

## ACO KerbDrain®

The cost effective approach to kerb drainage systems





## ACO KerbDrain<sup>®</sup> Combined drainage and kerb channel system

ACO KerbDrain<sup>®</sup> is a one-piece resin concrete kerb and drainage unit for carriageways, roundabouts, local road schemes, car parking and many other applications.

ACO KerbDrain<sup>®</sup> is a kerb drainage system which conforms to EN 1433:2002/DIN 19580 Load Class D400. It is available as both ACO KerbDrain<sup>®</sup> 480 Kapacity (480 deep overall) and ACO KerbDrain<sup>®</sup> 305 Kompact (shallow 305mm depth) units to meet a wide range of applications.

The ACO KerbDrain<sup>®</sup> system has been extended with complementary products consisting of centre stones, drop kerb assemblies radius units, 90° external quadrant (KD305), 90° internal angle (KD305),Splayed (KD480), Bus Stop (KD480), etc.

### **Technical support services**

To support the specifier and contractor in designing and installing ACO KerbDrain<sup>®</sup> schemes, ACO's Design Services Team offers a free computer-aided scheme design, hydraulic performance calculations and installation advice services without obligation.

## Telephone Hotline: 01462 816666

## Fax Hotline: 01462 851081

e-mail Design Services Team: draintechnical@aco.co.uk



website:

www.aco.co.uk

ACO KerbDrain® 480 Kapacity kerb unit



ACO KerbDrain® 305 Kompact kerb unit Load Class (EN 1433:2002/DIN 19580)

### **Optimum** solutions

ACO's expertise in engineering solutions for road drainage results from 30 years of providing channel drains, hydraulics and solving drainage problems for local, urban and highway schemes all over the world.

## Road engineering advantages

Research through local authority engineers and their contractors into the problems of highway drainage has led to the development of the smaller, lighter and more cost-effective ACO KerbDrain® range. The benefits of unobtrusive, inkerb drainage can now be extended, from larger highway schemes, to smaller, lighter duty projects than was previously affordable, for a wider range of urban and rural locations.



ACO Kerbdrain® Centre stone.

## ACO KerbDrain®

### COMBINED DRAINAGE AND KERB CHANNEL SYSTEM

### New capabilities in kerb drainage from ACO



One of many applications which can benefit from ACO KerbDrain<sup>®</sup> Systems.

- Stronger : independent local authority tests show that ACO KerbDrain<sup>®</sup> has 50% more impact resistance than standard HB1 kerbs.
- Lighter and easier to lay : at 32kg (KD480 kerb unit) and 25kg (KD305 kerb unit). A laying rate of up to 400m per day has been achieved. ACO KerbDrain\* is up to 60% lighter than a standard HB1 kerb stone.
- One piece construction means no separate parts to bed and level.

- Resin concrete construction means products are lighter and three times stronger than conventional concrete.
- Water absorption < 0.01% by weight (BBA report number 1580).</p>
- High chemical resistance ACO KerbDrain<sup>®</sup> is resistant to salts, hydrocarbons, antifreeze and a wide range of other pollutants.
- Excellent versatility in application as a result of the extensive selection of units, sizes and cost-effectiveness.
- Safe in use one piece construction means no loose top covers.
- High capacity drainage performance compared to size an weight
- Aesthetic appearance same width, profile and colour as standard HB1 or SP kerb stones
  - unobtrusive.
- Standards compliant certificated to DIN EN 1433:2002/DIN 19580 Load Class D400 for kerbside installations; Rodding and Gully Access cover to BS EN 124.
- Complies with Specification for Highway Works (2001) Clause 516.



# ACO KerbDrain®

CARRIAGEWAY INSTALLATIONS

## ACO KerbDrain<sup>®</sup> design advantages

- Certified to Load Class D EN 1433:2002/DIN1958.
- Designed for use with typical kerb upstand of 100 - 125mm (with Junction Channel upstand = 125mm).
- Ideal where carriageway width restricts conventional drainage (especially in widening schemes) and for draining camber or cross fall transition points to avoid ponding and streaming.
- Highly efficient in flat areas with a large number of inlets.
- Versatile for remedial drainage of difficult falls, even in short lengths.
- Effective substitute for traditional road gullies where large numbers exist. (eg. roundabouts).
- Suitable for sensitive areas where efficient drainage needed, eg bus stops and pickup points.
- Excellent for drainage around speed humps and other traffic calming measures to supplement gullies.
- Removes ironwork from carriageway, a common failure point in heavily trafficked areas.
- Blind unit without inlets for connection across high points.
- Removes gully grating safety hazard to cyclists.
- Options include drop kerbs, gully units, rodding points and mitred kerbs. Cable loop units for ACO KerbDrain<sup>®</sup> 480 Kapacity System only.
- > Easy integration with highway drainage.
- Easy pavement access for cables and ducting behind 150 wide units.

ACO KerbDrain<sup>®</sup> was developed to allow specifiers to design and install a comprehensive range of carriageway kerb configurations easily, quickly and inexpensively. With its width and appearance identical to standard HB1 concrete kerb units, its competitive price and low installation costs, ACO KerbDrain<sup>®</sup> can be employed where existing products are too bulky, obtrusive, difficult or costly to install.

### **Traffic control**

ACO KerbDrain<sup>®</sup> is ideal for use in traffic calming schemes enabling drainage around obstructions such as speed humps, constrictions and islands. Blind units without inlets facilitate connections across raised carriageway sections.





### ACO KerbDrain<sup>®</sup> CARRIAGEWAY INSTALLATIONS

ACO KerbDrain<sup>®</sup> was developed to allow specifiers and contractors to design and install a comprehensive range of carriageway and pavement kerb configurations easily, quickly and inexpensively. With its width and appearance similar to standard HB1or SP concrete kerbs, its competitive price and low installation costs, ACO KerbDrain<sup>®</sup> can be employed where some existing 2-piece products are too bulky, obtrusive, difficult or costly to install.

