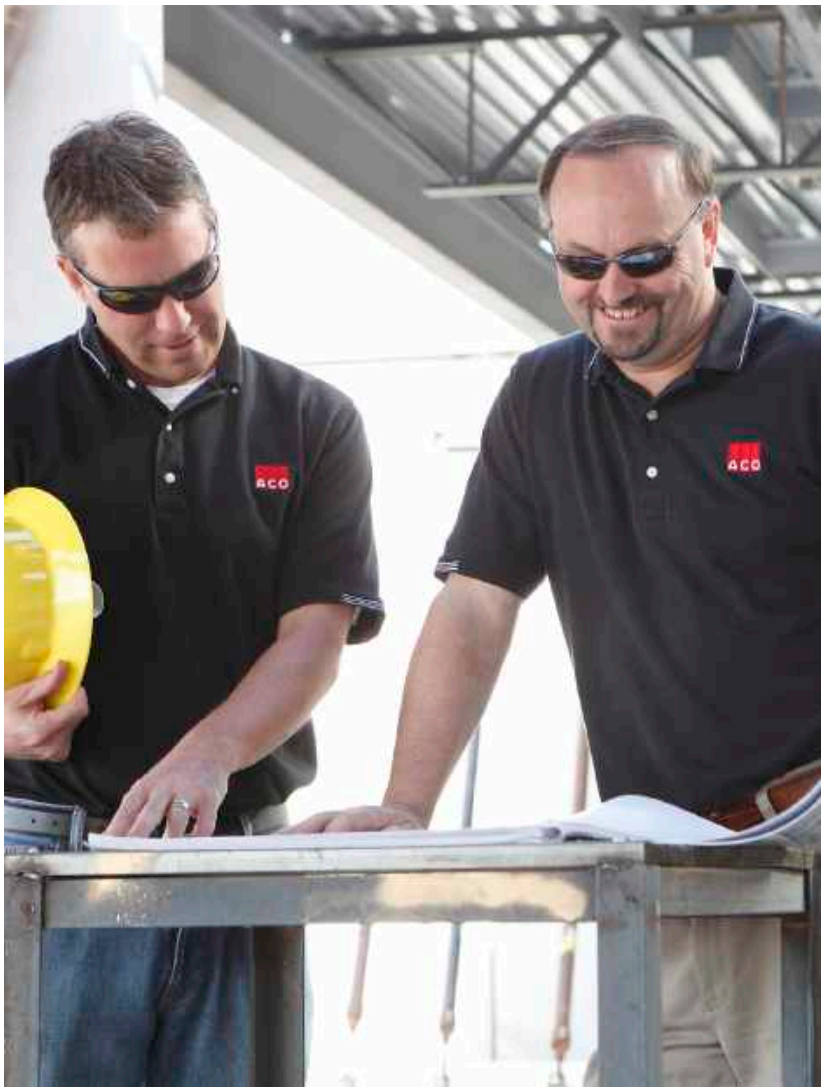
3

Technical Services and Product Support

ACO helps ensure the correct product by application and performance.

ACO has an established technical support team who offer guidance during all stages of construction involving the use of ACO Drain—from selection of appropriate products, to on-site advice to ensure correct product installation.

These complimentary services are offered with no obligation and are supported with extensive, high-quality information, literature and project-specific technical information.



ACO Complimentary Services

1 Application

Trench drains are designed to collect and remove surface water. Failure is usually due to application issues. If the product physically fails, replacement is essential. The priority is to address where—and how—the product will be used to ensure long service life.

1A) LOADING

pages 161–168

Loads influence pavement design and as the trench system is an integral part of the pavement, the correct installation detail is critical to product longevity.

A summary and comparison of commonly referenced Load Standards is provided on pages 161–162.

1B) SITE REQUIREMENTS

pages 169–172

There are a variety of materials used in trench drain systems. A summary of each is provided on page 170.

Each material behaves differently in various environments and situations. ACO can provide advice on chemical and corrosion resistance for most common trench drain materials.

Non-metallic and environmental (SD, LID, LEED) considerations may also impact product choices. ACO can assist in these decisions as well.

1C) USER REQUIREMENTS

pages 173–174

ACO provides specific product documentation indicating the standards each complies with.

Intallation Details

A SERVICE A - ACO can supply:

- Advice on application load class
- Load test certificates
- Installation section details (see pages 189–191)

Material Data

B C SERVICE B/C - ACO can supply:

- Material coupons (samples) for on site testing
- Material test reports (available upon request)

Supporting Documentation

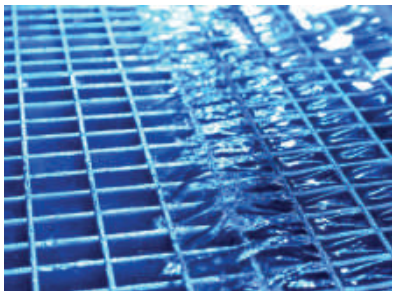
D SERVICE D - ACO can supply:

- Industry standards/requirements and 3rd party test data, where relevant

2 Hydraulics

Hydraulics covers trench drain functionality and failure isn't always apparent. Use of an undersized or oversized trench drain can have major cost and liability consequences, particularly in applications where flood damage to property or personal risk are of concern.

ACO offers several project specific hydraulic support services to accurately determine the most hydraulically efficient and cost effective trench drain size and layout.



Trench Hydraulics - Hydro

E SERVICE E - ACO can supply:

- Sizing and outlet spacing recommendations
- Liquid depth profiles at design conditions

Trench Hydraulics - Ponding

F SERVICE F - ACO can supply:

- Hydraulic recommendations showing the effect of ponding

Grate Hydraulics - GIC

G SERVICE G - ACO can supply:

- Grate performance data dependent on location with crossfalls

3 Trench Layout

Modular trench runs can be complex and ensuring the correct materials can be time consuming, particularly where multiple trench runs are involved. In addition, once materials arrive on site, determining what pieces go where can be a challenge. ACO offers several services to ensure this part of the process runs as smoothly and efficiently as possible.

Trench Layout Documents

H SERVICE H - ACO can supply:

- Plan layouts of trench runs (CAD)
- Section layouts of trench runs showing modular sequence of channel units
- Bill of Materials (BOM) - fully itemizing parts and pieces

4 Installation Support

Even the correct product choice can fail if incorrectly installed. To ensure your trench drain investment performs as expected, getting installation right is important. ACO has an in-house team of engineers qualified to offer advice on most installation issues, such as size of concrete surround, haunch details, installation method options, etc.

Installation Guidance

ACO can supply:

- Installation section details by product type, pavement type and loading type
- Consultation on specific installation concerns

1a) Application - Loading

CURRENT US LOAD STANDARDS

A number of US standards make reference to grate loading. There is no current standard that specifically deals with trench drains of different widths.

To assist with applying these standards to ACO products, a guide is provided below equating stresses (psi) to the Load Class A–F categories from EN 1433: 2002 Drainage channels for vehicular and pedestrian areas. It is also categorized by internal channel widths.

Where possible, to enable comparison between the loading specified within each standard, equivalent stresses (psi) are calculated from the specified test load and test block size of each standard.

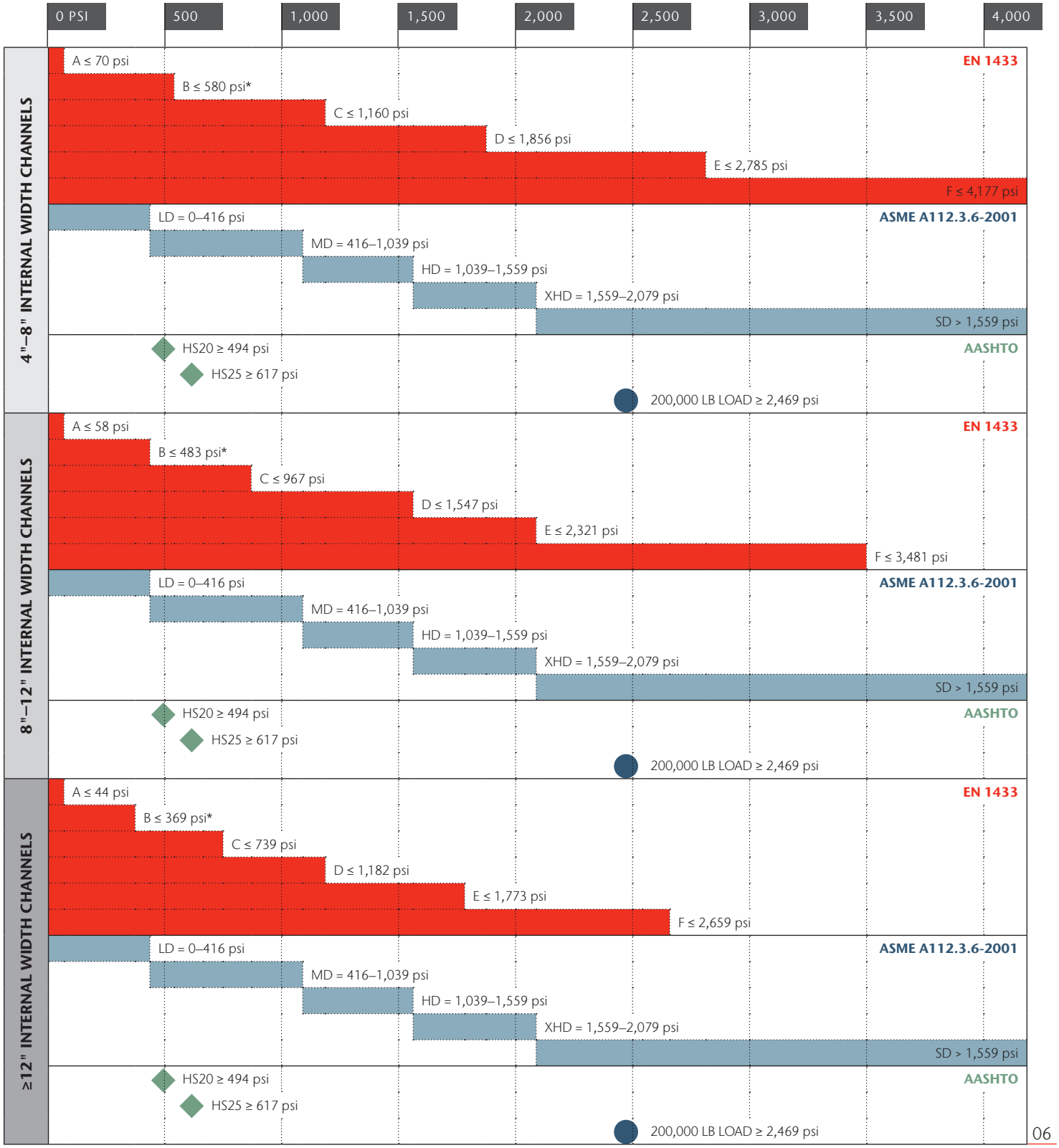
Load class certification for each product is available upon request.

Common Standards in North America:

	EN 1433 LOAD CLASS of similar or equivalent rating		
	Internal Channel Width		
	< 8" (200 mm)	8" (200 mm) ≤ CO* ≤ 12" (300 mm)	> 12" (300 mm)
ASME: A112.6.3 - 2001: Plumbing standard relating to internal floor drains.			
Light Duty (Live Load < 2,000 lbs)	A–B	A–B	A–C
Medium Duty (Live Load = 2,000 lbs–4,999 lbs)	B–C	B–D	C–D
Heavy Duty (Live Load = 5,000 lbs–7,499 lbs)	C–D	D	D–E
Extra Heavy Duty (Live Load = 7,500 lbs–10,000 lbs)	D–E	E	E–F
Special Duty (Live Load > 10,000 lbs)	E–F	E–F	F
AASHTO Standard Specification for Highway Bridges			
Standard relating to design for bridges. Loadings are dealt with by wheel footprints and axle ratings. No specification is given for measurement of the performance of trench drains.	**HS20**		
	C*–F	C–F	E–F
General specifications relate to vehicle loading up to HS20/HS25. Maximum truck weight 90,000 lbs - 3 axles.	**HS25**		
	C–F	C–F	E–F
200,000 lb Proof Load			
The lack of a very heavy duty test standard created the need for a line of measurement. Although no independent standard refers to this measure, it has become widely accepted as a line of measurement for very heavy duty loadings.	F	F	F
FAA AC: 150/5370-10 - Item D-751			
Airport standard that covers manholes, catch basins and inspection holes. No measurement or specification given for testing.	Insufficient data		
FAA: 150/5320-5B & 6D			
Standard relating to airport drainage and pavement designs. Loadings up to 100,000 lbs but no specific test procedure specified.	Insufficient data		
AASHTO: M306-10 Drainage Structure Castings			
Standard relating to castings in roadways.	See HS20/HS25		

