Code of practice for

Machine laid in situ edge details for paved areas

Confirmed
January 2009

UDC 625.888

Cooperating organizations

The Road Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Aluminium Federation
Asphalt and Coated Macadam Association*
Association of Consulting Engineers
British Quarrying and Slag Federation*
British Tar Industry Association
Cement and Concrete Association*
Concrete Society Limited*
Contractors' Plant Association
Convention of Scottish Local Authorities
County Surveyors' Society*
Department of the Environment (Property Services Agency)
Department of the Environment (Transport and Road Research Laboratory)
Department of Transport*
Federation of Civil Engineering Contractors*
Federation of Manufacturers of Construction Equipment and Cranes
Greater London Council
Institute of Petroleum
Institute of Quarrying
Institution of Civil Engineers*
Institution of Highway Engineers*
Institution of Municipal Engineers*
Institution of Structural Engineers
Lighting Industry Federation Limited
Ministry of Defence
Refined Bitumen Association Limited
Road Emulsion Association Limited
Road Surface Dressing Association
Sand and Gravel Association
Society of Chemical Industry
Trades Union Congress

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Cement Admixtures Association
Cement Makers' Federation
Institute of Geological Sciences
National Paving and Kerb Association
Individual expert

This British Standard, having been prepared under the direction of the Road Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 30 April 1980

The following BSI references relate to the work on this standard:
Committee reference RDB/31
Draft for comment 77/14456 DC

ISBN 0 580 11367 1

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Foreword

Extruded asphalt kerbing was introduced into the United Kingdom from the USA in 1961 and concrete some years later, since which time a substantial amount of experience has been obtained with their use. Some kerbs of this type have now been in service for over 15 years with satisfactory performance. These recommendations set out to give general information on such kerbs based on this experience.

This code recommends good practice for the production of both asphalt and concrete edge details. Specific reference to either material is made only where their individual characteristics warrant such reference.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

0.1 Uses. Most forms of road-edge detail may be successfully extruded or, for concrete alone, slip formed. Raised kerbs may be formed on both rigid and flexible pavements during new construction projects.

The principle use of machine laid in situ sections in the United Kingdom has been at the back of hardshoulders on motorways as a drainage detail. However there are now many cases where these sections have been successfully adopted immediately adjoining carriageways on all-purpose roads and on housing estates. Other situations where this type of section may be used include surrounds to vehicle parking areas, as a means of channelling traffic (e.g. at toll booths) and for the delineation of individual parking bays.

Sections may be formed on existing pavements for surface water control, to facilitate provision of footways with minimum cost or for traffic management purposes.

Where an edge beam is specified as a buttress or datum for pavement construction, a machine laid in situ concrete section may be the preferred form of construction and this may include a raised kerb where required.

0.2 Advantages. Machine laid in situ sections can be laid at up to ten times the rate of laying for conventional forms of kerbs. The in situ type of kerb may be superimposed on existing kerbs thus avoiding taking up and relaying to new levels. It is particularly suitable where a simple addition to an existing pavement is required for surface water control or traffic segregation.

Even if the length to be constructed is small but speed is essential, machine laid in situ kerbs, channels or other features may be considered advantageous in spite of any possible additional cost.

0.3 Disadvantages. Line-guided machines are susceptible to inaccuracies or disturbances of line setting possibly leading to expensive remedial works on long lengths of in situ section. Conventional pre-cast kerbs are fairly easily adjusted for line and level, and conventional formwork can be checked before concrete is placed.

Apart from the question of cross-sectional area, the main limitation on the use of an extrusion machine is the presence of obstacles adjacent to the line of the section. For example, the machines cannot normally be operated immediately against bridge parapets, walls, etc. although, to overcome this problem, hand placing of pre-extruded section may be practicable.

Machine laid in situ concrete is not readily adapted to allow for settlement or alteration to provide for accesses. Extruded asphalt is more readily adapted than concrete to provide entrances and replacement of damaged sections.

Aesthetically, asphalt sections are vulnerable to damage from heavy traffic particularly in the first few weeks of life and they may soften in extremely hot weather.