### Internal and external angles

ACO KerbDrain<sup>®</sup> 305 90° internal angle and quadrant units enable ACO KerbDrain<sup>®</sup> installations to maintain hydraulic continuity through internal and external right angles.







ACO Kerbdrain<sup>®</sup> 90° internal and external angle.

## ACO KerbDrain®

CARRIAGEWAY INSTALLATIONS

## Integration with carriageway drainage

At junctions, the ACO KerbDrain<sup>®</sup> system may:

- i continue across the carriageway via an ACO drain KD480 Junction channel providing both continuous drainage and surface drainage of the carriageway (KD480);
- ii continue under the carriageway either by a buried 150mm dia. pipe in a concrete surround or a closed channel unit (KD480);
- iii utilise the ACO KerbDrain<sup>®</sup> 305 Quadrant to maintain hydraulic continuity through an external right angle (KD305).

### Roundabouts

For simple and highly effective drainage of roundabouts thus minimising the number of traditional road gullies. A combination of ACO KerbDrain<sup>®</sup> gully and rodding access units may be used. For additional identification or safety requirements, all ACO KerbDrain<sup>®</sup> units may be specified as self-coloured units in white or black.









ACO Kerbdrain<sup>®</sup> Bus stop system.

## ACO KerbDrain®

CARRIAGEWAY AND CARPARK INSTALLATIONS



### **Bus stop**

Draining inwards with ACO KerbDrain<sup>®</sup> inlet units connected by plain face ACO KerbDrain<sup>®</sup>, or PVC-U pipe buried under standard HB1 or HB2 kerbstones.

### **Car parks**

An alternative to installing channel drainage throughout a car park, is to use a combination of ACO KerbDrain® to drain the perimeter – and drainage channels in the centre of the car park area. Special self-coloured ACO KerbDrain® units may also be used to identify special parking needs, obstructions and safety routes.

### **Cable ducting**

Blind kerb units can also be used separately as cable ducts for TV, cable, telecommunications etc.



### ACO KerbDrain<sup>®</sup> CARRIAGEWAY INSTALLATIONS

### Kerbside crossing access

Compatible with ACO KerbDrain® kerb units, the drop kerb and centre stone units provide access across the kerb whilst allowing continuous drainage. Centre stones with water inlets are available to special order.







ACO KerbDrain® 6m external radius system

## ACO KerbDrain<sup>®</sup> CARRIAGEWAY INSTALLATIONS



### **Bus Stop applications**

ACO KerbDrain<sup>®</sup> Bus Stop kerbs, with an upstand of 180mm above road level, raise pavement level to that of some low floor buses. The system incorporates transition kerbs, left and right hand, to integrate with the ACO KerbDrain<sup>®</sup> 480 Kapacity units. We can also provide other upstands of varying heights to special order.

### **Pedestrian Crossings**

ACO KerbDrain<sup>®</sup> 305 Kompact drop kerb assemblies and flush drainable centre stones follow the DETR "Guidance on the use of Tactile Paving Surfaces" recommendations for the installation of pedestrian crossings. ACO KerbDrain<sup>®</sup> 305 kerbs are available in straight or 6m external radius and they are therefore suitable for pedestrian crossings at junctions. The units are manufactured with a vertical rear face for easy installation within existing or proposed pavements.

### ACO KerbDrain<sup>®</sup> design advantages

- ACO KerbDrain<sup>®</sup> drop kerb assemblies have a surface gradient of 1:12 and comply with DETR recommendations for the installation of pedestrian crossings.
- All ACO KerbDrain<sup>®</sup> radius units are manufactured with a straight back for easy installation and integration with existing paviours and flagstones.
- Flush drainable centre stones have been designed to conform to recommendations in the DETR document "Guidance on the use of Tactile Paving Surfaces".
- Flush drainable centre stone inlets are HeelGuard<sup>®</sup> width and comply with DETR recommendations for the installation of pedestrian crossings.
- Certified to Load Class D 400 EN 1433:2002/DIN19580.
- Designed for use with typical kerb upstand of 100 - 125mm

### Channel Capacity: An explanation and use of the Hydraulic Performance Tables

#### Introduction

The determination of the hydraulic capacity of surface water channels is not a simple calculation. It is inappropriate, for instance, to apply formulae such as Manning, or Colebrook-White, or similar, because these equations are applicable only to steady, uniform flows. Using uniform flow equations with ground slopes that are level, or nearly level, a flow velocity or cross sectional channel area will be very severely under or over estimated respectively.

With steep slopes the velocity will be overestimated and the cross sectional area underestimated. In the case of channels, and although the flow is steady, the depth and velocity of flow will vary gradually along the length of the channel – and the flow therefore is non-uniform. For steady, non-uniform flows, channel capacities can be calculated accurately only by applying and solving spatially varied flow equations. Recourse to a computer program to predict accurately the flow capacity in channels, using these equations, is necessary.

Over twenty years ago ACO, following extensive full scale laboratory testing and validation via a 30 metre length of channel, developed a computer program to solve the differential equations for steady non-uniform flows.

The program is capable of calculating channel capacities of complex and varied layouts – for example where the ground and/or channel invert gradients/depths vary or where the area draining into the channel is irregularly shaped or, in internal applications, where discharges from machines occur or the channel layouts are interconnected.

#### Definitions

Rainfall intensity  $[l/s/m^2]$ : The rainfall intensity [i] is a function of the location, and the duration and return frequency of a storm. For areas that can tolerate ponding for a short period following the end of a storm then [i] may be assumed to be  $0.014l/s/m^2$  (50mm/h).