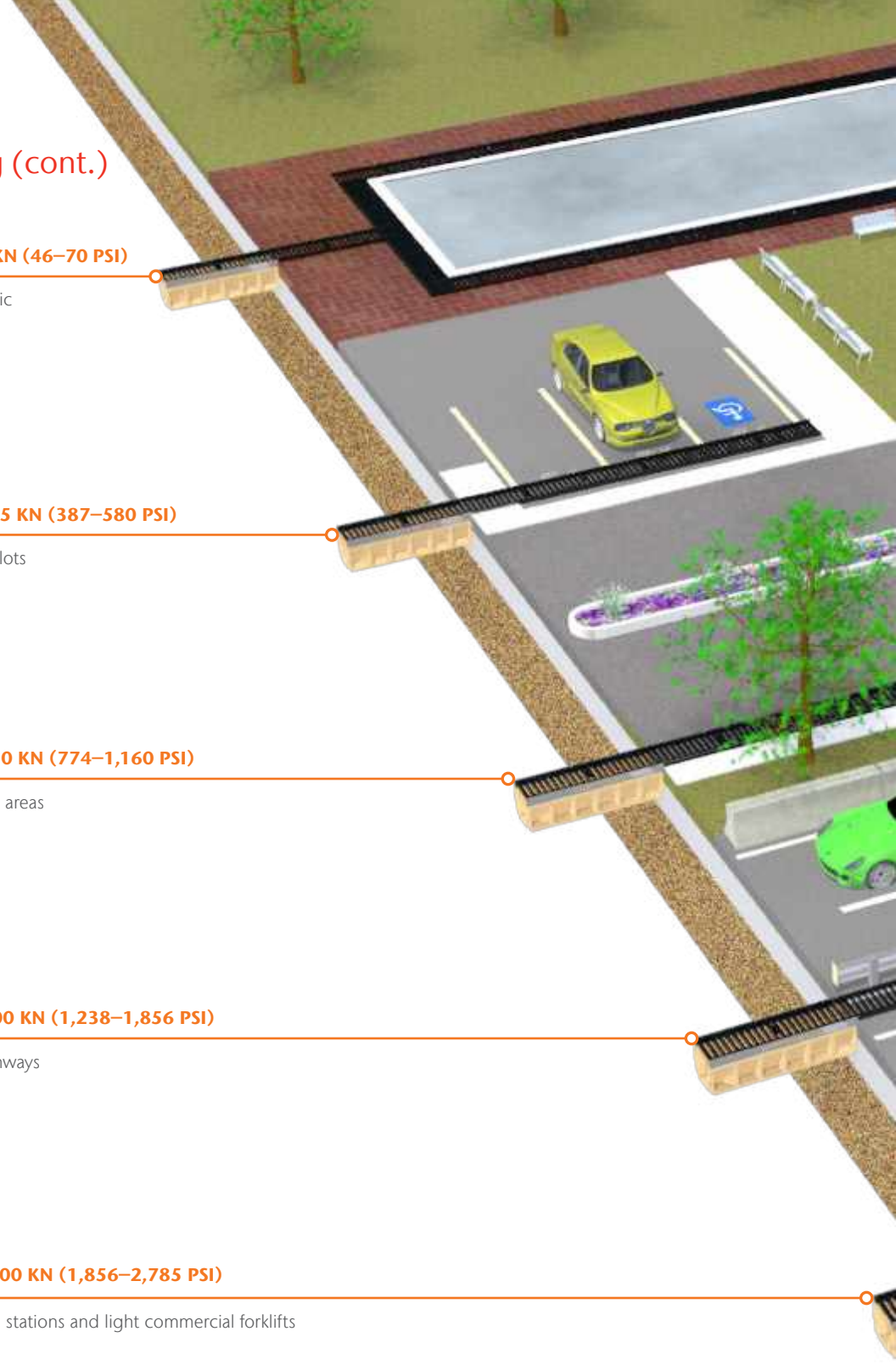
**CO: Clear Opening*

LOAD STANDARD POUNDS PER SQUARE INCH (PSI) COMPARISON OF LOAD TESTING



**Although the chart indicates that the minimum psi for HS20 falls into the top of Load Class B range, ACO strongly recommends using Load Class C or higher due to the volume and dynamic nature (speed, turning & braking) of traffic in typical HS20 applications.*

1a) Application - Loading (cont.)



LOAD CLASS A - 3,372 LBS - 15 KN (46–70 PSI)

Residential and light pedestrian traffic

LOAD CLASS B - 28,101 LBS - 125 KN (387–580 PSI)

Sidewalks and small private parking lots

LOAD CLASS C - 56,202 LBS - 250 KN (774–1,160 PSI)

Parking lots and general commercial areas

LOAD CLASS D - 89,924 LBS - 400 KN (1,238–1,856 PSI)

Trafficked sections of roads and highways

LOAD CLASS E - 134,885 LBS - 600 KN (1,856–2,785 PSI)

Aircraft hangars, industrial areas, gas stations and light commercial forklifts

LOAD CLASS F - 202,328 LBS - 900 KN (2,785–4,177 PSI)

Aircraft runways, military establishments, docks, heavy industrial, heavy fork trucks and very heavy wheel loads

200,000 LB PROOF LOAD

Airport extra heavy duty wheel loads up to 100,000 lbs; with an engineering safety factor of 2 applied, a 200,000 lb proof load is used


West
Bennett St
EXIT
ONLY
TOYOTA

1a) Application - Loading (cont.)

LOAD TESTING

EN 1433

The only standard written specifically for trench drains, and internationally recognized, is EN 1433: 2002 Drainage channels for vehicular and pedestrian areas.

EN 1433 accounts for different widths of grates. For trench drains less than 8" (200 mm) wide, test block for load testing is 10" (250 mm) long by 3" (75 mm) wide. For trench drains 8" (200 mm) to 12" (300 mm) wide, test block is 10" (250 mm) long by 6" (150 mm) wide; for trench drains over 12" (300 mm), the test block is 10" (250 mm) diameter. This ensures that the full force of the test load is directed onto the grate.

EN 1433 also prescribes testing methods for system testing (the complete trench drain and grate). It accounts for both proof loading and catastrophic failure.

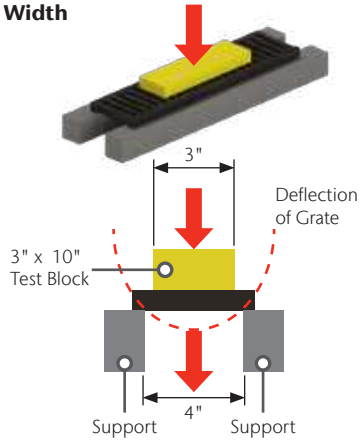
EN 1433 also outlines system testing for monolithic trench drains (grate and body manufactured as a single unit). See ACO Infrastructure for monolithic trench drains.

EN 1433 Load Test - Width-Specific Test Block

Diagrams show test load applied to typical grates through an EN 1433 prescribed width specific test block. Test blocks are sized to ensure the entire test load is applied to grate NOT grate supports - this ensures relevant results for all trench drain widths.

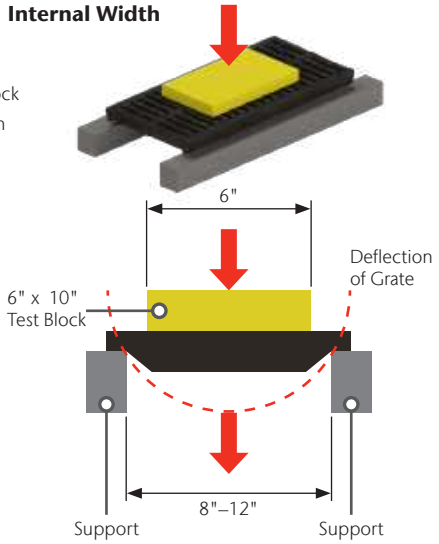
Grate for 4" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



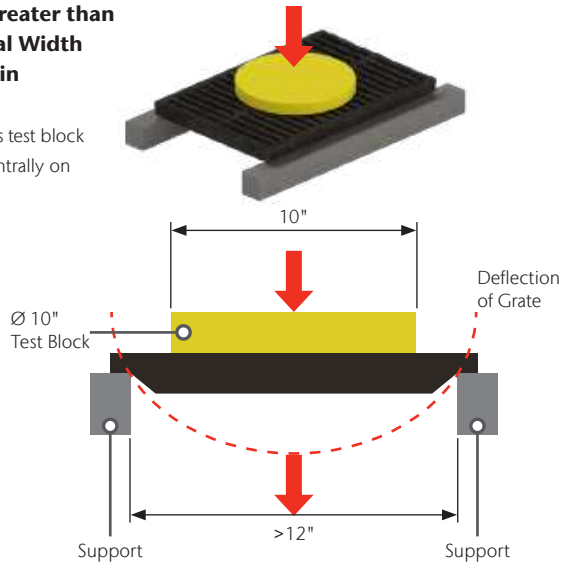
Grate for 8"–12" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



Grate for greater than 12" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.

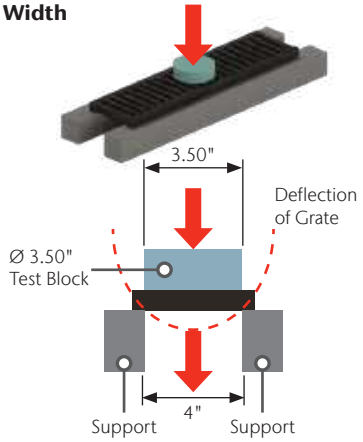


ASME: A112.6.3 Load Test - Ø3.5" Test Block

This load standard is designed for small internal floor drains and prescribes a smaller (3.50" dia.) test block therefore exerting entire test load into the grate, providing relevant results for all trench drain widths.

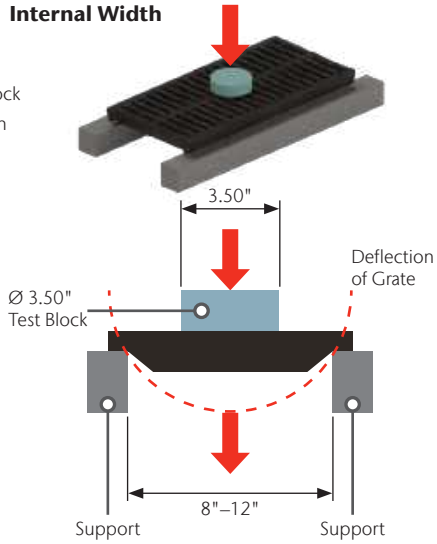
Grate for 4" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



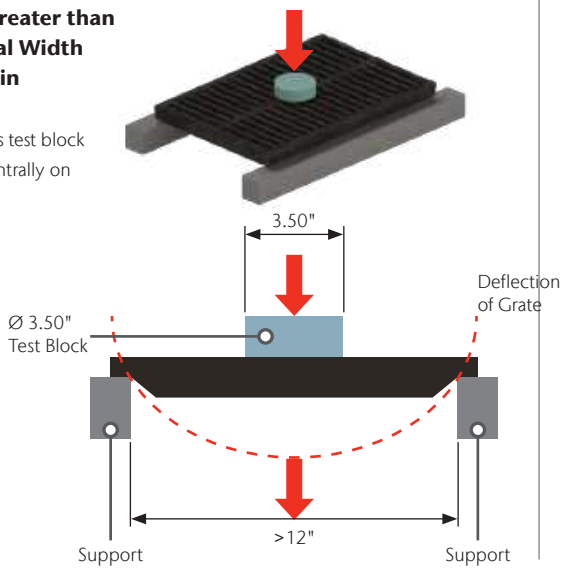
Grate for 8"–12" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



Grate for greater than 12" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.

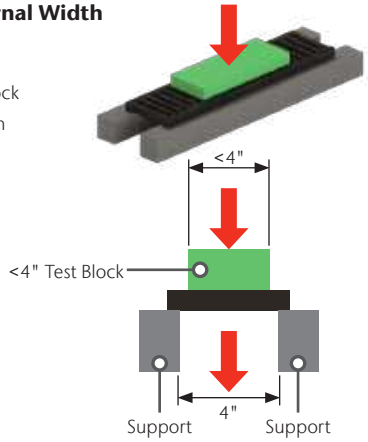


AASHTO Load Test - M306-10

Test block size is 9" x 9" (225 mm x 225 mm). For trenches less than 9" (225 mm) wide, test block width must be less than the trench clear opening.

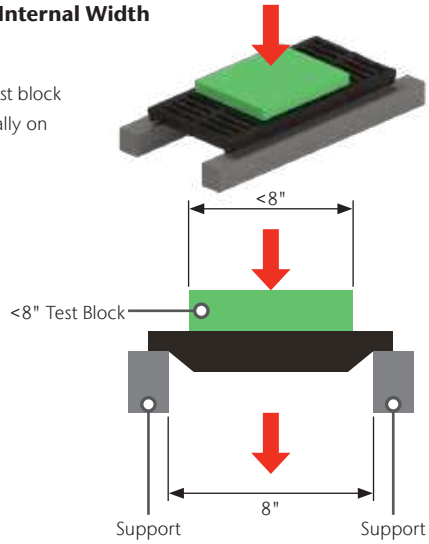
Grate for 4" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



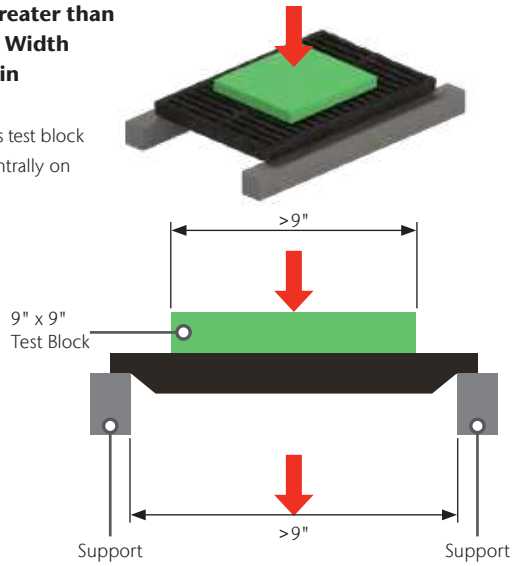
Grate for 8" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



Grate for greater than 9" Internal Width Trench Drain

Diagram shows test block positioned centrally on grate.



1a) Application - Loading (cont.)

LOADING

Loading - often referred to as traffic - is any weight that will rest on, or travel over, the trench drain.

Traffic includes pedestrians, livestock, machinery and vehicles; anything that will be going over the trench drain.

Traffic is the most important factor in pavement design. A trench drain is an integral part of the pavement. Therefore, traffic is also the number one consideration when determining the type of trench drain (both channel and grate) and the concrete encasement required for each application.

During the construction phase it will be necessary to protect the trench from site traffic. See page 187 for details.

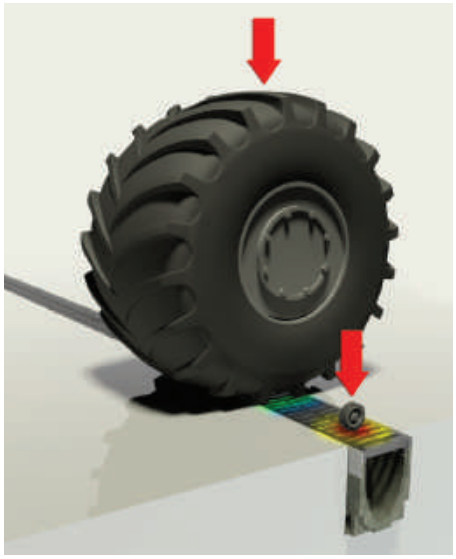
FACTORS AFFECTING LOADING

Contact Area

Contact area between load and trench drain grate affects pressure (psi) exerted by load. Typically relates to tire type, but can include anything that may rest permanently or periodically on trench drain.