1 Scope

This code gives information and recommendations about the use of extruded-asphalt or extruded-concrete, and slip-formed concrete road-edge features such as kerbs or channels. Details of asphalt and concrete mixes that are suitable for the processes are given together with construction details.

This code does not provide recommendations for the forming of such edge features monolithically with paved areas nor on the forming of safety barriers.

2 References

The titles of the publications referred to in this code are listed on the inside back cover.

3 General considerations

In general, the case for or against the adoption of a machine laid in situ section is one of economics. Where a kerb is to be formed on the surface of a new pavement the cost of that portion of the pavement should be added to that of the kerb.

Because the mechanized construction of in situ edge details is a specialized process, it is recommended that experienced machine operators be employed. Continuity of experience is also desirable.

Construction should be a continuous process and it is recommended that the supply of materials should be co-ordinated with the output of the particular machine.

Where line-guided machines are used, care should be taken to ensure that the line is not displaced.

4 Machines for forming in situ edge details

4.1 General considerations. There are two basic types of machine commonly referred to as:

a) extrusion machines;

b) slip-form machines.

Further details of the characteristics of both types are given in Appendix A.

The selection of a machine for a particular project should take account of:

a) the material to be laid;

b) the section dimensions;

c) in the case of concrete, whether dowels or reinforcement are to be included.

Asphalt may be laid by only certain of the extrusion machines.

Plain concrete may be laid by either extrusion or slip forming machines.

Reinforced concrete or that containing vertical dowels, may be laid by most slip forming machines but not by extrusion machines.

4.2 Auger powered extrusion machines. To achieve the correct density there is a critical relationship between machine mass, auger size and number of augers to the cross-sectional area of the mould. The density of the extruded section is a direct result of the resistance of the machine to forward movement. Hence a machine of a mass appropriate to the section dimensions should be selected (see Appendix A).

5 Section size and tolerances

5.1 General. A wide variety of kerb, kerb and gulley, channel, edge beams and ditch liners can be achieved. There are some physical limitations, however, that affect the choice of machine as indicated in **4.1** and Appendix A.

Most slip-form machines will accept moulds for almost any section from 120 mm × 120 mm chamfered kerb upwards. Many can place structures, such as kerb and footpath combined, up to 1.5 m to 2 m wide and a few will accept moulds up to 3 m wide. The auger powered extruding machines are more limited.

Whilst machine laid kerbs are preferably laid to straight line or gentle curves, it is possible for them to be satisfactorily laid to radii as sharp as 5 m.

Abrupt changes in kerb-line and level, e.g. at gulley outlets or at dropped kerbs, should receive special attention as indicated in **7.3.6** and **8.5.6**.

5.2 Dimensional tolerances on cross section of moulds. The tolerance on the cross section of the mould should be ± 3 mm.

5.3 Finished tolerances on alignment. Except in the case of line-guided machines the regularity of asphalt kerbs with respect to level depends on the accuracy of finish of the surface on which it is laid.

In the case of line-guided machines the surface regularity of the top of the kerb should be within ± 3 mm of the theoretical line.

The horizontal alignment should not depart from the intended line by more than ± 13 mm nor deviate from the straight by more than 3 mm in 3 m.

Where false falls have been provided in the pavement surfacing to assist drainage in the channels, except where a line-guided machine is used, special measures are usually necessary to ensure that the kerb level follows the true road level rather than that of the falls. It may simply require adjustments to be made to the height of the wheels of the extrusion machine or it may be necessary to run the machine on a short length of suitably supported track or board, placed at the required datum. Alternatively, consideration should be given to the use of pre-extruded kerbs laid on an in situ bed such as would normally be laid for conventional kerbs.

6 Trial lengths

Before commencing any contract it is recommended that the contractor, having selected a mix, should demonstrate, by laying a trial length, that this mix, the plant, equipment and method of construction will produce an acceptable end product. Such trial lengths should be assessed for the required degree of compaction, a uniform surface finish free from blemishes, accurate cross-sectional dimensions and longitudinal alignment.

The capability of the machine to do the curve and gradient work required in the contract should be checked during the trial.

Consideration should be given to the siting of the trial length so that, if successful, it can form part of the main work.