Catchment Area [m<sup>2</sup>] : The area [CA] drained by a channel(s).

Catchment Length [m] and Depth [m] : The catchment length [CL] is assumed in the direction of the channel run. Catchment depth [CD], measured on plan at right angles to the channel, is the distance over which surface water drains to a channel. A channel may be positioned anywhere within the catchment depth.

Lateral Inflow [I/s/m] : The lateral design inflow to a channel per metre length [q] and equals rainfall intensity x catchment depth\*.

End Inflow [I/s] : An inflow directly into the upstream end of a channel run. End inflow may result from a pipe connection or another channel or from pre-cast concrete kerb channels draining an area upstream of a channel run.

Length to Outlet [m] : The length of channel [Lo] draining to an outlet.

Design Flow [l/s] : The calculated total runoff [Qd] from a catchment area.

Flow Capacity [I/s] : The maximum flow capacity of a channel [Qmax] is reached when the maximum flow depth equals the design channel depth. The position of maximum flow depth will vary with the longitudinal ground slope.

A channel installed in level ground has the maximum flow depth at the start of the run; in sloping ground the maximum flow depth occurs somewhere downstream towards the outlet.

The tables indicate the maximum catchment depth (lateral inflow, CD) and catchment area (end inflow, CA) for a given length of channel to an outlet [Lo]. Both CD and CA may be adjusted prorata for other rainfall intensities.

The catchment depth, and hence the lateral inflow, is assumed to be uniform over the length of the channel run. Four ground slopes are given and interpolation of the data is possible.

For lengths to an outlet and ground slopes outside the ranges shown, or if technical assistance is required, please contact ACO's Design Services department.

### (A) Using the Tables : Lateral Inflow

#### Example 1.0

(a) A 180m length of a 10m wide road and footpath, laid level, is to be drained with ACO KerbDrain<sup>®</sup> 480. The design rainfall intensity assumed is 0.014l/s/m<sup>2</sup> (50mm/hour). Determine how many outlets are required and their spacing.

With a catchment depth of 10m and a longitudinal slope of 0.0% the maximum channel length to an outlet may be read directly from the table.

Thus with CD = 10m the maximum length of channel before an outlet is 100m and therefore only one outlet is necessary in the 180m run.

(b) As an example of a 'back to back' configuration assume the road was extended to 1000m; then 5 outlets would be required, each discharging 28l/s (100m from each end and 4 x 200m spacing).

Note: That although both catchment depths and areas are improved, or lengths to an outlet extended, by increasing the ground slope, it is possible that a more economic drainage scheme may result from a level site where opposing channel lengths drain to the same outlet [back to back configuration].

### Example 2.0

Assuming the same catchment depth and design rainfall intensity as Example 1.0, but with the ground slope increased to 1.5%, how many channel outlets are required, equally spaced, in a road 1.5km long constructed with ACO KerbDrain<sup>®</sup> 305 Kompact?

From the KD305, lateral inflow table, a 12m catchment depth requires a maximum outlet spacing of 100m. Total number of outlets therefore = 15.

Although the table does not show catchment depths less than 12m it can be seen that, with increasing outlet spacing, the catchment depths are reducing slowly. It would be reasonable to assume that with a CD = 10m, Lo = 120m or more. The number of outlets therefore could be reduced to say 12.

(Using the ACO computer program, and if a slight reduction in the design rainfall intensity can be tolerated (from 0.014 to 0.0111/s/m<sup>2</sup>), it can be shown that the outlet spacing may be increased to 150m and thus the number of outlets reduced to 10).

### Example 3.0

Consider a 150m square lorry park. ACO KerbDrain<sup>®</sup> 480, laid level, will drain the area on one side. Determine the number of gully outlets required if the design rainfall intensity is 0.010l/s/m<sup>2</sup>.

The tables are based on a rainfall intensity of  $0.014l/s/m^2$  therefore tabulated catchment depths should be increased by a factor of 0.014/0.010 = 1.4.

From the KD480, lateral inflow table, with a slope = 0.0% a CD of 145m (104 x 1.4) requires a maximum outlet spacing of 15m. With a 'back to back' arrangement the number of gullies =  $150/(15 \times 2) = 5$ . The discharge from each gully =  $150 \times (15 \times 2) \times 0.010 = 45$ l/s.



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### (B) Using the Tables : End Inflow

As with lateral inflow, channels laid in level or nearly level ground will have reduced catchment areas, as the length of the channel to an outlet increases. Considerable increases in the area drained can be made by providing longitudinal falls to the channel.

#### Example 1.0

An area, of 800 square metres, drains directly into the end of an ACO KerbDrain<sup>®</sup> 480 Junction channel laid level. The design rainfall intensity is 0.014l/s/m<sup>2</sup>. Ignoring any lateral inflow to the junction channel determine its maximum length to an outlet.

From the KD480 Junction Unit, end inflow, table, with a slope = 0.0% and interpolating between catchment areas of 879 and  $786m^2$  gives a maximum length to an outlet of 19.3m, say 20.0m.

### (C) Combined Lateral and End Flows

It is practically impossible to provide general tables of catchment depths/areas for any combination of lateral and end inflows due to the infinite channel arrangements possible.

However it is possible to use the end and lateral inflow tables to assess approximate channel arrangements and outlet positions provided the sum of the combined end and lateral catchments areas is less than the tabulated catchment area.

#### Example 1.0

A 30m run of KerbDrain<sup>®</sup> 305 channel, laid at 0.5%, has an end inflow area of 140m<sup>2</sup> and a lateral inflow catchment depth of 12.0m. Will one end outlet from the channel be possible?