Small and/or solid tires concentrate load onto a small contact area, exerting a higher psi. This application requires grate and/or trench system with higher load rating.

Larger and/or pneumatic tires spread load over a larger contact area, exerting lower psi.



Wheel Loads

Combined with contact area to calculate loading.

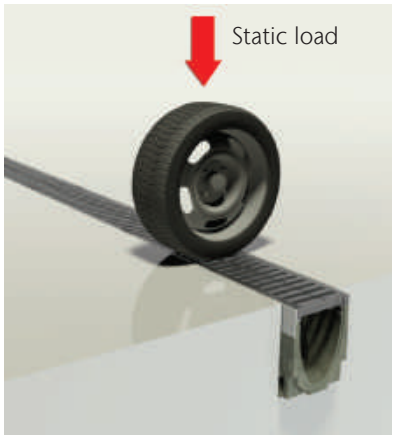
- Weight of vehicle/cart and its typical load, eg. forklift & weight of typical loaded pallet
- Number of wheels and axles that load is distributed over, affects individual wheel load
- Unusual traffic, e.g. dollies/ dumpsters going over trench

Load Frequency

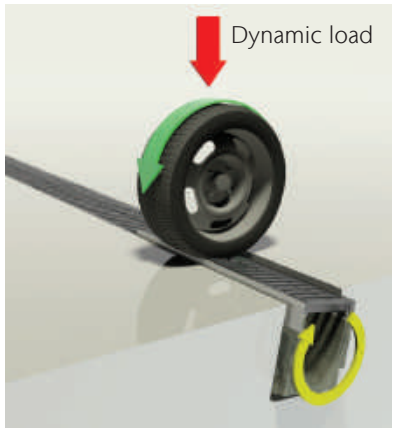
It is also important to consider how often load is applied. Frequent or continuous loads will require heavier duty trench drain and/or larger concrete encasement detail than occasional loads of the same weight.

Installation Details - Loadings

DYNAMIC VS STATIC LOADS



Static loads are a load/weight applied vertically onto the trench - no other movement. Not typically found in real-life scenarios, but are used for load testing a grate or trench drain. They provide an objective measuring scale to rate loadings of grate/trench drain.



Dynamic/moving loads - forces rise rapidly as traffic speed increases. Factors that intensify dynamic loading include:

- Vehicles traveling across or along trench
- Traffic braking, accelerating or turning on trench
- Speed of traffic
- Trench located at top or bottom of a ramp

Forces created by dynamic loads tend to twist trench drain and grates out of position. The more movement (turning and/or braking) and/or faster traffic, the greater the dynamic load. Trench body, grate type, installation detail, and locking mechanisms, are all important factors to consider when addressing dynamic loads.

Load categories

To assist product selection, ACO independently tests each channel and grate to an internationally recognized load standard - EN 1433. Results are categorized into 6 classes from light duty - 'A' to heavy duty - 'F'.

ACO offers advice on the most appropriate load class. An overview, and comparison of EN 1433 and other commonly referenced US load standards is provided on pages 161–162.

To advise on most appropriate Load Class, the following information is required:

- Type of traffic
- Location of trench - bottom of ramp, alongside building, etc.
- Wheel type, if appropriate
- Vehicle/cart weight and weight of typical load
- Typical vehicle speed
- Traffic flow pattern - along or across trench? Turning or braking on trench?
- Unusual traffic - snow plows, dumpsters, etc.

Concrete surround

Loading will also impact the size of concrete encasement required. It is recommended that the cement concrete encasement be durable and conform to minimum strength requirements shown in ACO's recommended installation detail.

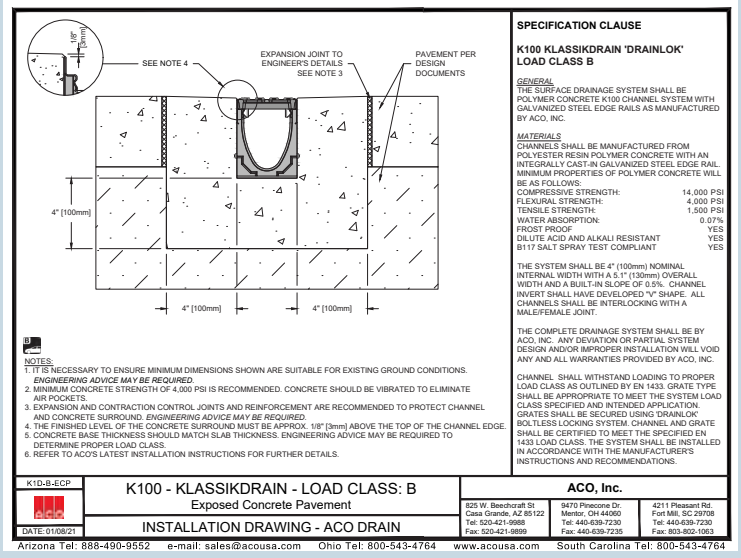
Poor site conditions and low load bearing pavements will require an increase in these dimensions to meet both vertical and lateral loads.

Some applications will also require concrete reinforcement.

Always seek engineering advice for specific applications.

To select correct section detail, the following information is required:

- Load class
- Product type & width (e.g. KlassikDrain K100)
- Pavement finish



Download details for all products, loadings and pavements at **www.acoswm.com**

1b) Application - Site Requirements

TRENCH MATERIALS

Modular trench drain systems are generally manufactured from polymer concrete, fiberglass or polyethylene.

ACO Drain commercial trench systems are manufactured from either polymer concrete or fiberglass. Other materials do not meet the compressive strength and thermal expansion properties required in commercial and industrial projects. ACO uses plastics primarily as a grate and trench material for residential applications (ACO Self).

Polymer Concrete

Polymer concrete is a composite material produced by mixing mineral aggregates with a resin binding agent. The finished material has excellent mechanical and thermal properties and offers good corrosion resistance to many chemicals. A maximum working temperature of 180°F (82°C) is recommended.

Due to their structural rigidity, polymer concrete trench drains can be used in a variety of pavement types such as concrete, asphalt and brick pavers.

Fiberglass

Fiberglass uses similar resin binding agents to those used for polymer concrete, but glass mat and fibers are used instead of mineral aggregates to provide a robust flexible material.

Fiberglass trench drains are designed to be fully encased in concrete.

Cement Concrete

Cement concrete is Portland cement mixed with mineral aggregates. Generally used for large cast-in-place slab applications, where mass is required for structural rigidity.

Expanded polystyrene formers have disposal concerns, and are often released using gasoline. Local EPA regulations should be complied with.

Plastic

The most common plastic used in a trench drain is polyethylene - usually HDPE (High density PE) or MDPE (Medium density PE). Both HDPE & MDPE are readily available, economical materials that are easy to mold.

Plastic trench drains are designed to be fully encased in concrete, however, HDPE/MDPE have thermal properties that require the addition of concrete keying features to securely anchor the product within the concrete slab. Without adequate concrete keying features the trench may lose bond (pull away) from the concrete encasement and buckle, ultimately leading to product failure. This is of particular concern in applications where short term wide temperature ranges are expected, and/or long trench runs are involved.

Metals

Trench drains can also be fabricated from mild or stainless steel. ACO recommends stainless steel trench drains for hygienic applications. See ACO Building Drainage products for details.

A material comparison chart is provided opposite and chemical resistance chart on page 172.

GRATE MATERIALS

Grates are manufactured from a variety of materials. The most common are ductile iron, mild steel, stainless steel and plastic.

Grates need higher bending strength properties than the trench body to withstand flexural loads. Unlike the trench drain body, grates can be removed and replaced after installation.

In commercial applications, all grates should be locked in place to ensure user safety and channel longevity.

Edge Protection

The exposed edge of the trench helps pavement to maintain a visual straight line and helps hold the grate in position. The exposed edge is subjected to the same loads as the grate. In addition to effect of climate and traffic, the edge is exposed to impact from items being dropped or pulled across it (e.g. snow plows). Once the edge fails, the grate will move and cause catastrophic failure.

Metal edges are most commonly used as a wearing rail to withstand rigourous and repetitive traffic. Edge protection rails should be integrally cast-in or mechanically connected to the trench body. Edge rails that sit over existing standard edges are often ill-fitting and susceptible to failure.

Edge rails also provide some protection during installation. Appropriate edge protection is particularly important in asphalt situations where rolling machines can damage exposed edges, leading to premature trench drain failure.

NON-METALLIC OPTIONS

Polymer concrete is an ideal material for non-metallic requirements. It offers excellent insulation properties - electrical resistivity rating of 1x108 Ω/sq.

H100 is a 100% polymer concrete channel that can be used with non-metallic grates (Types 494Q/495Q - See ACO Sport range) to provide a 100% non-metallic trench drain system.

Call ACO's Technical Services Department for additional suggestions if this is not a suitable solution.

SERVICE B

Trench Materials - Physical Properties

Different materials offer different surface and physical performance properties which may affect their suitability of use in various applications. These charts provide a side by side comparison.

SURFACE PROPERTIES	Fiberglass	Cement Concrete	Polymer Concrete	Polyethylene
Surface burning Trench systems are often used around gas stations, chemical processing and interior applications and may be subject to fire; they should be non-flammable and not give off fumes or smoke.	After flame time: 216 sec fail UL-94	7 rating E119	Flame spread: 0 Smoke density: 5 E84	After flame time: 390 sec fail UL-94
Weathering The majority of trench drains are used in exterior applications. Ability to withstand adverse weather will ensure long service life (erosion, UV degradation etc).	1000 hr exposure no change G-153*	[a] Good depending upon proper curing	2000 hr exposure no change G-153*	[b] 1000 hr exposure no change FAIL G-153*
Roughness Coefficient (Manning's) Any degree of friction will affect liquid flow to an extent, therefore the lowest value is desirable.	n = 0.008	n = 0.013	n = 0.011	n = 0.010
Chemical resistance Trench may be used for chemicals - for chemical resistance data see page 172.	Good	Poor	Good	Good
MECHANICAL PROPERTIES				
Compressive strength The trench body is subject to compressive loads in use and needs to withstand the specified load.	24,400 psi D-695	4,500 psi C-39	14,000 psi C-579	8,450 psi D-695
Flexural strength Affects site handling and when trench body is in areas where encasement and soils are suspect.	9,943 psi D-790	587 psi C-78	4,000 psi C-580	2,224 psi D-790
Bending strength Not generally required in trench bodies, but relevant to grates. Used as material measurement.	7,378 psi D-638	[c] 419 psi	2,000 psi C-307	1,993 psi D-638
THERMAL PROPERTIES				
Water absorption The trench is designed to carry and collect liquids without contaminating surrounding soil/encasement.	+0.33% D-570	+5.00% C-97	+0.07% C-97	+0.31% D-570
Freeze-thaw Inability to withstand freeze-thaw cycles causes surface spoiling and leads ultimately to trench failure.	223 cycles modulus of elasticity 89.5% C666	300 cycles maintain 80% structural integrity	300 cycles modulus of elasticity 95.1% C666	223 cycles FAILED modulus of elasticity test C666
Coefficient of expansion/contraction Excessive movement between trench and trench surround creates debonding, causing unwanted stresses and possible failure.	[d] 6-17 x 10-6 per °F D696-03	6.5 x 10-6 per °F D696-03	11.0 x 10-6 per °F D696-03	54.0 x 10-6 per °F D696-03
Water vapor transmission WVT is measurement of water vapor flow through a material. Passage of water vapor may be critical.	WVT - 0.109 g/m² 1,592 hrs E96	See water absorption test	WVT - 0.036 g/m² 1,592 hrs E96	WVT - 0.139 g/m² 1,592 hrs E96

Notes

a. Carbonation can affect steel rebar leading to poor weathering (PCA Design & Control of Concrete Mixtures - 14th ed).
b. Bending exceeded 5% strain - unable to complete test.
c. Equals 6.25 x √ compressive strength (psi) - (PCA Design & Control of Concrete Mixtures - 14th ed).
d. Variance due to many manufacturing processes for fiberglass - FG200 falls into the higher part of the range.
*Test was done to prior standard but procedure requirements were identical.

1b) Application - Site Requirements (cont.)

SUSTAINABLE DRAINAGE

In an environmentally perfect world permeable landscapes would be everywhere, allowing nature to work as intended. However, in reality, this is not possible and hard landscapes are common.

Sustainable drainage is the collection of rainwater, its treatment and, ultimately, its reuse.

The process involves collecting water runoff (that may or may not contain pollutants) and allowing it to be dealt with in a controlled manner - i.e. treated, stored for future use, or discharged to receiving waterways, ideally at low cost, and with minimal impact to the environment.

Surface drainage can be used to assist the collect part of this process. Trench drains are ideal as they provide maximum collection and can form a barrier to prevent runoff flowing onto sensitive areas or soft landscaping. This is particularly important if the toxicity risk of pollutants is high, such as highway and gas station applications.

EPA REQUIREMENTS

Stormwater runoff is generated from rain and snowmelt events flowing over land or impervious surfaces, and not percolating into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the runoff is discharged untreated.

The primary method to control stormwater discharges is the use of Best Management Practices (BMPs). In addition, most stormwater discharges are considered point sources and require coverage under an NPDES permit.

LEED

Leadership in Energy and Environmental Design provides a green building rating system. Principles have been applied to commercial and institutional projects, schools, multi-unit residential buildings, manufacturing plants, laboratories and other building types.

Areas where the use of trench drainage may assist in assignment of credits include:

Sustainable Sites - Protect or Restore Habitat

Compared to catch basins, trench drains require minimal excavation; reducing site restoration requirements.

Rainwater Management

Trench drains offer maximum capture of run-off, allowing for on-site nonpotable uses such as irrigation. Run-off can also be quality assessed and treated as required.

Water Efficiency - Water Use Reduction

Reclaimed water/Alternative water source - use of trench drains to capture rainwater for future irrigation/ toilet flushing use to achieve increased water use reduction.