Once the mix details, plant and method of construction have been chosen, these should not be varied without the prior approval of the engineer.

7 Asphalt sections

7.1 General. Experience in the United Kingdom has shown that rolled asphalt mixes of the type described in BS 594 are most suitable for extrusion. Recommended recipe mixes are detailed as follows.

7.2 Materials. A nominal coarse aggregate content within the range 20 % to 30 % is recommended, although other stone contents have been successfully used. The nominal size of the coarse aggregate should not exceed 20 mm and will normally be 10 mm. The aggregate type and other properties should comply with the requirements of BS 594. The binder content of the asphalt mix should normally lie within the range 6 % to 9 % although some aggregates may require 0.5 % to 1 % more binder. It is recommended that the binder be 50, 70 or 100 penetration grade. In general the upper range of binder content and the lower range of penetration will lead to a more durable kerb. In situations where the kerbs will be immediately adjoining a carriageway and where there is a high risk of mechanical damage from vehicle impact, a harder grade of binder (e.g. 35-pen), coupled with the upper range of coarse aggregate content may be considered more appropriate.

The final mix composition will depend on the type of machine, the profile specified and the nature of the coarse aggregate.

The normal tolerances specified in BS 594 with respect to composition of the mixture apply to asphalt mixes to be used for extruded kerbing.

7.3 Construction

7.3.1 *Setting out.* Asphalt kerb extrusion does not necessarily require the setting of rails or guide wires and it is common practice simply to work to a string or chalk guide line on the surface on which the kerbs are to be placed.

7.3.2 *Preparation of foundation.* Asphalt kerbs may be extruded on to the basecourse or wearing course of a flexible construction or, in the case of a rigid construction, on the finished concrete. The surface on which the kerbs are to be laid should be dry and cleaned of loose or deleterious material.

7.3.3 *Bond.* Except in the case of freshly laid bituminous pavements, a tackcoat of either bitumen emulsion complying with the requirements of class A1-40 or class K1-40 of BS 434 or cut-back bitumen complying with the requirements of BS 3690, should be applied to the surface before the sections are laid. Where emulsion is used, it is essential that it be allowed to break before the kerb is laid.

7.3.4 *Supply of material.* The asphalt mix should be transported to the site in suitably insulated vehicles so as to prevent an excessive drop in temperature and as a protection against adverse weather conditions. The temperature at which the asphalt should be delivered to the hopper of the extrusion machine is dependent upon the mix composition but will normally be within the range 135 °C to 180 °C.

7.3.5 *Laying.* It is essential that all machine parts in contact with the asphalt are cleaned of all adhering material at the end of the day's production or if a delay occurs which will allow the asphalt to cool within the machine. The mould should be pre-heated and may require intermittent reheating. The asphalt mix may be fed to the hopper of the extrusion machine by hand or by mechanical means.

During laying, the machine should be operated as far as possible at a constant speed. The engine should not be kept running whilst waiting for materials as distortion of the laid kerb could occur. Asphalt should not be permitted to remain in the hopper for any length of time whilst the machine is not in operation as this could result in the temperature of the material becoming too low for satisfactory compaction and will encourage the machine to lift and distort the profile. The usual restrictions on working in adverse weather conditions should be observed in accordance with the requirements of BS 594.

The sections should be closely compacted with regular sides, edges, arrises and chamfers, finished to a fine surface free from blow holes and dragging, and should be impervious. Use of a hot trowel may be permitted to remove minor surface blemishes.

The most likely source of damage to asphalt kerbs is from site vehicles and construction equipment. Every effort should therefore be made to keep construction traffic away from the laid kerbs.

7.3.6 *Joints and terminations.* Unless conditions dictate otherwise, construction should be a continuous operation. Specific construction joints are not required in asphalt kerbs laid on asphalt surfaces. However, where joints do occur such as between each day's work or as a result of changes in line, these should be made by cutting back the asphalt at the exposed joint to a vertical face, discarding all loosened material and coating the exposed face with a thin coat of a grade of hot bitumen suitable for the purpose, normally as used in the main mix. Gentle heating of the completed joint may be carried out to fuse the adjoining asphalt sections.