End : Inflow area =  $140m^2 \ll maximum$  area of  $736m^2$  : OK

Lateral : Catchment Depth = 12m < maximum depth of 23m : OK

Sum of catchment areas = 140 + (30 x 12) = 500m<sup>2</sup> << 736m<sup>2</sup> : OK

Therefore for 30m of KerbDrain<sup>®</sup> 305, laid at a slope of 0.5%, one end outlet is acceptable.

### ACO KerbDrain<sup>®</sup> 305 Kompact System Hydraulic performance tables

ACO KerbDrain<sup>®</sup> offers excellent hydraulic performance to meet the majority of urban and suburban carriageway applications, with appropriate siting of outlet points to sub-surface drainage. The tables indicate the maximum catchment depth/area for a rainfall intensity of 0.014 l/s/m<sup>2</sup>.

#### **KD305 Kerb units**

Lateral inflow		Catchment	depth (m	)
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	103	121	137	151
10	48	64	74	85
15	31	44	53	61
20	21	33	40	47
25	17	27	33	39
30	13	23	28	33
40	9	17	22	26
60	6	12	15	19
80	4	9	11	14
100	3	7	9	12

#### KD305 Radius half batter kerb units

Lateral inflow		Catchment	depth (m	ı)
Length to outlet		Ground s	lope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	103	121	137	151
10	48	64	74	85
15	31	44	53	61
20	21	33	40	47
25	17	27	33	39
30	13	23	28	33
40	9	17	22	26
60	6	12	15	19
80	4	9	11	14
100	3	7	9	12

### KD305 Perforated centre stone and KD305 Flush drainable centre stone

Lateral inflow		Catchment	depth (m	)
Length to outlet		Ground s	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	53	64	78	92
10	25	36	43	50
15	16	26	31	36
20	11	20	24	28
25	9	17	20	24
30	7	14	18	21
40	5	11	14	17
60	3	7	9	12
80	2	6	7	9
100	1	5	6	8



### **KD305 Centre stone**

End inflow		Catchmen	t area (m²)	
Length to outle	t	Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	314	457	600	679
10	250	443	600	679
15	214	443	600	679
20	193	436	600	679
25	171	436	600	679
30	157	436	600	679
40	143	436	600	679
60	121	436	600	679
80	107	432	600	679
100	86	429	600	679

#### **KD305 Kerb units**

End inflow		Catchmen	t area (m²)	
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	643	829	1043	1286
10	514	771	1043	1286
15	443	750	1043	1286
20	400	743	1043	1286
25	371	743	1043	1286
30	343	736	1043	1286
40	307	736	1043	1266
60	250	736	1043	1286
80	214	736	1043	1286
100	200	736	1043	1286

### KD305 Radius half batter kerb units

End inflow		Catchmen	it area (m²)	
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	643	829	1043	1286
10	514	771	1043	1286
15	443	750	1043	1286
20	400	743	1043	1286
25	371	743	1043	1286
30	343	736	1043	1286
40	307	736	1043	1266
60	250	736	1043	1286
80	214	736	1043	1286
100	200	736	1043	1286

### KD305 Perforated centre stone and KD305 Flush drainable centre stone

End inflow		Catchmen	t area (m²)	
Length to outle	et	Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	314	457	600	679
10	250	443	600	679
15	214	443	600	679
20	193	436	600	679
25	171	436	600	679
30	157	436	600	679
40	143	436	600	679
60	121	436	600	679
80	107	432	600	679
100	86	429	600	679

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# ACO KerbDrain<sup>®</sup> 480 Kapacity System

ACO KerbDrain<sup>®</sup> offers excellent hydraulic performance to meet the majority of urban and suburban carriageway applications, with appropriate siting of outlet points to sub-surface drainage. The tables indicate the maximum catchment depth/area for a rainfall intensity of 0.014 l/s/m<sup>2</sup>.

#### **KD480 Kerb units**

End inflow		Catchment	area (m	1²)
Length to outlet		Ground slo	ope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	2243	2500	2821	3186
10	1800	2214	2657	3107
15	1571	2071	2593	3093
20	1407	1971	2550	3093
25	1257	1886	2543	3093
30	1129	1836	2536	3093
40	1007	1814	2529	3093
60	907	1807	2529	3093
80	807	1793	2529	3093
100	736	1786	2529	3093

#### **KD480 Splayed kerb units**

Lateral inflow		Catchment	depth (m	)
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	357	394	427	454
10	166	196	219	236
15	104	131	150	164
20	74	99	115	128
25	55	79	94	107
30	44	66	80	92
40	31	50	61	71
60	20	33	41	48
80	14	25	32	37
100	10	20	26	30

### **KD480 Perforated centre stone**

Lateral inflow	,	Catchmen	t depth (m	)
Length to outlet	t	Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	264	293	321	343
10	127	154	171	193
15	78	104	118	131
20	58	79	91	105
25	44	64	76	87
30	37	54	65	74
40	26	41	50	57
60	16	28	35	40
80	11	21	26	30
100	8	16	20	24

#### **KD480 Centre stone**

End inflow		Catchment a	area (m	²)
Length to outlet		Ground slo	pe (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	1643	1929	2214	2536
10	1350	1736	2143	2536
15	1179	1643	2086	2536
20	1036	1571	2064	2536
25	936	1536	2064	2536
30	836	1507	2057	2536
40	736	1500	2057	2536
60	671	1486	2057	2536
80	607	1486	2057	2536
100	550	1479	2057	2536

### **KD480 Junction units**

End inflow		Catchmen	t area (m²)	
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	1214	1443	1714	2029
10	1014	1343	1679	2029
15	879	1271	1650	2029
20	786	1236	1629	2029
25	700	1214	1593	2029
30	629	1193	1579	2029
40	557	1193	1557	2029
60	507	1186	1550	2029
80	450	1186	1543	2029
100	400	1179	1543	2029