Materials & Resources - Construction & Demolition Waste Management

To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.
Compared to catch basins, trench drains require minimal excavation; reducing site waste/debris.

Go to www.usgbc.org for full details.

CLEAN

Hydrocarbons

Stormwater run-off frequently carries the risk of containing hydrocarbons. Trench drains in high risk areas—i.e. gas stations and airports—almost always drain into oil-water separators (refer to ACO Environment for details: www.acoswm.com/environment).

ACO now offers solutions for hydrocarbons to be removed at the outlet. These solutions are ideal for applications where the risk is lower, and/or where space does not allow for the use of an independant oil-water separator. Call ACO for details.

CHEMICAL RESISTANCE

ACO Drain channel bodies are highly resistant to chemical attack and, with the appropriate grate, can be used in most environments where everyday acids and dilute alkalis are encountered.

Important considerations for chemical environments

Trench drains can also be fabricated from mild or stainless steel. ACO recommends stainless steel trench drains for hygienic applications. See ACO Building Drainage products for details.

A material comparison chart is provided on page 170. A chemical resistance chart is provided to the right.

When reviewing potential applications of trench drains in chemical environments, the following issues should be considered:

- Type(s) & mixture of chemical(s).
- Concentration percentages.
- Contact time with trench system.
- Temperatures of chemicals flowing into the trench drain. 180°F (82°C) max.
- Flushing system employed to clear chemicals from the system.
- Cleaning agents should be checked for compatibility with trench materials.
- ACO test coupons can be used for final determination of chemical resistance.
- Grate, locking mechanism, edge rail, outlet and trash bucket materials should be checked for chemical resistance.
- Check sealant for compatibility, if applicable.

Chemical Resistance Chart

These recommendations are for guidance only. They are based upon information compiled from resin plastic manufacturers. Customers are advised to test a coupon of polymer concrete to ensure suitability. Test coupons are available free of charge from ACO. If ACO Drain standard products are unable to provide adequate chemical resistance, contact ACO for a suitable product solution.

CHEMICAL MEDIUM	Maximum Concentraion %	Short Time Exposure (72 hrs)	Long Time Exposure (42 days)
Acetic Acid	**30%**	✓	×
Acetone	**10%**	✓	×
Ammonia	**10%**	✓	×
Aniline	**100%**	✓	×
Aniline in Ethyl Alcohol	**10%**	✓	✓
Benzene	**100%**	✓	×
Boric Acid	**100%**	✓	✓
Butyric Acid	**25%**	✓	✓
Butyl Alcohol	**100%**	✓	✓
Calcium Chloride	**100%**	✓	✓
Calcium Hydroxide	**100%**	✓	×
Caster Oil	**100%**	✓	✓
Chloric Acid	**5%**	✓	×
Chromic Acid	**5%**	✓	✓
Citric Acid	**100%**	✓	✓
Diesel Fuel	**100%**	✓	✓
Ethanol	**100%**	✓	×
Ethlendiamine	**100%**	✓	✓
Ethyl Acetate	**100%**	✓	×
Ferrous Sulfate	**30%**	✓	✓
Fluorallic Acid	**10%**	✓	✓
Formaldehyde	**35%**	✓	✓
Formic Acid	**10%**	✓	×
Fuel Oil	**100%**	✓	✓
Gasoline	**100%**	✓	✓
n-Heptane	**100%**	✓	✓
n-Hexane	**100%**	✓	✓
Hydraulic Oil	**100%**	✓	✓
Hydrochloric Acid	**10%**	✓	✓
Hydrofluoric Acid	**5%**	✓	×
JP4	**100%**	✓	✓
JP8	**100%**	✓	✓
Lactic Acid	**10%**	✓	✓
Methanol	**5%**	×	×
Methyl Amine	**100%**	✓	×
Methyl Ethyl Ketone	**100%**	✓	×
Mineral Oil SAE5W50	**100%**	✓	✓
Monochlor Benzene	**0.05%**	×	×
Monochloroacetic Acid	**10%**	✓	✓
Nitric Acid	**10%**	✓	×
n-Nonane	**100%**	✓	✓
Iso-Octane	**100%**	✓	×
Oxalic Acid	**100%**	✓	✓
Phenol	**100%**	✓	×
Phosphoric Acid	**10%**	✓	✓
Potassium Hydroxide	**10%**	×	×
Sodium Acetate	**100%**	✓	×
Sodium Carbonate	**20%**	✓	✓
Sodium Chloride	**100%**	✓	✓
Sodium Hydroxide	**15%**	✓	×
Sodium Hypochloric	**5%**	✓	✓
Sulfuric Acid	**40%**	✓	✓
Tetrafluoroborsaure	**20%**	✓	×
Toluene	**100%**	✓	×
Trichloroethylene	**100%**	×	×
Triethylamine	**100%**	✓	✓
Xylene	**100%**	✓	×

ASTM - B117 Salt Spray Test

ACO polymer concrete has passed independent tests and is unaffected by road de-icing salts. This test is an accelerated corrosion test that produces a corrosive attack to predict a material's suitability in use. The ACO test sample showed no sign of degradation after 1,000 hours of salt spray exposure.

1c) Application - User Requirements

Once trench drain choice has been narrowed by determining loading and durability requirements, options relative to project specific end user needs, or legislative obligations, need to be considered.

ACO can provide product guidance based on current industry standards and requirements. When third party testing has been carried out copies of test certificates are also available.

1. LEGISLATIVE COMPLIANCE

Trench drains are commonly used in public areas where accessibility is a concern and ADA legislation must be met. A number of grates are available that provide ADA compliance without compromising aesthetics or performance.

2. USER SAFETY

ACO has categorized grate safety into 3 main types:

- Heel-resistant - complies with ASME: A112.6.3
- Heel-safe - Narrow slots for stiletto heel safety
- Bicycle-safe - complies with AS 3996

3. GRATE SECURITY

ACO recommends that grates should be secured to prevent movement by traffic, which can cause damage to the trench and/or grate.

4. AESTHETICS

The top of the trench, usually the grate is the most visible part of the trench drain and aesthetically the most important.

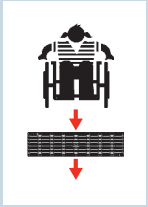
Grates can be selected to blend into the pavement, or used as a feature or border.

5. SLIP RESISTANCE

Slip resistance is critical for user safety. Ideally the slip resistance of the grate should be similar to the surrounding pavement to avoid both slip and/or trip hazards.

Selection Guidance and Test Data

ADA Requirements are set out in The Americans with Disabilities Act of 2010, Section 302.3



Where grates are used within walking surfaces, the open slots should be no greater than 0.5 inches (12.7 mm) wide in one direction. Where the length of the slot is greater than 0.5 inches, the opening should run perpendicular to the main direction of traffic

The diagram shows the slots perpendicular to the flow of traffic; this helps prevent wheelchair wheels and walking aids becoming trapped or slipping on the grate surface.

Heel-resistant - ASME: A112.6.3 : Section 7.12 Heel-resistant Strainers & Grates

A grate designed to resist entry of heeled shoes, in which the maximum grate hole size in least dimension shall be 0.31" (8 mm).

Heel-Safe

For applications where high stilletto heels are commonplace, ACO recommends grates with openings of 0.25" (6.5 mm) or less to prevent heels from becoming trapped, causing injury or falls.

Bicycle-Safe - AS 3996 - 2006 Clause 3.3.6

No US Standard exists detailing slot sizes to avoid bicycle tires from becoming trapped. ACO rates grates based on Australian Standard AS 3996 - 2006 Clause 3.3.6 which specifies maximum slot length dependent on slot width for grates that are deemed Bicycle Tire Penetration Resistant.

Slip-Resistant - ACO has tested grate patterns for slip resistance using the widely accepted pendulum test.

Pendulum test - A pendulum is swung over a wet surface and measures surface frictional properties. Test results are given a BPN value - typically values in excess of 24 would be used (24 and under is regarded as high slip and skid potential).

ACO recommends selecting a grate with the similar BPN values as the surrounding pavement finish. Pavement slope water, presence of surface contaminants, etc. can also negatively affect slip and skid resistance. Ask ACO for BPN reports if needed.

Other tests exist, such as the Variable-angle ramp test and horizontal pull test and can be carried out as necessary if required for specific projects.

Aesthetic Options are typically based on:

Grate materials - stainless steel, ductile iron and plastic can all offer excellent aesthetics. Monolithic trench drains are manufactured using the same material for the grate and trench drain body. See ACO Infrastructure for more details.

Grate slot patterns - perforated, slotted, mesh and decorative patterns are available.

To help determine the right aesthetics for a project, ACO offers an online grate Visualizer that allows pavement and grate choice combinations to be viewed: www.askaco.us/visualizer

Locking Options:

Boltless locking - mechanisms that hold grates captive without use of bolts. They are quick to install and remove, making installation and maintenance easier.

Bolt locking - uses bolts to hold grates in place. Bolts fasten into either the frame or locking bar that straddles the trench.

Other lockings - on rare occasions, something other than standard lockings are required, such as tamper resistant bolts. Contact ACO for more information.

2) Hydraulics

TRENCH HYDRAULICS - CALCULATING RUN-OFF

To calculate correct size of trench drain, catchment run-off must be calculated first.

$$Q\ (gpm) = \frac{(AB)C}{96}$$

96 = 60 minutes x 1.6 gallon conversion factor

Q Catchment run-off

A **B** Catchment area (ft) = pavement length x width

C Rainfall intensity (in/hr)

Visit www.acoswm.com/precipitation

to view the US government rainfall frequency atlas.

Once catchment run-off is calculated, other inflows, e.g. from down spouts, can be added. Other factors that affect trench drain hydraulics:

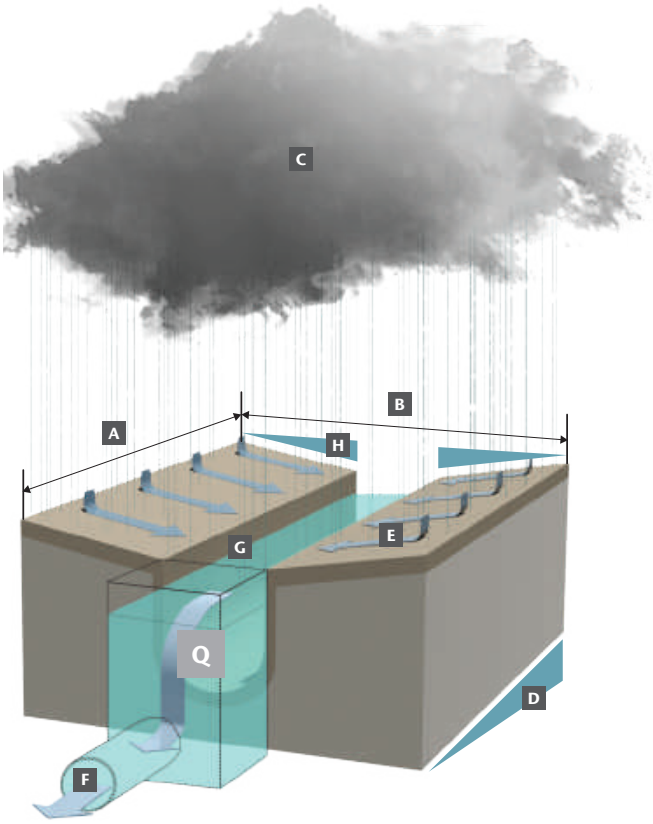
D Ground fall percentage

E Pavement material - some materials absorb liquids (e.g. brick pavers); apply rational runoff coefficient

F Position and size of outlet pipe

G Surface roughness of trench material. Manning's coefficient of roughness figures. See page 170.

H Pavement angle of approach to trench - this can affect grate hydraulics (steep slopes may cause bypass)



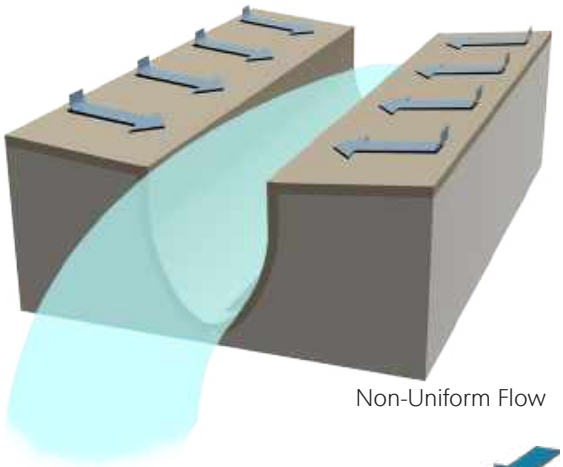
NON-UNIFORM FLOW (SPATIALLY VARIED FLOW)

$$\frac{dy}{dx} = \frac{S_0 - S_1 - 2\alpha Qq/gA^2}{1 - \alpha Q/gA^2D}$$

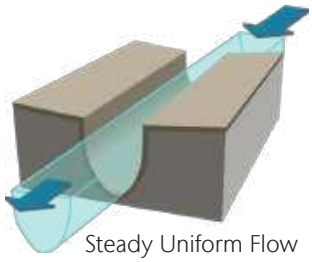
A characteristic of non-uniform flow is liquid velocity and height change at successive cross-sections along the trench.

Non-uniform flow accounts for liquid being carried in a trench plus the constant addition of liquid collected through the grates along the trench run - lateral intake. Run lengths, therefore, also influence a trench drains capacity.

To correctly model this situation, differential calculus is required; usually computer modeling is needed.



Non-Uniform Flow



Steady Uniform Flow

Hydro Software - Modeling Trench Hydraulics

Hydro is a purpose written, hydraulic design program modeled on differential calculus for non-uniform flow in open channels. The program has been calibrated by empirical data following a series of experiments modeling lateral intake into trenches. Analysis of the effect of slope, run length, and trench cross sectional profiles are incorporated into the program.

Complex scenarios such as the effects of water inflow from down spouts or inlets along the length of the trench can also be modeled by the Hydro program. ACO can use Hydro to recommend optimum outlet positions along trench runs.