Where asphalt kerbs are extruded over joints in a concrete pavement, it will be necessary for a joint to be introduced in the kerb. This may be achieved either by use of a trowel whilst the asphalt is still in the plastic condition, or by means of a suitable saw if the asphalt has hardened.

Where the line and/or level of the kerb are purposely discontinued, hand-finishing may be necessary. Sharp bends, such as those associated with off-set gullies, can be formed by pre-extruding the kerb and then placing it by hand and bonding with tackcoat in the required position. Similarly, for dropped kerbs at entrances, the asphalt kerb can be pre-moulded, cut to length and set by hand. Alternatively, dropped kerbs may be formed by extruding in the normal way and then striking off the top part of the kerb and hand-finishing to the desired height and configuration using a suitable template or jig made to conform to the pattern required.

7.4 Testing. Sampling and testing of the asphalt kerb mix should be carried out in accordance with standard methods as laid down in BS 598. The actual percentages by mass of coarse aggregate, fine aggregate, filler and soluble binder, should comply with the requirements of Appendix A of BS 594:1973.

It has not been possible to include other forms of testing for extruded edge details as no suitable tests specifically for this type of construction have been developed and furthermore some existing tests are not applicable in these circumstances.

7.5 Maintenance and repairs. Repairs to asphalt kerbs are relatively simple, involving the removal of the damaged section, and the hand-placing of pre-extruded sections of kerbing. In such cases, a bond between the new section of kerb and the surfacing should be made by the use of a suitable hot applied bitumen or synthetic resin adhesive. The joints between the old and new sections of kerb should be sealed with the use of an appropriate sealant or alternatively be gently heated to fuse the joint. In the event of extensive repairs being necessary, it may prove easier and more economical for an extrusion machine to be used to lay new sections.

8 Concrete sections

8.1 General. Even long lengths of extruded or slip-formed edge details will require relatively small quantities of concrete, and the scale and nature of the work will generally not justify the application of mix design procedures and the associated testing. For example, the number of strength test results would probably be too few to be statistically significant and reliable. The mix proportions recommended in this code of practice have been selected to provide durable concrete having a sufficient characteristic strength.

8.2 Materials

8.2.1 *Cement.* The cement used in the concrete mix should be ordinary Portland cement complying with the requirements of BS 12, Portland blast furnace cement complying with the requirements of BS 146, or a blend of ordinary Portland cement premixed with pozzolanic pulverized fuel ash. If pozzolanic pulvarised fuel ash is used it should satisfy the requirements of BS 3892. Where there is a risk of sulphate attack, sulphate resisting cement complying with the requirements of BS 4027 should be used, without the addition of pulverized fuel ash.

8.2.2 *Aggregates.* The aggregate should comply with the requirements of BS 882.

8.2.3 *Admixtures.* An air-entraining agent should always be incorporated in the concrete mix to provide additional protection against frost attack. In addition, a water reducing admixture (plasticizing agent) in accordance with the recommendations of CP 110 may also be used if it is shown to be a necessary aid to the laying process or the production of a satisfactory surface finish. All relevant admixtures should comply with the requirements of BS 5075.

8.2.4 *Water.* The water used for making concrete should be clean and free from harmful matter in such quantities as would affect the properties of the concrete in the plastic or hardened state. (See the Appendix to BS 3148:1959)

8.3 Recommended mix proportions

8.3.1 *Mix proportions.* Because the scale and nature of the work will generally not justify the application of mix design procedures and the associated testing, it is recommended that the concrete mix be specified in the form of a special prescribed mix in accordance with the requirements of BS 5328. There is a suitable form in Appendix C of BS 5328:1976 which should be used to specify the concrete required and provide the supplier with all the necessary information.

In order to ensure that the air-entrained concrete has adequate strength, it is recommended that the combined dry mass of the coarse and fine aggregate to be used with 100 kg of cement, should not exceed 600 kg. This ratio corresponds approximately with a cement content of 300 kg per cubic metre of compacted concrete.