#### KD480 Splayed kerb units

	Catchment a	area (m²)	
	Ground slo	ope (%)	
0.0%	0.5%	1.0%	1.5%
2243	2500	2821	3186
1800	2214	2657	3107
1571	2071	2593	3093
1407	1971	2550	3093
1257	1886	2543	3093
1129	1836	2536	3093
1007	1814	2529	3093
907	1807	2529	3093
807	1793	2529	3093
736	1786	2529	3093
	0.0% 2243 1800 1571 1407 1257 1129 1007 907 807 736	Catchment       Ground slo       0.0%     0.5%       2243     2500       1800     2214       1571     2071       1407     1971       1257     1886       1129     1836       1007     1814       907     1807       807     1793       736     1786	Catchment area (m²)       Ground slope (%)       0.0%     0.5%     1.0%       2243     2500     2821       1800     2214     2657       1571     2071     2593       1407     1971     2550       1257     1886     2543       1129     1836     2536       1007     1814     2529       907     1807     2529       807     1793     2529       736     1786     2529

### **KD480 Perforated centre stone**

End inflow	low Catchment area (m²)									
Length to outlet		Ground slo	Ground slope (%)							
(m)	0.0%	0.5%	1.0%	1.5%						
5	1643	1929	2214	2536						
10	1350	1736	2143	2536						
15	1179	1643	2086	2536						
20	1036	1571	2064	2536						
25	936	1536	2064	2536						
30	836	1507	2057	2536						
40	736	1500	2057	2536						
60	671	1486	2057	2536						
80	607	1486	2057	2536						
100	550	1479	2057	2536						

#### **KD480 Junction units**

Lateral inflow		Catchment	depth (m	)
Length to outlet		Ground	slope (%)	
(m)	0.0%	0.5%	1.0%	1.5%
5	190	216	241	257
10	89	111	126	138
15	56	75	87	98
20	40	57	68	78
25	30	46	56	65
30	24	39	48	56
40	17	29	37	43
60	11	20	25	30
80	7	15	19	22
100	6	12	15	18

## ACO KerbDrain® 305 Kompact System PARTS TABLE

KD305 Kerb unit

	Dimensions (mm)									Connection Availability				
		Depth	Depth Width		Weight Knockou		Gully	Closing	Outlet	Step				
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305	7961	305	280	100	150	500	25.0	820	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E309(LH)	KD305E308(RH)	-		
KD305B	7972	305	280	100	150	500	29.5	820	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E309(LH)	KD305E308(RH)	-		





#### KD305 Rodding access unit

Dimensions (mm)									Connection Availability					
	Depth Width			Weight Knockou		Gully	Closing	Outlet	Step					
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305A	7962	305	280	100	150	500	29.7	820	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E309(LH)	KD305E308(RH) -	-		











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Note: The KD305A access cover can be hinged at either end to suit traffic direction, the KD305B is a blind kerb unit. As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

#### KD305 Drop kerb unit

		Dimensions (mm)									
		Depth		Width							
Description	Order no.	Overall	Invert	Bore	Overall	Length	Weight (kg)				
KD305LH	7966	305/205	280/180	100	150	915	48.5				
KD305RH	7967	305/205	280/180	100	150	915	48.5				





KD305RH

#### KD305 Centre stone unit



Note: Centre stone available with inlets to special order. As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

KD305 Mitre units

		Dimensions (mm)						
		Depth V			Width			
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	
KD305RX7	7968	305	280	100	150	500/487	24.5	
KD305RX10	7969	305	280	100	150	500/490	24.6	
KD305RX25	7970	305	280	100	150	500/493	24.7	
KD305R125	7971	305	280	100	150	500/503	25.1	



External Curve 7-6m Part No. KD305RX7

500mm External Curve 25-11m

Part No. KD305RX25





External Curve 10-8m Part No. KD305RX10

L-		503mm	
-			-
ļ——	$\cap$		$\cap$
		500mm	
-		50011111	-

Internal Curve 25-11m Part No. KD305RI25

#### KD305 Perforated centre stone - straight

205mm

		Dimensi	ons (mn	ר)				Connection Availability					
		Depth		Width	Width Wei			Knockout	Gully	Closing	Outlet	Step	
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector	
KD305CSP	4982	205	180	100	150	915	42.0	-	-	-	-	-	







KD305CSP

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### KD305 6m external radius

		Dimensi	ons (mn	n)			Mainht	Connection Availability				
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector
KD305R6	4984	305	280	100	150	495 (front arc)	27.0	820	KDG/KD610/ KD611/KD612RE	KD305E306	KD305E309/ KD305E308	-
305mm	150mm	130mm			<u>50m</u>		495	R6m	100mm 100mm 		6m RAL 498	
						20506				ØI	IVIIIII	

KD305R6

#### KD305 1.8m external radius

Dimensions (mm)								Connection Availability					
Depth Width					Weight	Knockout	Gully	Closing	Outlet	Step			
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector	
KD305R1.8	4990	305	280	100	150	470 (front arc)	27.0	820	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E308	KD305E309	-	



KD305R1.8

### KD305 Flush drainable centre stone - straight

	Dimensions (mm)								Connection Availability					
		Depth		Width	Width			Knockout	Gully	Closing	Outlet	Step		
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305CSF	7992	180	155	100	150	1000	35.8	-	-	-	-	-		

8mm <sub>II</sub>



KD305CSF

KD305 Flush drainable centre stone drop kerb assembly straight

		Dimensions	(mm)				
	Depth		Width			Weight	
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)
KD305CSFLH	7995	305/180	280/155	100	150	1500	75.5
KD305CSFRH	7996	305/180	280/155	100	150	1500	75.5