To generate results from the Hydro program, the following information is required:

- Length of trench run (feet or meters)
- Length and width of catchment area (feet or meters).
- Surrounding pavement/surface type, e.g., concrete, asphalt, etc.
- Rainfall intensity (in/hr or mm/hr)
- Ground fall along trench (%)
- Perpendicular approach slopes to trench (%)
- Preferred position of outlets along trench and any outlet size restrictions
- Any slab depth restrictions

Results are provided either electronically and/or in printout format, in metric or imperial units.

Electronic request form can be found at **www.acoswm.com.**

Hydro printout shows:

A Position and size of minimum freeboard (gap between underside of grate and top of liquid in trench)

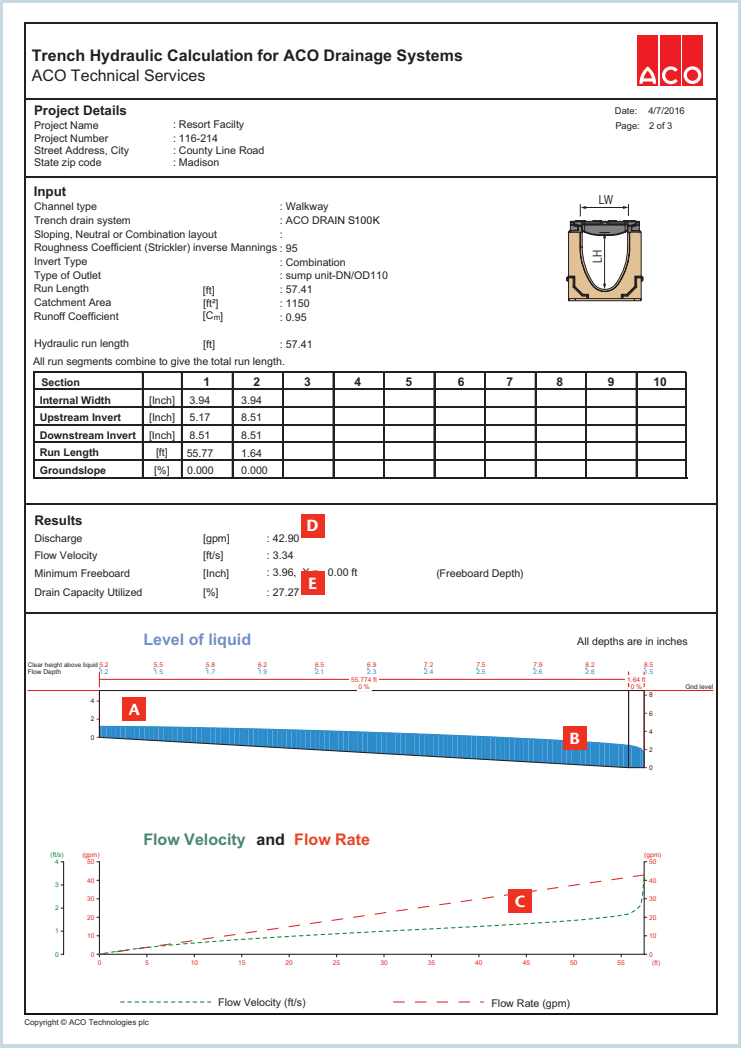
B Hydraulic profile of liquid

C Flow velocity and flow rate at all points along the trench run

D Maximum free-flow discharge capacity of trench run. (42.9 GPM - 2.7 l/s from example below)

E Hydraulic utilization of trench (%) is given. If over 100%, flooding occurs. (27.27% from example below)

An online "Lite" version of the Hydro software is available for customer use at:
hydrolite.acotechsupport.com



Trench Hydraulic Calculation for ACO Drainage Systems
ACO Technical Services

Project Details

Project Name : Resort Facilty
Project Number : 116-214
Street Address, City : County Line Road
State zip code : Madison

Date: 4/7/2016
Page: 2 of 3

Input

Channel type : Walkway
Trench drain system : ACO DRAIN S100K
Sloping, Neutral or Combination layout :
Roughness Coefficient (Strickler) inverse Mannings : 95
Invert Type : Combination
Type of Outlet : sump unit-DN/OD110
Run Length [ft] : 57.41
Catchment Area [ft²] : 1150
Runoff Coefficient [C_m] : 0.95

Hydraulic run length [ft] : 57.41

All run segments combine to give the total run length.

Section		1	2	3	4	5	6	7	8	9	10
Internal Width	[Inch]	3.94	3.94								
Upstream Invert	[Inch]	5.17	8.51								
Downstream Invert	[Inch]	8.51	8.51								
Run Length	[ft]	55.77	1.64								
Groundslope	[%]	0.000	0.000								

Results

Discharge [gpm] : 42.90 **D**
Flow Velocity [ft/s] : 3.34
Minimum Freeboard [Inch] : 3.96, 0.00 ft (Freeboard Depth)
Drain Capacity Utilized [%] : 27.27 **E**

Level of liquid — All depths are in inches

Flow Velocity and Flow Rate

Flow Velocity (ft/s) — Flow Rate (gpm)

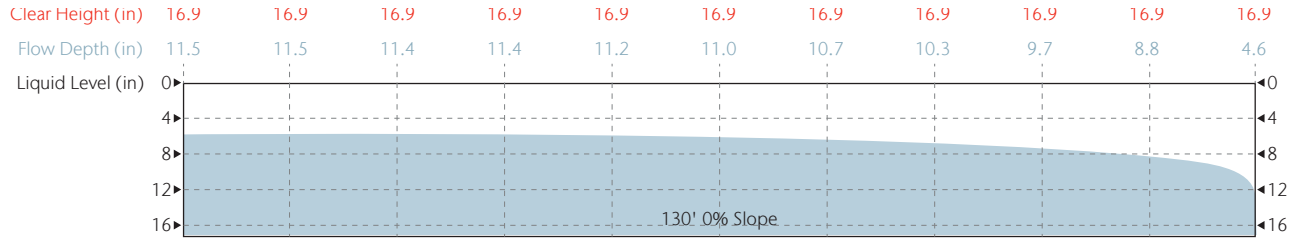
2) Hydraulics

EFFECT OF GRADE & SLOPE ON TRENCH HYDRAULIC PERFORMANCE

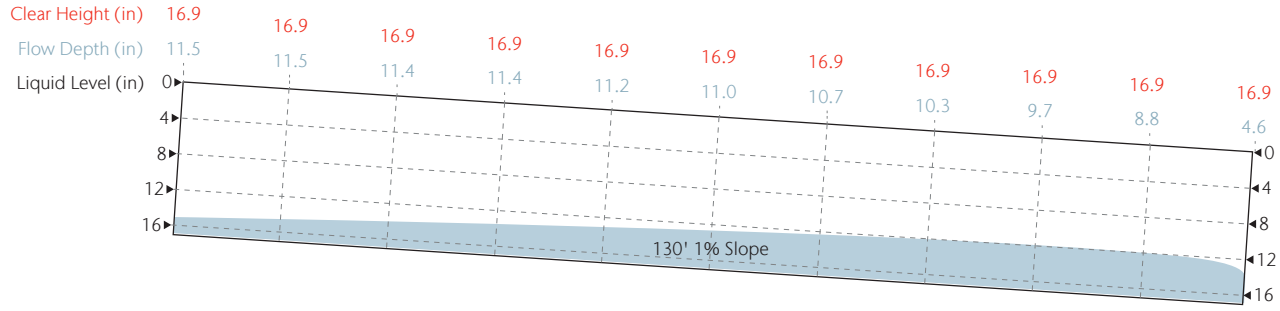
Slope increases the hydraulic performance of the trench system because flow velocity is increased. The drawings below highlight the water profile in the trench where all parameters are the same on both examples except lower image has a 1% slope added.

This increase in capacity may result in larger areas being drained, outlets spaced further apart, or a narrower or shallower trench system being specified which will result in product and/or installation savings.

No Grade, No Slope



Grade & Trench Slope



Size and Type of Outlet

In modeling hydraulic performance of trench drains, the assumption is that the outlet is not a restricting factor. Designers should ensure outlet, and subsequent pipe infrastructure, is not undersized and restricts outflow of the trench drain.

Limited

End Outlet

Pipe connected horizontally at the end of the trench. Minimizes excavation but offers lowest outlet capacity.

Good

Bottom Outlet

Pipe connected vertically out of the bottom of the trench. Offers improved outlet capacity due to slight head of pressure.

Better

In-Line Catch Basin

Same width as trench, but deeper. Offers superior outlet capacity as large pipes can be connected and increased depth gives significant head of water pressure.

Best

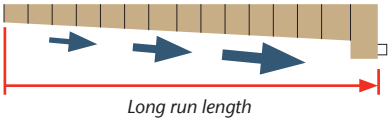
Catch Basin

Large basin wider and deeper than trench. Offers best outlet capacity as larger pipes can be used and increased depth gives significant head of water pressure.

Position of Outlet

A trench drain is ultimately connected to an underground pipe system. Outlet position can dramatically affect size and length of trench drain required.

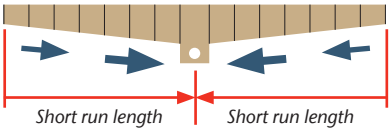
End outlet - Water builds up along trench and may flood before reaching outlet. A larger/more costly trench drain and/or more outlets may be required.



Long run length

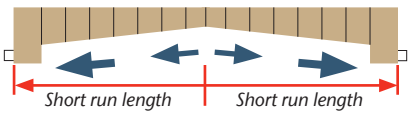
Up to 131' (40 m) continuous slope

Central outlet - If zero ground slope, run lengths to outlet are shorter and less likely to exceed capacity and flood. Allows smaller, more economic trench drain and/or fewer outlets with associated pipework.



Up to 262' (80 m) continuous slope

Double end outlet - Where zero ground slope, allows run lengths to outlet to be shorter and less likely to exceed capacity and flood. Allows smaller, more economic trench drain but more outlets and associated pipework.



Up to 262' (80 m) continuous slope

SERVICE F

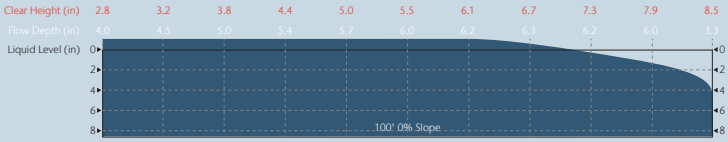
Ponding Analysis - Trench Hydraulics

Temporary ponding is a short lived flood situation, which, in some circumstances, can be tolerated with an intentionally undersized trench drain. It allows a more economical system to be used that will work effectively under average weather conditions, but will be slightly under designed for heavy storms.

Ponding analysis should only be considered where buildings and property are not in close proximity to the drainage system to minimize risk of damage. It is an ideal option for the outer areas of large parking lots, distribution yards, etc. (Risk Analysis should be carried out). The ponding analysis map shows the size and duration of the flood.

In order to produce a ponding analysis, the following information is required:

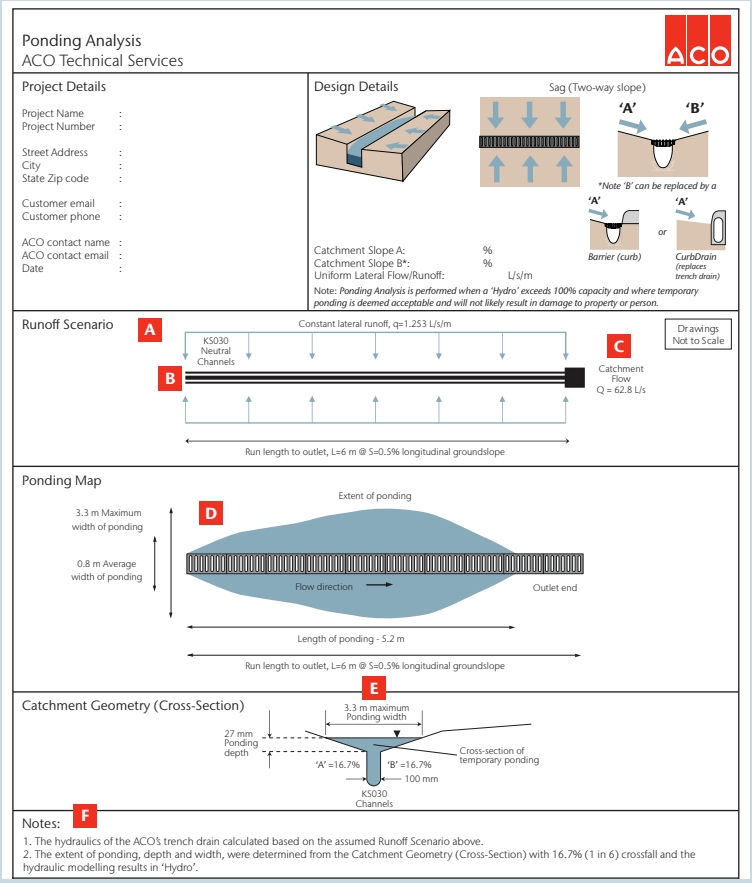
- Full information required to run the Hydro printout. See page 176.
- Plan of site showing elevations
- Existence of any buildings



Flooded Hydro printout indicates that ponding will occur and either a Ponding Analysis should be done or channel metrics (width, depth, run length) re-evaluated.

Ponding analysis shows:

- **A** Run-off scenario
- **B** Trench drain length, size and type
- **C** Design discharge
- **D** Visual map of worst ponding scenario
- **E** Width of temporary ponding
- **F** Project notes



2) Hydraulics

GRATE HYDRAULICS

Usually the trench drain reaches hydraulic capacity before the grate. However, where there are concentrated flows running down steep slopes, the grate may not be capable of capturing all flow - even if the underlying trench is correctly sized.

Properly located trench runs put grates in the direct path of surface water runoff, exposing them to the following conditions:

- Flow rate of liquid from catchment area or point source(s). See page 175.
- Velocity and approach head (depth) of liquid determined by catchment roughness and slope.

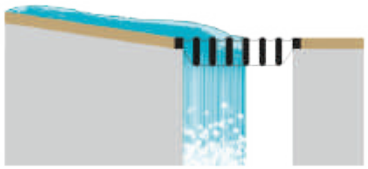
A grate has a finite capacity to capture flow (surface water run-off) originating from catchment area - bypass occurs when the grate's hydraulic capacity is exceeded.