8.3.2 *Proportion of fine aggregate.* The most suitable mix to use in a laying machine depends upon both the type of machine and the aggregate. To achieve a well sealed surface, the proportion of fine aggregate will usually need to be between 45 % and 55 % of the total mass of aggregate depending upon the maximum size of the aggregate and the grading of the sand.

8.3.3 *Maximum aggregate size.* The size of aggregate which is to be used should be related to the cross-sectional area and the type of laying machine. The nominal maximum size of aggregate should generally not exceed 20 mm. For some cross sections of finished concrete and for certain types of laying machine, it may be found necessary to use 10 mm sized aggregate in order to achieve the correct profile or a satisfactory surface finish.

8.3.4 *Air content.* Since the optimum volume of air in air-entrained concrete is indirectly related to the maximum size of aggregate in the mix, it is recommended that the total air content of the fresh concrete should be as follows.

For 10 mm and 20 mm nominal maximum size: 6 %

For 40 mm nominal maximum size: 4.5 %

The percentage air content should be maintained within ± 1.5 % of the optimum value.

8.3.5 *Water/cement ratio.* The ratio of free water to cement in the mix should not exceed 0.55 by mass.

8.3.6 *Proportioning the materials.* The solid constituents of the mix should be proportioned by mass. It is most important that the air-entraining or other admixtures be dispensed into the mixing water, as only in this way can thorough distribution throughout the batch of concrete be assured.

8.4 Workability

8.4.1 *Level of workability.* The workability of the concrete should be such as to ensure the achievement of maximum compaction with the equipment being used, a uniform surface finish and a cross section which is free from slumping to within the dimensional tolerances required.

8.4.2 *Working range.* Strict control of workability is essential with all types of machine if a uniform surface finish and an accurate cross section are to be achieved. As a guide, for auger extruders the workability of the concrete should not exceed 15 mm slump. With the slip-form type of machine the most suitable target workability is likely to be within the range 25 mm to 65 mm slump and this should be maintained within a tolerance of ± 10 mm.

8.5 Construction

8.5.1 *Setting out.* Setting out to line and level varies with the type of machine. In the case of rail-mounted machines, the rails are set out accurately for line and level and the machine works from these as a datum. Considerable care is therefore necessary to support the rails firmly.

With line-guided machines, the spacing of the supports for the line varies. On a straight line they should be placed at about 5 m centres but on curves the spacing should be reduced.

With both types of machine the accuracy of the product depends to a large extent on the care and attention paid to the initial setting out.

8.5.2 *Supply of materials.* Laying machines are usually supplied by ready-mixed concrete and it is normally necessary to combine a slow rate of discharge with a slow forward movement of the delivery truck. Generally, a truck on which the drum is powered by a separate engine has an advantage, since the speed of drum discharge can be changed independently of the truck speed. The quantity of concrete ordered should be decided, taking into account the distance it has to be delivered, the size of section and the time it will take to complete the discharge.

8.5.3 *Formation preparation.* If the sections are to be formed directly on to the formation or sub-base, it may be necessary to carry out a preparatory operation. The method normally employed is to use a small gang of labour and plant to accurately trim, blind and compact the surface ahead of the laying machine. Alternatively, these operations can be carried out mechanically by attachments which fit into the larger laying machines.

Care should be taken to ensure that there are no high spots in the working surface which would impede the forward progress of the moulds on the laying machine.

8.5.4 *Laying on or abutting existing surfaces.* Where the main function of the concrete section is to channel surface water into a drainage system, e.g. at the back of hardshoulders, no special measures to achieve bond should be necessary and the cleaning off of loose material from the working surface is all that should be required, care being taken to ensure that previously laid concrete surfaces are free from curing compound.

Other sections may require the incorporation of dowel bars or a keyway and tie bars to provide base restraint and tie the kerb section into the road structure.

For example, edge strips cast alongside an existing concrete carriageway will require tying in to the main slab. Other upstanding edge features, such as kerbs and safety barriers which are required to withstand vehicle impacts, will probably need base restraint in the form of dowels or a keyway into the underlying surface, or be cast in one with the edge strips tied to the carriageway.