#### KD305 Flush drainable centre stone - 6m external radius



KD305 Left hand drop kerb assembly- 6m external radius

		Dimensi	Dimensions (mm)					Connection Availability						
		Depth		Width			Weight	Knockout	Gully	Closing	Outlet	Step		
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305LHR6	4998	305	280/155	100	150	1500	77.5	-	KDG/KD610/	KD305E306	KD305E309/	-		
									KD611/KD612RE	KD305E308				





KD305LHR6

### KD305 Right hand drop kerb assembly - 6m external radius

		Dimensions (mm)						Connection Availability						
		Depth	Depth Width We					Knockout	Knockout Gully Closing Outlet					
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305RHR6	4999	305	280/155	100	150	1500	77.5	-	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E308	KD305E309/	-		





KD305RHR6

#### KD305 Quadrant

		Dimensi	Dimensions (mm)					Connection Availability						
		Depth Width Weight					Weight	Knockout	Gully	Closing	Outlet	Step		
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD305EXT	4992	305	280	100	305	305	35.0	-	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E308	KD305E309/	-		









KD305EXT

#### KD305 90° internal angle

		5										
		Dimensi	ons (mn	n)				Connectio	n Availability			
		Depth Width Weigh						Knockout	Gully	Closing	Outlet	Step
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector
KD305INT	4991	305	280	100	150	305	25.7	-	KDG/KD610/ KD611/KD612RE	KD305E306 KD305E308	KD305E309/	-
								150m	m 			







KD305INT

#### KD305 Endcap - closing/outlet

		Dimensions	(mm)				
	Depth		Width				
Description	Order no.	Overall	Invert	Bore	Overall	Length	Weight (kg)
KD305E306 (Closing)	4938	480	-	-	150	50	7.5
KD305E308 (RH)	7963	305	280	100	150	50	3.9
KD305E309 (LH)	7964	305	280	100	150	50	3.9



KD305E308 (RH)

KD480 Kerb unit

		Dimension	ns (mm)					Connection Availability					
		Depth		Width			Weight	Knockout	Gully	Closing	Outlet	Step	
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector	
KD480	4926	480	455	100	150	500	32.0	820/822	KDG/KD610/ KD611/KD612RE	KD480E306	KD480E309 KD480E308	-	
KD480B	4923	480	455	100	150	500	35.0	820/822	KDG/KD610/ KO611/KD612RE	KD480E306	KD480E309 KD480E308	-	





KD480

#### KD480 Rodding access unit

		Dimensio	ns (mm)					Connectio	n Availability			
Description	Order no.	Depth Overall	Invert	Width Bore	Overall	Length	Weight (kg)	Knockout Union	Gully Unit	Closing Endcap	Outlet Endcap	Step Connector
KD480A	4927	480	455	100	150	500	36.0	820	KDG/KD610/ KD611/KD612RE	KD480E306	KD480E309 KD480E308	-
					-		78mm	H	inged ductile on cover*			
1	150m	Sealin 10 x 5	g groove imm deep	p				2				
480mm	455mm					ACO	49	27	Optional knockouts Ø160mm Ø110mm	and		27
						Vertical o max. disc	utlet Ø11 harge 12	0mm .5 l/s				

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\* The access cover can be hinged at either end to suit traffic direction.

Note: As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

KD480A

#### KD480 Drop kerb unit

		Dimension	ns (mm)					Connection Availability						
		Depth Width				Weight	Knockout	Gully	Closing	Outlet	Step			
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector		
KD480LH	4931	480/375	455/350	100	150	915	63.5	-	-	KD480E306	KD480E309	-		
KD480RH	4932	480/375	455/350	100	150	915	63.5	-	-	KD480E306	KD480E308	-		





KD480 Centre stone

		Dimensions (mm)									
	Depth		Width			Weight					
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)				
KD480CS	4933	375	350	100	150	915	62.0				





#### KD480 Perforated centre stone - straight

	Dimensions	(mm)					
	Depth		Width				
Description	Overall	Invert	Bore	Overall	Length	Weight (kg)	
KD480CSP	4983	375	350	100	150	915	61.0





KD480CSP

#### KD480 Mitre units

375mm

	Dimensions (						
		Depth					Weight
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)
KD480RX7	4934	480	455	100	150	500/487	31.5
KD480RX10	4935	480	455	100	150	500/490	31.6
KD480RX25	4936	480	455	100	150	500/493	31.7
KD480R125	4937	480	455	100	150	500/503	32.1

┝ <b>╼</b> ──		487mm	
	$\cap$		$\cap$
		500mm	_
-			

External Curve 7-6m Part No. KD480RX7



External Curve 25-11m Part No. KD480RX25



External Curve 10-8m Part No. KD480RX10



Internal Curve 25-11m Part No. KD480RI25



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#### KD480 Cable loop unit

		Dimensions (					
		Depth		Width		Weight	
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)
KD480CL	4943	480	454	-	150	150	12.0



KD480CL

#### KD480 Endcap - closing/outlet

		Dimensions (mm)								
	Depth		Width	Weight						
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)			
KD480E306 (Closing)	4938	480	-		150	50	7.5			
KD480E308 (RH)*	4940	480	455	150	150	50	6.0			
KD480E309 (LH)*	4939	480	455	150	150	50	6.0			





KD480E306 (Closing)







\* ACO KerbDrain<sup>®</sup> Inlet/outlet endcaps are designated RH or LH when viewed from the carriageway.