A grate's hydraulic performance is influenced by:

1.Grate characteristics
- Intake area
- Width of grate
- Design features e.g. direction of bars/slots, slip resistant features

2. Catchment characteristics
- Approach catchment slope (determines water velocity)
- Catchment roughness (determines flow direction, water velocity and head)
- One direction (barrier drain) or two or more directions (sag/valley drain)
- Type of liquid
- Debris

Designers should be aware of the trade-off between small inlets for heel safety and large inlets for optimum grate hydraulics.



100% Capture
All liquid flowing through grate openings.

Less than 100% Capture
Not all liquid flows through grate openings - bypass occurs. Reasons:

- Not enough grate open area.
- Too much liquid.
- Too much slope perpendicular to grate.

The science of grate hydraulics is difficult to model in fluid mechanics. A grate's hydraulic performance can be greatly influenced by subtle changes to the grate, and/or catchment characteristics described left.

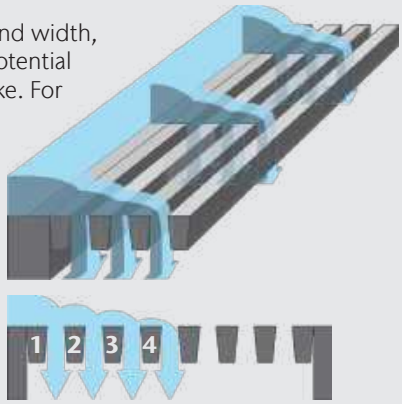
When liquid moves over a grate, either/or a combination of two scenarios can occur:

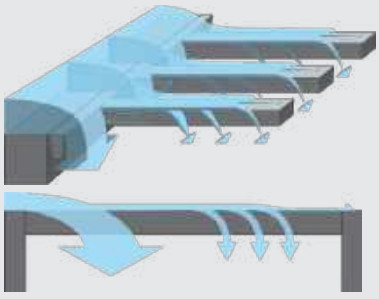
- **Weir Scenario**: relevant where water depths are minimal and speeds are high.
- **Drowned Orifice**: relevant where there is an accumulation of water above grate.

Drains positioned in sag/valley locations give rise to higher flow rates due to pressure of substantial static head (liquid depth) pushing through grate openings.

Longitudinal Opening Grate at Capacity
When comparing grates of equal intake area and width, longitudinal opening grates offer maximum potential for flow evacuation leading to high water intake. For example:

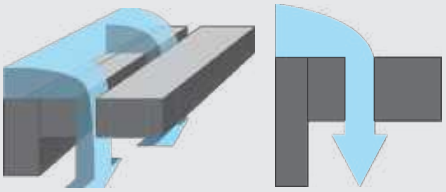
- 4 bars to interrupt and slow down flow before weir is produced.
- Slots 1, 2, 3 are treated as drowned orifices.
- Slot 4 acts as a weir.





Transverse Opening Grate at Capacity
When comparing grates of equal intake area and width, transverse grates offer moderate water intake. Bars bridge across both sides of trench giving little flow interruption, but some drowned orifice effect and connect as a bridge for the water.

Slot Opening Grate at Capacity
There is very little flow interruption before the weir is produced leading to low water intake. The minimal depth above the slot will have negligible drowned orifice effect.



Grate Intake Experiments

Due to the complex nature of fluids in relation to grate inlet hydraulics, testing is the only way to accurately predict how a grate will intercept surface water run-off.

ACO has contracted leading universities for the purpose of research and testing, in the area of grate hydraulics. Three studies carried out in 2016, 2004 and 1998 show capture rates for a number of ACO grates recorded at various water flows discharging down a ramp at a set of longitudinal angles, and cross falls.

Based on project specific requirements, results from these empirical tests allow ACO to accurately recommend a grate for designers with specific catchment hydraulics.

Measuring grate capture

Leaves and other debris can impact hydraulic performance and can be incorporated into ACO's software.

SERVICE G

Grate Hydraulics - GIC Service

ACO has independently measured, by experimentation, the hydraulic intake capacities of ACO grates. Tests were carried out under varying flow rates and catchment approach slopes. To determine the hydraulic utilization, each grate was tested until bypass occurred (point at which liquids would pass across grate).

ACO's Grating Intake Calculator (GIC) provides information on intake efficiency of chosen grate. If liquid intake is greater than grate's capacity, extent of bypass (or failure) will be calculated.

To generate results from the GIC program the following information is required:

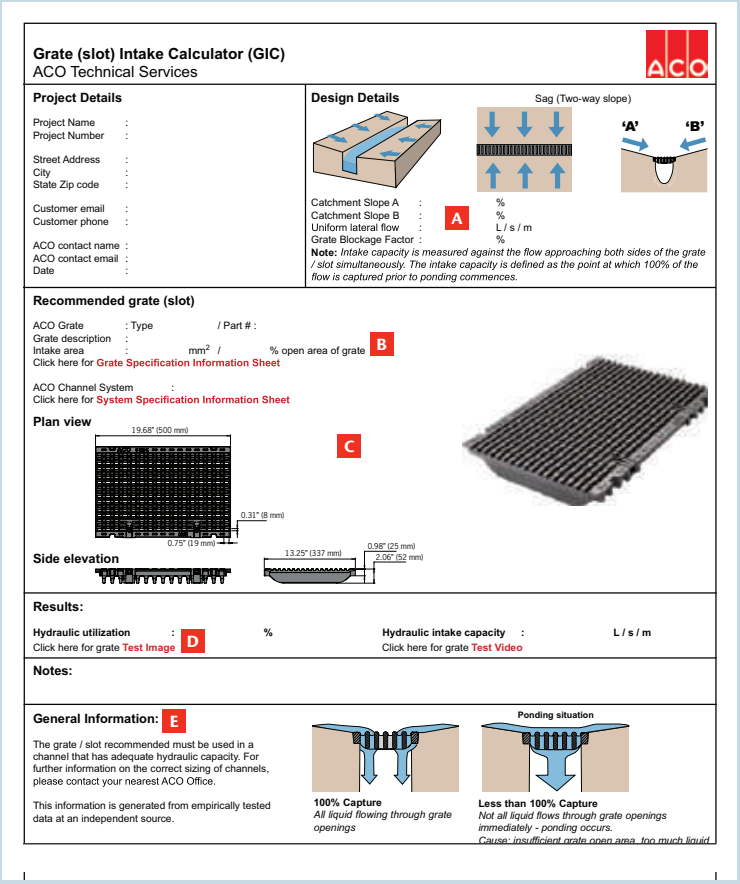
- Length of trench run (feet or meters)
- Length and width of catchment area (feet or meters). See page 175.
- Position of trench in catchment area
- Description of pavement/surface type, e.g., concrete, asphalt, etc.
- Rainfall intensity (in/hr or mm/hr)
- Perpendicular approach slopes to trench (%)
- Preferred grate type

Results are provided either electronically and/or in printout format.

An online "Lite" version of the Grate Hydraulics software is available for customer use at: **gic.acotechsupport.com**

Ponding analysis shows:

- **A** Catchment geometry and hydraulics
- **B** Total intake area per foot of trench run
- **C** Recommended grate information
- **D** Hydraulic utilization of grate (100% means all grate intake capacity is used)
- **E** Additional notes relating to grate performance



3) Trench Layout

ACO Scheduler
ACO has written a proprietary software program, Scheduler, that draws trench drain runs in profile and plan views. The program also shows positions of accessories, outlets, junctions, etc. It automatically calculates a Bill of Materials for each run and totals multiple runs to ensure the correct amount of parts and pieces are ordered. Scheduler printouts are particularly useful for installers.

Results provided are:

- Sectioned profile of trench runs
- Plan view of trench runs
- Parts schedule fully itemizing parts and pieces

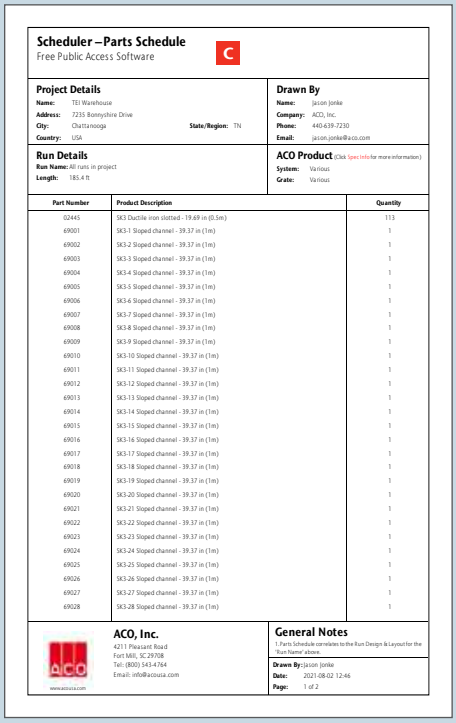
Scheduler printouts provide:

A Profile and plan view of each trench run

B Positions and type of outlets

C Detailed Bill of Materials to ensure all parts are correctly ordered

An online "Lite" version of the Scheduler software is available for customer use at: **scheduler.acotechsupport.com**



Scheduler – Parts Schedule C
Free Public Access Software

Project Details
Name: TEI Warehouse
Address: 7235 Bonnyshire Drive
City: Chattanooga State/Region: TN
Country: USA

Drawn By
Name: Jason Jonke
Company: ACO, Inc.
Phone: 440-639-7230
Email: jason.jonke@aco.com

Run Details
Run Name: All runs in project
Length: 185.4 ft

ACO Product (Click SpecInfo for more information)
System: Various
Grate: Various

Part Number	Product Description	Quantity
02445	SK3 Ductile iron slotted - 19.69 in (0.5m)	113
69001	SK3-1 Sloped channel - 39.37 in (1m)	1
69002	SK3-2 Sloped channel - 39.37 in (1m)	1
69003	SK3-3 Sloped channel - 39.37 in (1m)	1
69004	SK3-4 Sloped channel - 39.37 in (1m)	1
69005	SK3-5 Sloped channel - 39.37 in (1m)	1
69006	SK3-6 Sloped channel - 39.37 in (1m)	1
69007	SK3-7 Sloped channel - 39.37 in (1m)	1
69008	SK3-8 Sloped channel - 39.37 in (1m)	1
69009	SK3-9 Sloped channel - 39.37 in (1m)	1
69010	SK3-10 Sloped channel - 39.37 in (1m)	1
69011	SK3-11 Sloped channel - 39.37 in (1m)	1
69012	SK3-12 Sloped channel - 39.37 in (1m)	1
69013	SK3-13 Sloped channel - 39.37 in (1m)	1
69014	SK3-14 Sloped channel - 39.37 in (1m)	1
69015	SK3-15 Sloped channel - 39.37 in (1m)	1
69016	SK3-16 Sloped channel - 39.37 in (1m)	1
69017	SK3-17 Sloped channel - 39.37 in (1m)	1
69018	SK3-18 Sloped channel - 39.37 in (1m)	1
69019	SK3-19 Sloped channel - 39.37 in (1m)	1
69020	SK3-20 Sloped channel - 39.37 in (1m)	1
69021	SK3-21 Sloped channel - 39.37 in (1m)	1
69022	SK3-22 Sloped channel - 39.37 in (1m)	1
69023	SK3-23 Sloped channel - 39.37 in (1m)	1
69024	SK3-24 Sloped channel - 39.37 in (1m)	1
69025	SK3-25 Sloped channel - 39.37 in (1m)	1
69026	SK3-26 Sloped channel - 39.37 in (1m)	1
69027	SK3-27 Sloped channel - 39.37 in (1m)	1
69028	SK3-28 Sloped channel - 39.37 in (1m)	1

ACO, Inc.
4211 Pleasant Road
Fort Mill, SC 29708
Tel: (800) 543-4764
Email: info@acousa.com
www.acousa.com

General Notes
1 Parts Schedule correlates to the Run Design & Layout for the "Run Name" above.

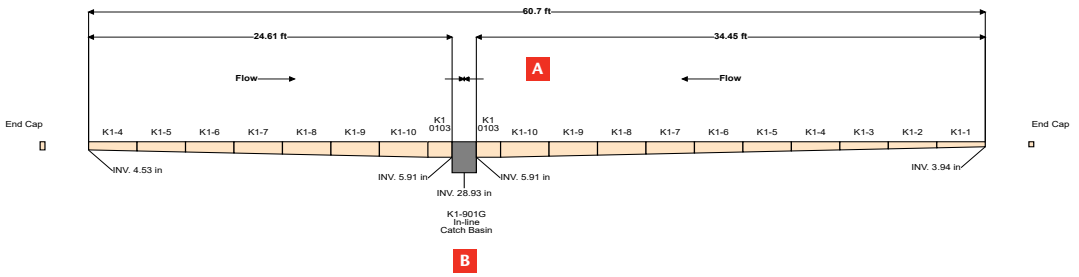
Drawn By: Jason Jonke
Date: 2021-08-02 12:46
Page: 1 of 2

Scheduler – Run Design & Layout
Free Public Access Software

Run Name: TD 1 **Total Length:** 60.7 ft

Project Details
Name: SMMC Surface Parking Lot
Address: 28th Street
City: Uniontown **State/Region:** OH
Country: USA

Drawn By
Name: Jason Jonke
Company: ACO, Inc.
Phone: 440-639-7230
Email: jason.jonke@aco.com



Legend
→ Flow Direction
INV Invert Depth of Channel

ELEVATION
NOT TO SCALE

PLAN

ACO, Inc.
9470 Pinecone Dr.
Mentor, OH 44060
Tel: (800) 543-4764
Email: info@acousa.com
www.acousa.com

General Notes
1. It is the customers responsibility to ensure that each product is fit for it's intended purpose and that the actual conditions are suitable.
2. This run design and layout is only intended to be used as a guide. Refer to engineer's construction drawings for further information. If in doubt, seek engineering advice.
3. The run layout does not show the concrete surround (encasement) refer to Site Installation Manual.

ACO Product (Click SpecInfo for more information)
System: KlassikDrain K100 (SpecInfo)
Grate: Type 476D (SpecInfo)

Drawn By: Jason Jonke
Date: 2021-08-05 12:18
Page: 2 of 2 **Run:** 4 of 4

CAD Design Services

For more complex projects, ACO can provide a custom trench drain layout to illustrate required positions and layouts of trench runs.