8.5.5 *Joints.* In many cases, joints will not be required except for aesthetic reasons or where contraction joints are introduced to limit random cracking. It may also be necessary to match joints already in the surface upon which the concrete section is laid. In this case, expansion and contraction joints should be formed in the kerb section to match the position and width of joints in the underlying surface or structure. For concrete containing coarse aggregate other than flint or quartzite, or similarly hard aggregate, these joints may be sawn in the hardened concrete.

Where flint or quartzite coarse aggregate is used or when contraction cracks are likely to occur before satisfactory sawing can take place, the joints should be wet formed in the concrete while it is still plastic.

A method which may be used for wet forming expansion joints involves the placing of a pair of shaped plates over the section with a gap between them equal to the joint width. The plastic concrete in the gap should then be carefully removed, avoiding disturbance of the concrete on either side and ensuring that no stones are left bridging the gap. A coarse toothed blade has been found to be useful for removing the concrete in this way. The joint gap may need to be filled with a suitable compressible material.

Contraction joints may be formed by simply making an incision with a steel trowel or other sharp tool, sufficient to reduce the strength of the section by one-quarter to one-third.

At the end of a day's work the concrete should be cut back to a point where the cross-sectional profile is satisfactory. Shortly before concreting is resumed, the cut face should be wire brushed and dampened.

8.5.6 *Dropped kerbs, ramps and splays.* Consideration should be given to forming dropped and ramped kerbs from full height sections by striking off the top part of the kerb and hand finishing to the desired height and configuration using a suitable template or jig made to conform to the pattern required. Alternatively, dropped and ramped kerbs may be formed by means of a special attachment on the laying machine but it is unlikely that this method will result in any reduction in the amount of hand finishing required.

Splayed kerbs to channel surface water into off-set gullies may be formed by pre-forming the kerbs on to polyethylene sheeting, and bonding them into position with a synthetic resin mortar after the concrete has hardened.

8.5.7 *Curing.* The exposed faces of sections should be cured immediately after laying to prevent rapid moisture loss and to reduce the effects of solar radiation.

A sprayed, resin based, aluminized curing membrane is the most convenient and efficient method of curing.

8.6 Testing

8.6.1 *Air content.* The air content of the air-entrained concrete should be determined during the trial and at least once a day and not less than once for every five loads during the course of the work. The test should be carried out at the point of laying, using an air meter as described in BS 1881.

8.6.2 *Dry density.* Where the scale or importance of the work justifies the testing which is involved, the degree of compaction achieved in the concrete which is laid in the trial length should be such that its in situ dry density, in the form of cut-out sections or cores, should be not less than 95 % of the average dry density obtainable in cubes prepared and tested in accordance with the requirements of BS 1881.

If the engineer has reason to suspect that the concrete laid by the machine is of variable or insufficient density, he should consider asking for cores to be cut and tested in accordance with the requirements of BS 1881-5.

8.7 Maintenance and repairs. Minor repairs can readily be carried out by hand, using fine concrete or sand/cement mortar.

Where short sections have to be replaced, this can either be done in situ between formwork or by replacing with sections which had been previously formed on to polyethylene sheeting at the time the original work was done, and cut into lengths for storage. The use of synthetic resin bonding agent is a convenient method of fixing these previously formed sections.

Appendix A Characteristics of machines for forming in situ edge details

A.1 Extrusion machines. Almost all of the extrusion machines follow the same principle. They have no motive power to the wheels but rely upon one or more augers which compress material into the mould and so achieve a forward motion. These machines are automatic inasmuch as they will move forward when there is plenty of material in the hopper to feed the auger, and they will stop when there is insufficient material to feed the auger.

They do not have an automatic levelling ability, but rely upon the accuracy of the surface upon which they are running or, if so desired, they can be arranged to run on pre-levelled and aligned track.

The auger type of extruder is robust, simple and relatively inexpensive in the initial purchase. Further details are given in Table 1.

There is another type of extruder which includes limited motive power to drive wheels at the front, but relies mostly upon a large paddle wheel in place of the auger for its forward motion. This machine is semi-automatic, inasmuch as it will take its level from a datum line through simple electronic controls, but it is hand steered.