Note: The junction channel inlet/outlet endcap is supplied black coloured. Other colours can be supplied on request. As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

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#### KD480 Junction channel

		Dimensions	s (mm)				
		Depth		Width			Weight
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)
PD100 F 30.1	32301	350	325	100	160	500	26.5







PD100 F 30.1

#### KD480 Bus stop kerb designed for use with kerb upstand of 180mm

		Dimensi	Dimensions (mm) C						Connection Availability				
Depth Width					Weight	Knockout Gully Closing Outlet Step				Step			
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector	
KD480BS180	4964	535	510	100	150	500	45.8	820/822	-	-	-	-	







535mm

Note: Junction channel is supplied in black (highway applications). Other colours can be supplied on request. As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

### KD480 Bus stop kerb LH kerb transition assembly\*

		Dimension Depth	ns (mm)	Width			Weight	Connectio Knockout	on Availability Gully	Closing	Outlet	Step
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector
KD480BSLH	4965	535	455/510	100	150	1000	82.4	820/822	KDG/KD610/ KD611/KD612RE	KD480E306	KD480E309	-
		80mm			500	mm	-+-	500mr	n	<del></del> _−=  	<mark>⊨</mark> 100mm	
			1800		ACO	4967			535mm	120mm		

#### KD480BSLH

### KD480 Bus stop kerb RH kerb transition assembly\*

		Dimensions						Connection Availability					
		Depth		Width			Weight	Knockout	Gully	Closing	Outlet	Step	
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)	Union	Unit	Endcap	Endcap	Connector	
KD480BSRH	4966	535	455/510	100	150	1000	82.4	820/822	KDG/KD610/ KD611/KD612RE	KD480E306	KD480E309	-	





\* Bus stop kerbs and transition assemblies are compatible only with the ACO KerbDrain® 480 Kapacity system.

#### KD480 Splayed KerbDrain® channel Dimensions (mm) **Connection Availability** Depth Width Weight Knockout Gully Description Order no. Overall Invert Bore Overall Length (kg) Union Unit KDSP480 4960 480 455 100 150 500 33.8 820/822 KDSPG/KDSP610/KDSP611/KDSP612RE/KDSP615 500mm 100mm 150mm 75mm 75mm 50mm 0 455mm 455mm 480mm ACC Ø160mm Ø110mm KDSP480

KD480 Splayed KerbDrain<sup>®</sup> endcaps

				Dimens	ions (mm)			
				Depth		Width		Weight
Description		Order no.	Overall	Invert	Bore	Overall	Length	(kg)
KDSP480E306 (closing)		4961	480	-	-	150	50	7.4
KDSP480E308 (inlet/outlet)		4962	480	455	150	150	50	6.0
KDSP480E309 (inlet/outlet)		4963	480	455	150	150	50	6.0
				107n	nm			







là



Foul Air Trap PVC-U Ø160mm 820 Drain union PVC-U Ø110mm 822 Drain union PVC-U Ø160mm 823 Drain union PVC-U Ø200mm

Description





	Depth		Width			Weight
Order no.	Overall	Invert	Bore	Overall	Length	(kg)
4167	-	-	150	160	-	1.9
0056	-	-	100	110	100	0.1
0058	-	-	150	160	150	0.5
2732	-	-	190	200	200	0.6

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No 820 No 822 Drain Union Drain Union PVC-U Ø110mm PVC-U Ø160mm No 823 Drain Union PVC-U Ø200mm

## ACO KerbDrain<sup>®</sup> GULLY UNITS\*

#### KD Gully units

		Dimensions (	(mm)				
		Depth		Width			Weight
Description	Order no.	Overall	Invert	Bore	Overall	Length	(kg)
Gully Units Top Assembly KDG	4928	505	-	-	390	500	82.0
Top and Shallow Base Assembly KD610	4182	865	845		390	500	113.0
Top and Deep Base Assembly KD611	4183	1025	750/955	-	390	500	123.7
Top and Roddable Deep Base Assembly KD612RE	4184	1025	750/780	-	390	500	124.4
Top and Road Gully Connector 450mm dia. KD615	4185	545	-	-	390	500	88.6
Gully bucket	1616	330	-	-	250	395	4.7
	500mm				500m	m .	,
865mm 1000100 845mm invert 131/s 1/s/152	480mm 500mm ACO 4928	Porous asphalt inlet Ø160mm (35 l/s)	1025mm 750mm invert	00mm Ø200n (60 l/s) Ø160 (35 l/			-
KD610	500mm	_1		KD612	RE 500m	m	
	480mm	297mm				297mm	Ì
Porous asphalt inlet 0200mm (60 l/s) Ø160mm (45 l/s) KD611	500mm	Prop Ø45 gully supp Hance Let SS6 con	al road , not blied by mm d gully nector l l l l l l l l				
* Gully covers hinged and lockable to suit	traffic directio	n	`~_	 KD6	15		

## ACO KerbDrain®

### **GULLY UNITS**

#### KD480 Splayed KerbDrain<sup>®</sup> gully units

	Dimensions (mm)									
	Depth		Width	Weight						
Order no.	Overall	Invert	Bore	Overall	Length	(kg)				
4976	505	-	-	390	500	74.9				
4977	870	845	-	390	500	100.9				
4978	1025	750/995	-	390	500	109.7				
4979	1025	750/780	-	390	500	119.9				
4980	545	-	-	390	500	81.5				
1616	330	-	-	250	395	4.7				
	Order no. 4976 4977 4978 4978 4979 4980 1616	Dimensions ( DepthOrder no.Dimensions ( Depth497650549778704978102549805451616330	Dimensions (mm) Depth       Order no.     Overall     Invert       4976     505     -       4977     870     845       4978     1025     750/995       4979     545     -       4980     545     -       1616     330     -	Dimensions (mm)DepthWidthOrder no.OverallInvertBore4976505497787084549781025750/99549805451616330	Dimensions (mm)       Width       Opeth     Nvert     Bore     Overall       4976     505     -     -     390       4977     870     845     -     390       4978     1025     750/955     -     390       4979     1025     750/780     -     -     390       4980     545     -	Dimensions (mm)     Width       Opeth     Width     Bore     Overall     Length       4976     505     -     -     390     500       4977     870     845     -     390     500       4978     1025     750/955     -     390     500       4979     1025     750/780     -     390     500       4980     545     -     -     390     500       1616     330     -     -     -     390     500				



500mm



390mm

315mm



Ø160mm outlet @ 995mm invert Max. discharge 45 l/s













KDSP612RE

Note: As with all pre-cast products, polymer concrete units are subject to weight and dimensional tolerances.