In order to produce a plan layout, the following information is required:

- Plan of site showing elevations
- Existence of any depth restrictions
- Position and type of any plumbing fixtures/outlets
- Position of any permanent structures
- Catchment runoff pattern and type of traffic (including traffic flow)

Results provided are:

- Plan layouts (CAD) showing the trench drain positions relative to site structures

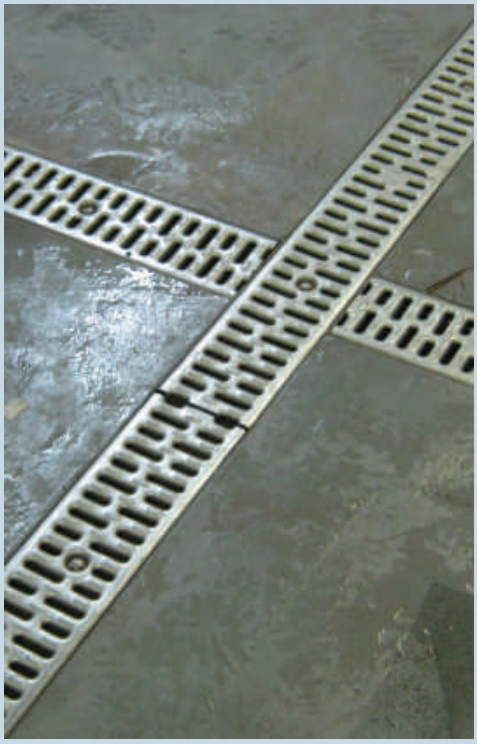
CAD printout provides:

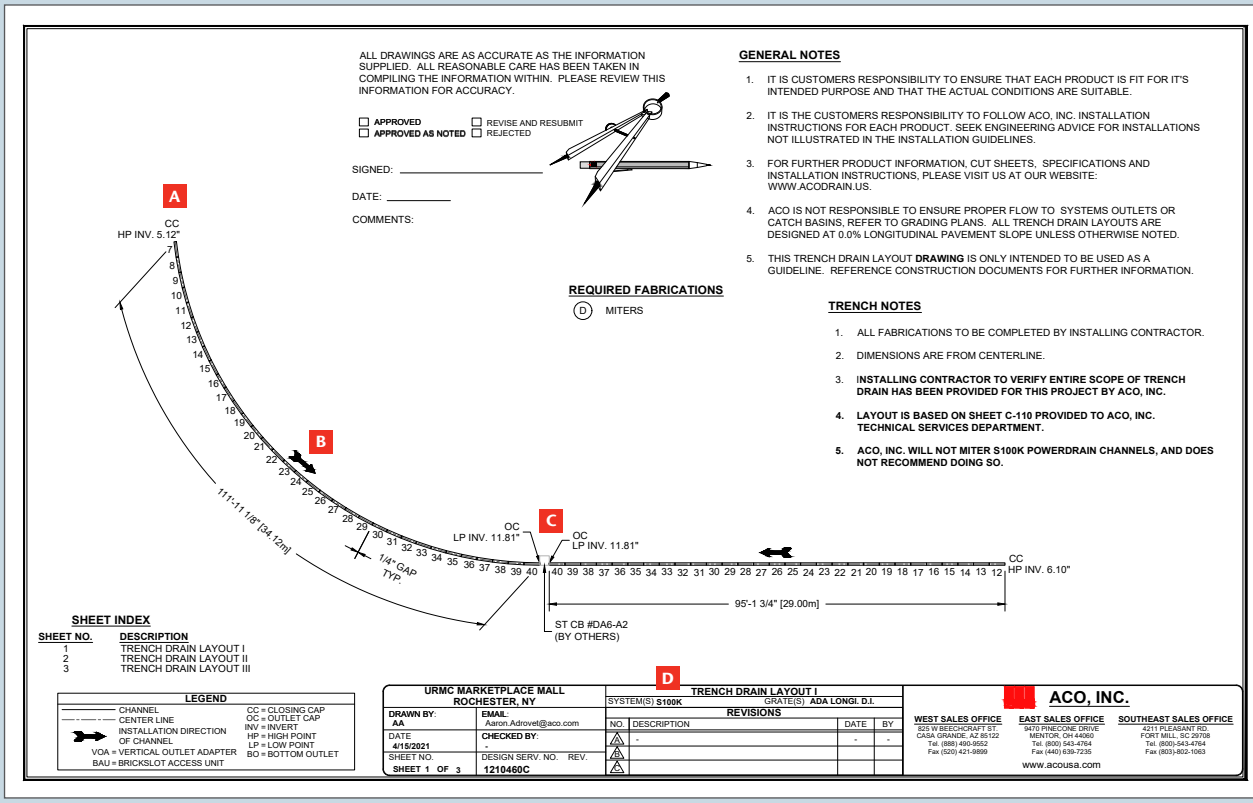
A Plan view of trench run layout with inverts

B Water flow & installation directions

C Positions and type of outlets

D Trench and grate type





4

Installation Guidelines

Correct installation ensures lifetime performance.

ACO has a qualified site support technician available for installation training and assistance.

ACO's fabrication service can assist with creating difficult corners, tees, shortened channels, etc. to make installations quicker and easier.

A Site Installation Guide is available, in addition to installation section drawings.

Contents — Installation Guidelines

Installation Support

Channel units are installed in a continuous trench, and are encased with cement concrete.

Full installation instructions are available in the Site Installation Manual. Contact ACO or visit www.acoswm.com or view ACO Installation videos on www.youtube.com/user/acoamerica

1. EXCAVATION

Excavate trench to accommodate trench drain system. Excavation should be around center line of trench.

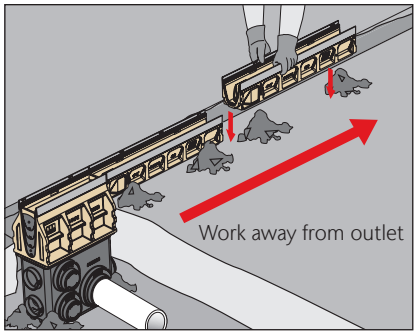
Excavation must be sufficient enough to accommodate the following:

- Channel/catch basin width and depth dimensions.
- Concrete surround dimensions - 4"–12". Specific loading and ground conditions will increase the excavation size. See page 189 for further guidelines.
- For sloped systems, excavate base to roughly follow fall of trench drain run.

2. OUTLET INSTALLATION

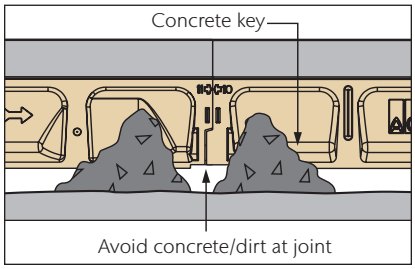
All installations should start from outlet point.

- Determine type of outlet and position
- Install outlet channel/catch basin and set haunch
- Install channels starting at, and working away from, outlet - from deepest (highest channel number) to shallowest



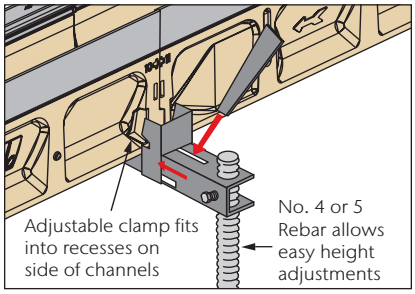
3. TRENCH DRAIN INSTALLATION

Channel units need to be supported at correct height and held securely in place to avoid movement during concrete pour. There are a number of options available:



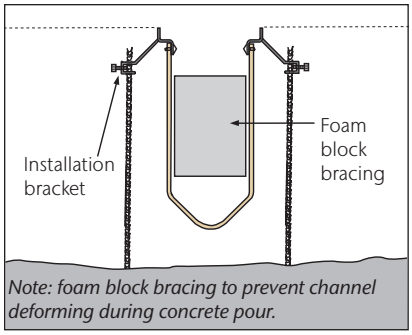
Patty supports

Care should be taken that concrete is not trapped in joint between channels.

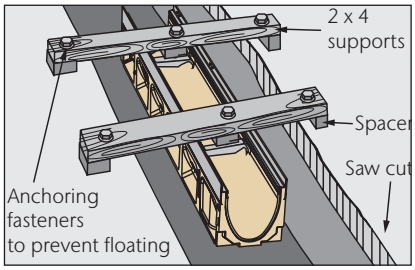


Installation device

A clamping system that fits around the profiled end. Rebar is used to achieve correct height. One device per joint is required. 100, 200 & 300 mm wide versions available.



FG200 has installation devices attached to frames for attaching No. 4 or 5 rebar.



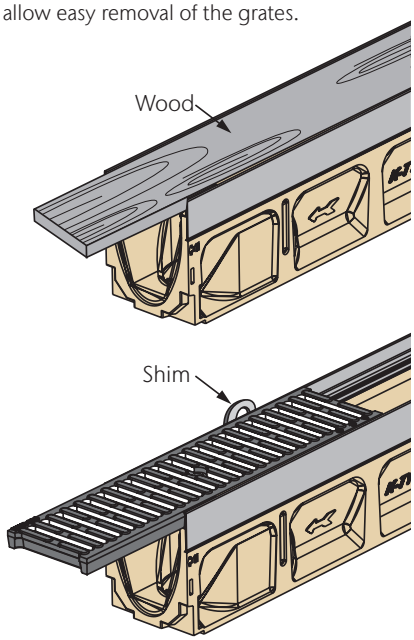
Hanging method

Channels can also be hung from grate locking. Useful in retrofit where existing slab is used to support channels.

4. CHANNEL BRACING

To prevent channel walls and joints being distorted by pressure of concrete, grates (or plywood cut to a snug fit) should be installed in channel prior to concrete pour.

Shims or washers placed along each side allow easy removal of the grates.



5. CONCRETE POUR

Concrete should have compressive strength of minimum 4,000 psi.

Grates should be suitably wrapped to protect from concrete splash.

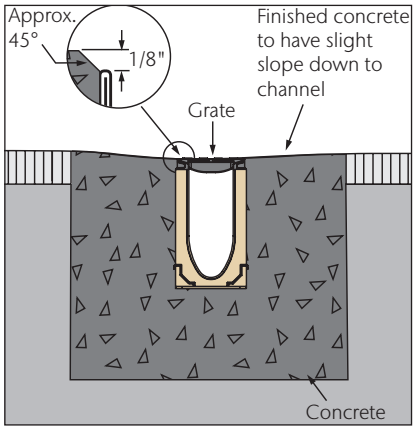
Concrete should be poured evenly (both sides of channel) and carefully to avoid dislodging channels. A wand-type vibrator should be used to ensure concrete distributes evenly underneath and around channels.

6. PAVEMENT FINISHING

Top of adjacent pavement must be above grate level by approximately 1/8" (3 mm).

Brick pavers should be set approx. 1/8" (3 mm) above trench edge. First brick course should be set on mortar/concrete.

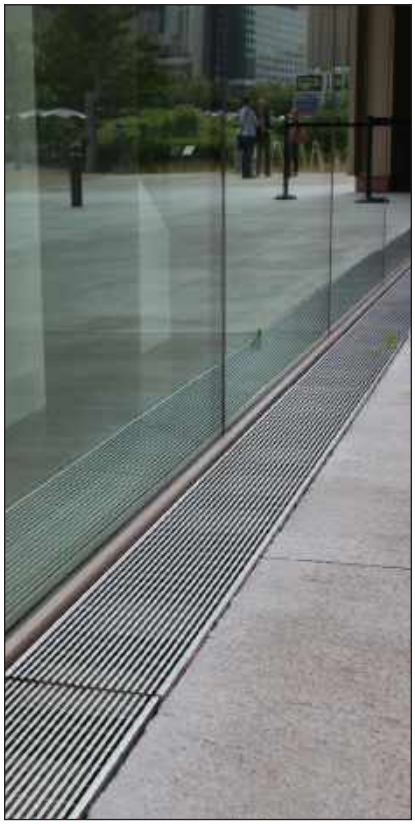
Care should be taken with asphalt rolling machines to avoid damage to trench edge.



7. COMPLETING INSTALLATION

- Remove grates and remove protective wrapping.
- Remove debris from trench drain and make sure outlet pipes are clear.
- Install trash buckets in catch basins, if required.
- Flush trench run to check for pipe work blockages; unblock if necessary.
- Empty trash buckets and clean out pipe connections, if necessary. Re-install trash buckets.
- Re-install grates in proper position ensuring they are securely locked down.

The trench drain is now ready for use.



MAINTENANCE

Regular inspections of the trench drain are recommended. Frequency will depend on local conditions and environment, but should be done at least annually.

Inspections should cover:

- Grates and locking devices
- Catch basins and trash buckets
- Concrete surround and adjacent paving

All items should be inspected for damage, blockage or movement. Compare with site drawings if necessary.

Maintenance Guidelines:

1. Remove grates
2. Remove debris from channel
3. Flush channels with water or high pressure washer (do not use boiling water or corrosive cleaning agents)
4. Repair damaged surfaces where necessary with an appropriate ACO repair kit. See page 187.
5. Repair/replace joint seals as required
6. Empty trash buckets and clean out pipe connections
7. Re-install trash bucket
8. Re-install grates, ensuring they are locked back in place

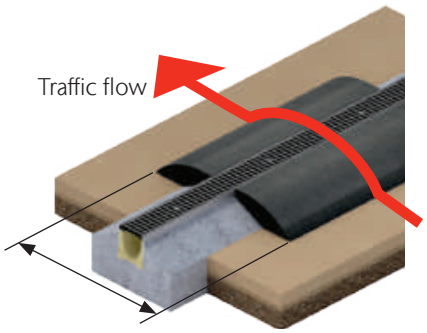
Site Work

ACO provides typical installation details for each product with comprehensive on-site advice, when appropriate.

GROUND CONDITIONS

Specific ground conditions or contaminated ground may call for a deeper/wider concrete surround or larger haunch than minimum recommendations.

If in doubt, seek engineering advice.