A.2 Slip-form machines. Slip-form machines have motive power to their tracks or wheels, and compact the concrete by means of internal poker vibrators mounted in the hopper section of the mould. All of these machines run from a pre-set datum line, which governs their level and alignment.

Most slip-form machines can accommodate reinforcement in the section, either hand fed bars or in a cradle form.

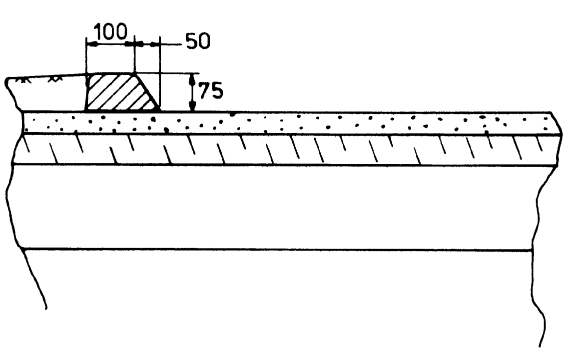
Because of the internal vibration applied with slip formers, and depending upon the mix used, the resultant density of the concrete will be higher than with extruders.

Although the slip former takes its level and alignment from an independent datum line, care should nevertheless be taken in preparing the grade to a reasonable tolerance. The slip forms on these machines have spring loaded, or in some cases, rubber bottom sections, which allow a formation deviation in the order of + 10 mm – 35 mm.

Formations higher than the + 10 mm may foul the machine and produce a tendency to swing off line, whilst deviations of more than – 35 mm will result in spillage of concrete.

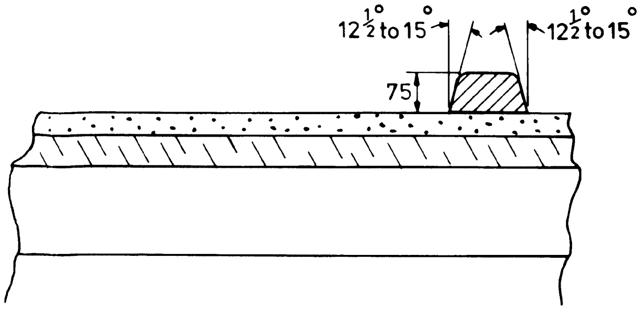
Table 1 — Classification of auger powered kerb extruder machines

Minimum				Maximum			
Model mass	**Height**	**Width**	**Cross section**	**Height**	**Width**	**Cross section**	**Remarks**
kg	mm	mm	m^2	mm	mm	m^2	**Remarks**
300	80	150	0.01	300	260	0.0775	Small sections use a single 100 mm auger. The larger sections use a single 130 mm or 150 mm auger.
300/450	80	150	0.01	300	460	0.09	Small sections with single 130 mm auger. *Sections greater than* 0.075 m^2 *require twin* 150 mm *augers*.
600/700	160	190	0.0366	460	460	0.09	Small section with single 150 mm auger. High or wide sections require one 180 mm and one 200 mm auger.
850/1 000	250	300	0.06	410	650	0.2145	Smallest section with two augers. Largest section with four augers.
1 000/1 200	300	400	0.1016	410	840	0.26	Smallest section with three augers. Largest section with five augers.
These height and width figures are the minimum and maximum available, but the cross-sectional area figures are guides only and will depend to some extent on the shape of the section.							



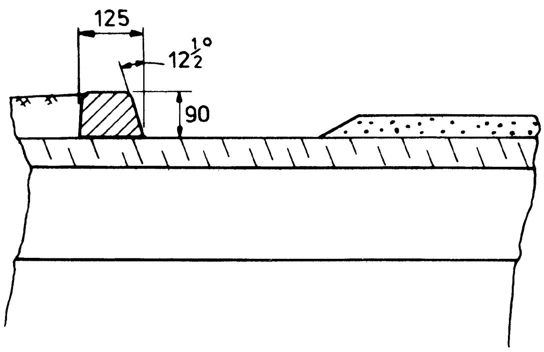
Detail A

Extruded asphalt kerb placed on flexible wearing course (or on rigid pavement) at back of hardshoulder or marginal strip.



