirements given in Appendix 5/5. The requirements should allow the widest choice of alternative systems as possible.

11.3 Typical edge details for combined systems are shown in Drawing B16 of the HCD (MCHW 3). This shows the system founded on the capping layer, however, this will not always be present and the bedding concrete may be located on fill, existing ground or the sub base. In these situations the Contract Documents should indicate the appropriate position for the fin or narrow filter drain to ensure effective pavement layer drainage.

11.4 When used on relatively flat gradients such systems may be prone to the build-up of silt and debris which may impede flow into and within the system. The designer should take account of potential maintenance difficulties in determining the most appropriate form of drainage system. Advice on current experience of maintaining such systems can be sought from the Overseeing Organisation.

12. LINEAR DRAINAGE CHANNEL SYSTEMS (DRAWING B17)

12.1 These channels comprise a longitudinal sub-surface hydraulic conduit into which surface water is drained via longitudinal or angled slots situated above the conduit. Water is discharged along the conduit to suitable outfall points. The channels can be either manufactured units or concrete in situ construction and are set flush with the pavement. Guidance on their application is given in HD 33 (DMRB 4.2) and of their use with porous asphalt in HA 79 (DMRB 4.2).

12.2 The contractor is required to design the channels in accordance with Clause 517 of the SHW (MCHW 1) with the design requirements given in Appendix 5/6 of the NGSHW (MCHW 2). The requirements should allow the widest choice of alternatives.

12.3 Typical edge details for linear drainage channels are shown in Drawing B17. This shows the system founded on the capping layer, however, this will not always be present and the bedding concrete may be located on fill, existing ground or the sub base. In these situations the Contract Documents should indicate the appropriate position for the fin or narrow filter drain to ensure effective pavement layer drainage.

12.4 The range of slot dimensions permissible in the SHW is suitable for motorised vehicles but is unsuitable for cyclists and pedestrians on safety grounds. Linear drainage channels can therefore be used in both verge and the central reserve for motorways. For trunk roads they can be used in verges when placed behind safety fencing where there is no pedestrian usage and in central reserves only behind safety fencing or immediately in front of vertical concrete barriers. This latter situation is shown in Drawing B17 and the drainage and pavement edge details are applicable to other permissible locations. Where linear drainage channels are considered economical for areas subject to pedestrian and cyclist use, the advice of the Overseeing Organisation should be sought.

12.5 There are potential maintenance difficulties with these channels and the comments given in paragraph 11.4 are relevant.

13. SPECIFICATION REQUIREMENTS

13.1 Both the SHW (MCHW 1) and HCD (MCHW 3) require Contract specific information to be provided by the Designer. As a guide, Appendix A lists the information that the Designer is required to provide and where it should be shown in the Contract Documents.

14. REFERENCES

1. Manual of Contract Documents for Highway Works (MCHW)

Specification for Highway Works (SHW) (MCHW 1).

Notes for Guidance on the Specification for Highway Works (NGSHW) (MCHW 2)

Highway construction Details (HCD) (MCHW 3).

Method of Measurement for Highway Works (MMHW) (MCHW 4).

2. Design Manual for Roads and Bridges (DMRB)

HD 33 Surface and Sub-Surface Drainage Systems for Highways (DMRB 4.2)

HA 37 Hydraulic Design of Road-Edge Surface Water Channels (DMRB 4.2)

HA 78 Design of Outfalls for Surface Water Channels (DMRB 4.2)

HA 79 Edge of Pavement Details for Porous Asphalt Surface Courses (DMRB 4.2)

TA 57 Roadside Features (DMRB 6.3)

3. TRRL Contractor Report CR2. The Drainage Capacity of BS Road Gullies and a Procedure for Estimating their Spacing. Transport and Road Research Laboratory, Crowthorne, 1984.

4. TRRL Laboratory Report LR 277. The Hydraulic Efficiency and spacing of BS Road Gullies. Road Research Laboratory, Crowthorne 1969.

15. ENQUIRIES

Approval of this document for publication is given by the undersigned.

The Divisional Director
Traffic Safety and Environment
St Christopher House
Southwark Street
London SE1 0TE

G CLARKE
Divisional Director

The Deputy Chief Engineer
The Scottish Office Development Department
National Roads Directorate
Victoria Quay
Edinburgh EH6 6QQ

J HOWISON
Deputy Chief Engineer

The Head of Roads Engineering (Construction) Division
Welsh Office
Y Swyddfa Gymreig
Crown Buildings
Cathays Park
Cardiff CF1 3NQ

B H HAWKER
Head of Roads Engineering (Construction) Division

The Assistant Technical Director
Department of the Environment for
Northern Ireland
Roads Service
Clarence Court
10-18 Adelaide Street
Belfast BT2 8GB

D O'HAGAN
Assistant Technical Director

All technical enquiries or comments on this document should be sent in writing as appropriate to the above.

APPENDIX A

INFORMATION REQUIRED TO BE SHOWN IN THE CONTRACT BY VIRTUE OF THE 'B' AND ‘F’ SERIES DRAWINGS

	DRAWING	INFORMATION REQUIRED	WHERE SHOWN IN CONTRACT
I	B1, B5, B15 Combined Surface & Ground Water Filter Drains	1. Options for top of drain (B15) & bottom of drain (F2) with schedule of permitted pipe sizes and types for filter drains. 2. Requirements where necessary for mesh, geotextile membrane, light-weight aggregate, unbound sub-base material.	Appendix 5/1 Appendix 5/1
II	B2, B3, B6, B7, B11, B12, B14, B18 Surface Water Channels	1. Options for grassing, or paving for non pavement verge/central reserve 2. Dimensions T, U, V, W, X, Y, Z to Drawing B14. 3. Paving details if used.	Appendix 5/3 Appendix 5/3 Appendix 5/3 or Contract Drawings
III	B9, B10 Channels formed by Kerbs	1. Drawing shows extruded kerb. 2. Details of other permitted types of kerbs, eg B16, will require separate drawings.	Contract Drawings
IV	B4, B8, B10 Drainage Channel Blocks	1. Options for types of channel block from F15 & F16 & grass or paving option 2. Dimensions W, X & Y.	Appendix 5/3 Appendix 5/3
V	B17 Linear Drainage Channels	1. Offset of channel from carriageway.	Contract Drawings
VI	F2 Filter Drains - Trench	1. Grading requirements for Type C filter material.	Appendix 5/1
VII	F15 Drainage Channel Blocks	1. Dimensions R, L	Appendix 5/3

	DRAWING	INFORMATION REQUIRED	WHERE SHOWN IN CONTRACT
VIII	F18, F19, F20 & F21 Fin Drains, Narrow Filter Drains and Under-channel Drainage layer	1. Options for types of fin and narrow filter drain (F18).	Appendix 5/4
		2. Dimensions for height, width and pipe diameter (F18); drain slope angle & (F19); a & b (F21).	Appendix 5/4
		3. Requirements for surround/backfill materials & marker tape.	Appendix 5/4
IX	F22, F23 & F24 Surface Water Channel Outlets	1. Outlet dimensions.	Appendix 5/3

NOTE: This Appendix lists only that information directly called for in the 'B' Series Drawings. However, for all drain types, additional contract drawings will be required.