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### ACO KerbDrain<sup>®</sup> SITEWORK AND INSTALLATION

### **ACO KerbDrain® installation** advantages

ACO KerbDrain<sup>®</sup> has been specifically developed to be simple to install in a wide range of urban and rural applications, as well as standard carriageway situations. With such versatility, the specifier can achieve, more easily effective kerb drainage where cost would otherwise be prohibitive. Disruption to vehicle or pedestrian traffic, and buried services, will be minimised.

- Compact size, same width to HB1 kerb for minimum disturbance of existing services and pavements.
- Lightweight, easy to handle, align and install without lifting frames or heavy plant.
- Pavement construction (furniture, lighting, services and finishes) is facilitated due to ACO KerbDrain<sup>®</sup>'s equivalent HB1 profile.
- Easy connection to existing drainage, typical distance to outlet 150 metres.
- Less and simplified jointing than typical OPC (Ordinary Portland Cement) drainage blocks, with no mortar in drain from cover jointing.
- Quicker to install, typically up to 200 metres per day, compared to conventional two part **OPC (Ordinary Portland Cement) system of 30** metres per day for a two man team.
- Drains porous asphalt wearing course.

### **Typical kerb installation** section - urban carriageway



fig. 1

### **Typical Splay Kerb** Installation\*

#### Asphalt with grass verge



is required the front haunch may be omitted

fig. 2

### ACO KerbDrain<sup>®</sup> SITEWORK AND INSTALLATION

### Installation\*

### 1. Excavation

Sufficient material should be excavated to accommodate concrete bedding and haunching and enable finished installation of ACO KerbDrain<sup>®</sup> to be level with the predetermined kerb height, and taking account of any local sub-surface services. Any soft spots or poorly compacted ground should be made good.



### 2. Setting out

The finished level should be laid out with a string line and accurately located setting out pins, especially with curves. When laying kerb units or mitred units, care must be taken not to exceed a gap of 4mm on the rear edge of the joint. With mitred units, do not lay them in radii outside the indicated range.



### 3. Laying

Starting at the outfall and working away from it, ACO KerbDrain<sup>®</sup> should be bedded onto a concrete foundation of the appropriate grade and thickness for the ground conditions.

Ensure the joint faces are clean and kept free of any concrete, especially where units are to be sealed. For fully watertight jointing a proprietary mastic (such as Sikaflex 11FC, or consult a specialist sealant manufacturer on sealant type and application) may be applied to the joint sealing groove (10mm wide x 5mm deep) whilst laying. Access and rodding units are also easily accommodated, with the same jointing procedure.

Asphalt may be rolled up to the unit's face, but care should be taken not to block the inlets.



### 4. Finishing

Flush channels out with a low pressure water jet to prove the system and remove any debris.

\* Please request full installation instructions from ACO Design Services Department.

Note: See Fig. 1 on page 33 for dimensions.

### ACO KerbDrain<sup>®</sup> MODEL SPECIFICATION CLAUSE

The surface drainage system shall be as ACO KerbDrain® 305 Kompact system or ACO KerbDrain® 480 Kapacity system as supplied by ACO Technologies plc; all materials and components within the scope of this system shall be obtained from this manufacturer. The system shall be certificated to EN 1433:2002/DIN 19580 to BS EN124 for access and gully unit covers. Load test certificates shall be supplied to the Supervising Officer. The system shall be of units 100mm nominal internal width, 150mm external width, matching standard HB1/SP kerbstone profile, one piece manufacture in polyester resin concrete with twin inlets per unit providing a minimum inlet area of 14,730mm<sup>2</sup> per metre. The standard units shall be installed with the manufacturer's drop kerbs, centre units, gullies, rodding and inspection units, mitre units for curves and accessories as required for the scheme. The system shall be installed in accordance with the manufacturer's printed recommendations, and the work carried out as specified on the Supervising Officer's drawing no. (\*) and in accordance with recognised good practice. Standards of workmanship shall generally be as specified in BS EN752 and BS 8000:Part 14:1989.

\* Please insert drawing no. relevant to the project. Note: Also available on our website for downloading

### **Technical Support Services**

To support architects, engineers and contractors in designing and installing ACO KerbDrain<sup>®</sup> schemes, ACO's Design Services Department offers a free, no obligation computer-aided scheme design, hydraulic performance calculations and installation advice services.

Our Telephone Hotline 01462 816666, Fax Hotline 01462 851081, e-mail draintechnical@aco.co.uk and website www.aco.co.uk enable us to give you the response you need.

#### **ACO United Kingdom**

ACO Technologies plc ACO Business Park, Hitchin Road, Shefford, Bedfordshire SG17 5TE Tel: 01462 816666

Fax: 01462 815895

e-mail Sales: drainsales@aco.co.uk e-mail Technical: draintechnical@aco.co.uk website: www.aco.co.uk

#### **International Enquiries**

Tel: +44 (0)1462 816666 Fax: +44 (0)1462 850957 e-mail: international@aco.co.uk website: www.aco.co.uk **ACO Worldwide** Australia Austria Belgium **Bulgaria** Canada China Croatia **Czech Republic** Denmark Finland France Germany Hungary Italy Latvia Lithuania Netherlands Norway Poland Portugal Romania Russia Slovakia Slovenia Spain Sweden Switzerland Ukraine USA Yugoslavia





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