Detail B

Extruded asphalt kerb placed on flexible wearing course (or on rigid pavement) at back of hardshoulder or marginal strip.



Detail C

Extruded asphalt kerb used to form part of a drainage channel.

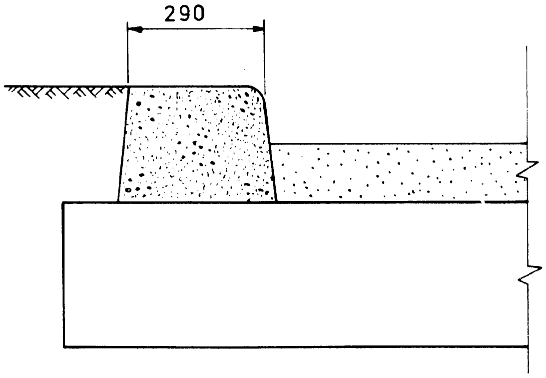
NOTE 1. All dimensions are in millimetres.

NOTE 2. Many other cross sections are possible but all should have an adequate base/height ratio for stability.

NOTE 3. The sizes shown are typical. However the height of the kerb will naturally depend on any specific height requirement above the surface on which the kerb is laid and the width may also be affected having regard to note 2 above.

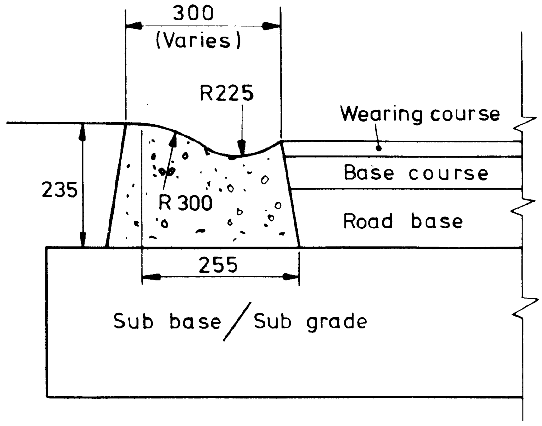
NOTE 4. Exposed arrises should be suitably radiused.

Figure 1 — Typical cross sections of asphalt kerbs



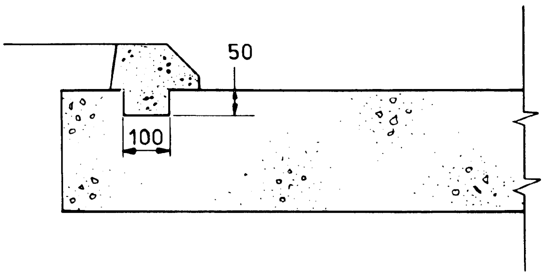
Detail 1

Extruded concrete kerb at back of marginal strip or hardshoulder.



Detail 2

Extruded concrete 'continental' kerb, flexible pavement.



Detail 3

Extruded concrete splayed kerb on rigid pavement.

NOTE 1. All dimensions are in millimetres.

NOTE 2. Many other cross sections are possible but all should have an adequate base/height ratio for stability.

NOTE 3. Dimensions are typical. Height will depend on road construction; width will relate to note 2 above.

Figure 2 — Typical cross sections of concrete kerbs

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Publications referred to

BS 12, *Specification for ordinary and rapid-hardening Portland cement.*
BS 146, *Portland-blastfurnace cement.*
BS 434, *Bitumen road emulsions (anionic and cationic).*
BS 594, *Rolled asphalt (hot process) for roads and other paved areas.*
BS 598, *Sampling and examination of bituminous mixtures for roads and other paved areas.*
BS 882, BS 1201, *Aggregates from natural sources for concrete (including granolithic).*
BS 1881, *Methods of testing concrete.*
BS 1881-5, *Methods of testing hardened concrete for other than strength.*
BS 3148, *Tests for water for making concrete.*
BS 3690, *Bitumens for road purposes.*
BS 3892, *Pulverized-fuel ash for use in concrete.*
BS 4027, *Sulphate-resisting Portland cement.*
BS 5075, *Concrete admixtures.*
BS 532, *Methods for specifying concrete.*
CP 110, *The structural use of concrete.*

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