TEMPORARY INSTALLATION

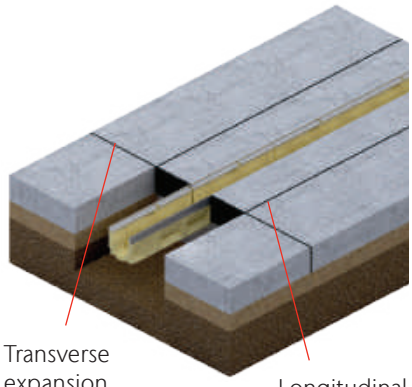
During site work, and after trench run is laid, the trench top can be vulnerable to damage. Site traffic should be routed away from the trench. If temporary crossings are required, a base course of 3' minimum width should be installed either side of the trench for protection. Loose boards or plates are inadequate.

THERMAL MOVEMENT

Longitudinal expansion joints, which for some slabs may be doweled horizontally and de-bonded, will isolate the trench and concrete haunch from thermal movement of large concrete slabs.

Transverse joints in the concrete slab should be positioned to coincide with channel-to-channel joints. Alternatively the channel may be cut to align with the slab joint and resealed with a suitable flexible sealant.

Engineering advice should be sought for specifying expansion joints.



Transverse expansion joint

Longitudinal expansion joint

JOINT SEALING

All channel-to-channel and channel-to-fitting joints may be sealed with appropriate sealant.

ACO channels are supplied with an SF Sealant Groove as standard. This provides a groove that can be filled with an appropriate flexible sealant to create a watertight joint. This is particularly important with elevated slabs and where liquids may contain chemicals or oils.

Sealant should be resistant to the same chemicals flowing through the trench drain and be flexible to allow for any slab movement from temperature changes. Surfaces should be correctly prepared prior to applying sealant to ensure good adhesion.

Contact ACO Technical Department, or go to www.acoswm.com

Site Work Seal and Patch Materials

	Part No.	Weight lbs
ACO Seal Flexible Joint Sealant - 10 oz	**91120**	1.0
ACO Bond - Polymer Concrete Repair Kit - 1 gallon	**06519**	11.0
ACO Bond - Polymer Concrete Repair Kit - 5 gallons	**06516**	55.0
ACO Fiberglass Repair Kit - 1 gallon	**08203**	11.0

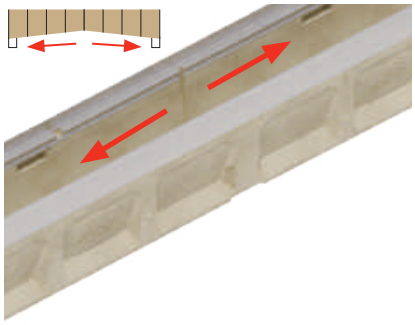
Sealant applied with caulk gun

Connection Options

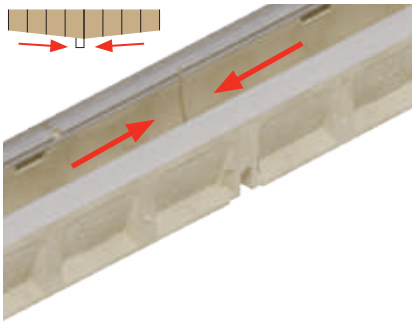
Arrows depict direction of slope and flow

MALE-FEMALE CONNECTION
Interconnecting end details allow easy and effective joining of channels. It also helps with height and sideways alignment between channels. An SF groove provides positive placement for appropriate sealant.

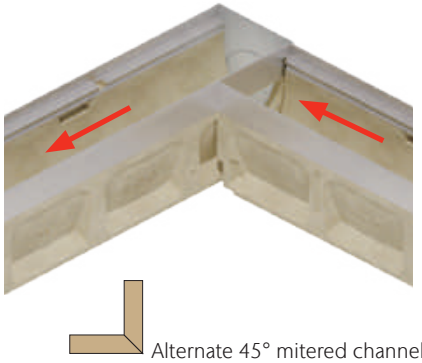
FEMALE-FEMALE CONNECTION
Creation of a direction change and high point, requires an outlet at start and end of run. To create, remove female end details and butt channels together, hold in place with ACO Bond.



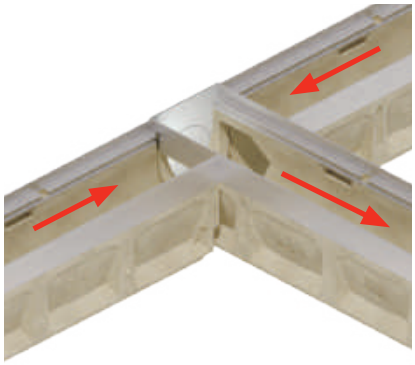
MALE-MALE CONNECTION
Creation of a low point, usually with bottom outlet where a catch basin is not required. To create, butt male ends together and fill gaps with ACO Bond.



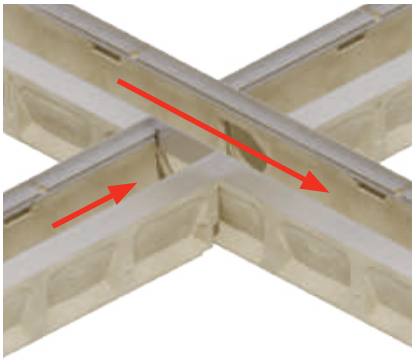
CORNER
Corners can be created by butting up as shown below or both channels mitered at 45°. Leave rail to support grate.



TEE JUNCTION
Junction details on sides of constant depth channels allow on-site creation of tees without fabrications. Edge rails and grate seats remain intact for structural integrity.

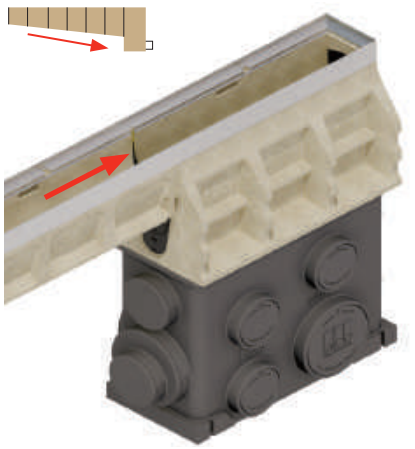


X CROSS
Junction details on sides of constant depth channels allow on-site creation of x - cross without fabrications. Edge rails and grate seats remain intact for structural integrity.

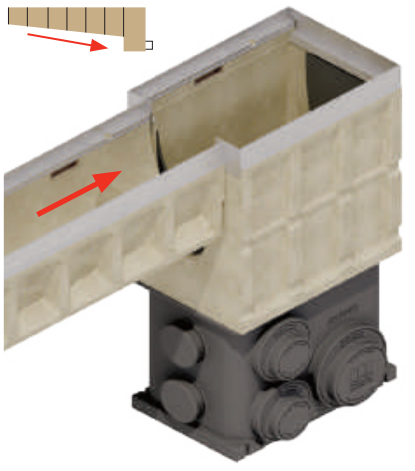


CATCH BASINS
The catch basin is typically the low point and has female connections at each side for easy connection to male (deeper) channel end.

BLANKING END PLATES
For 100 mm in-line basins a blanking end plate is supplied to prevent concrete ingress during concrete pour. It also provides an aesthetic end finish.



BLANKING END PLATES
For 200 and 300 mm catch basins, a kit is available to close one end and fill gaps between channel and catch basin.



Installation Sections

An installed ACO Drain System should incorporate the following:

- Correct grate type
- Correct channel type and size
- Minimum grade 4,000 psi compressive strength cement concrete surround

It is recommended that the cement concrete surround be durable and conform to minimum strength requirements, as shown in the illustrations. Poor site conditions and low load bearing pavements will require an increase in these dimensions to meet both vertical and lateral loads.

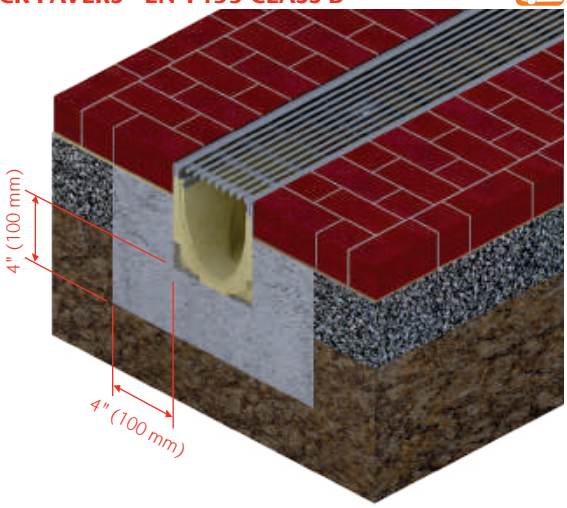
These illustrations are a guide for average ground conditions only. Electronic installation drawings are available at www.acoswm.com.

It is the customer's responsibility to ensure that encasement size and detail is suitable for the specific application.

These illustrations are typical only. See specific installation manual for details.

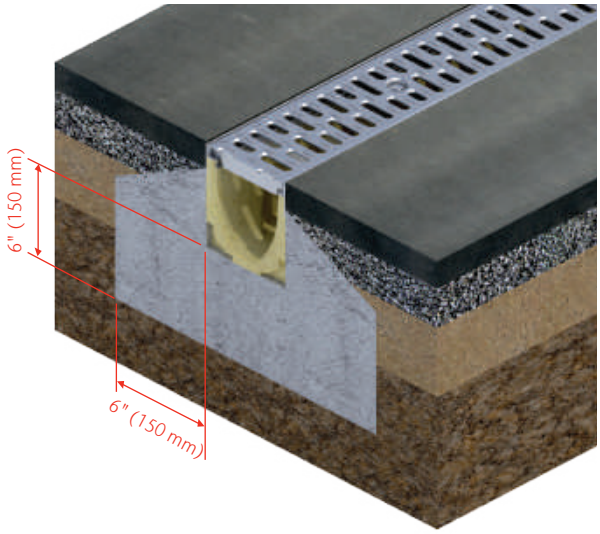
If in doubt, seek engineering advice.

4" (100 MM) CHANNELS BLOCK PAVERS - EN 1433 CLASS B



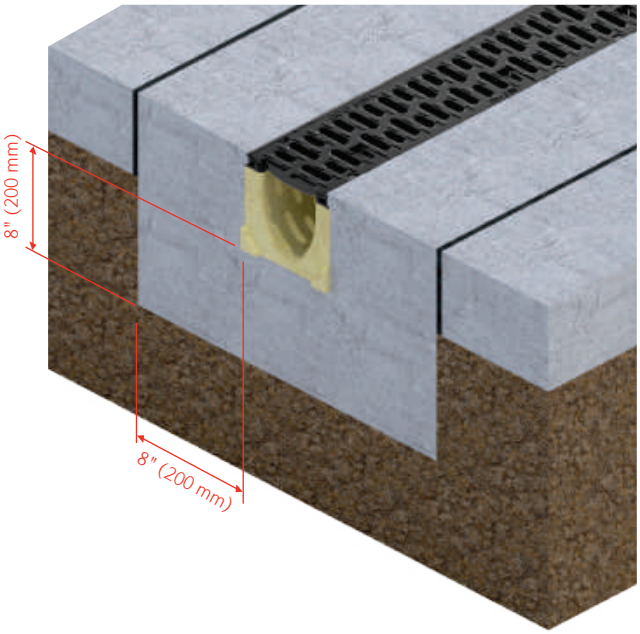
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Settling or movement of pavers should be accounted for in trafficked applications.

4" (100 MM) CHANNELS ASPHALT - EN 1433 CLASS C



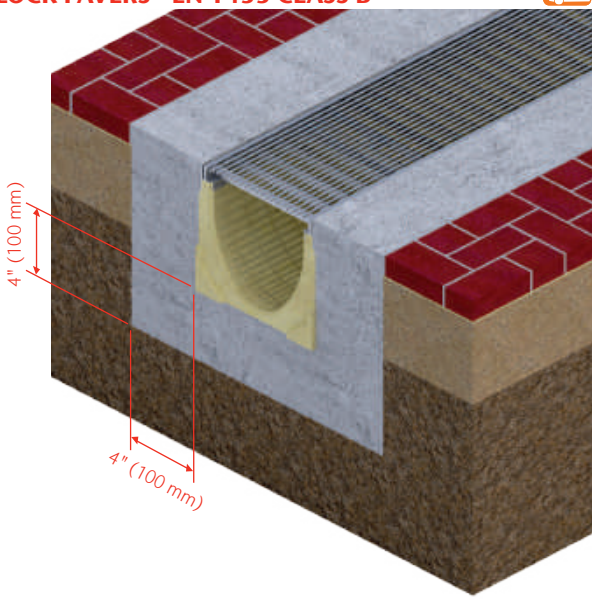
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Care should be taken with asphalt rolling machines to avoid damage to channel edge and/or grate.

4" (100 MM) CHANNELS CONCRETE - EN 1433 CLASS E/F



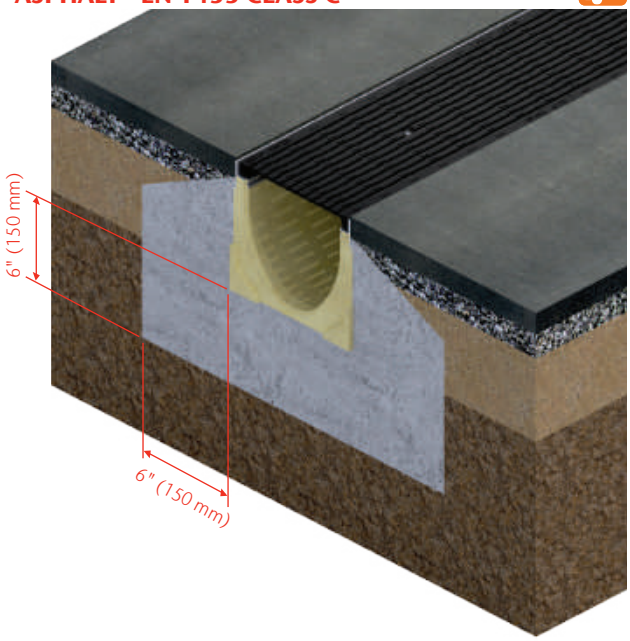
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.

8" (200 MM) CHANNELS
BLOCK PAVERS - EN 1433 CLASS B



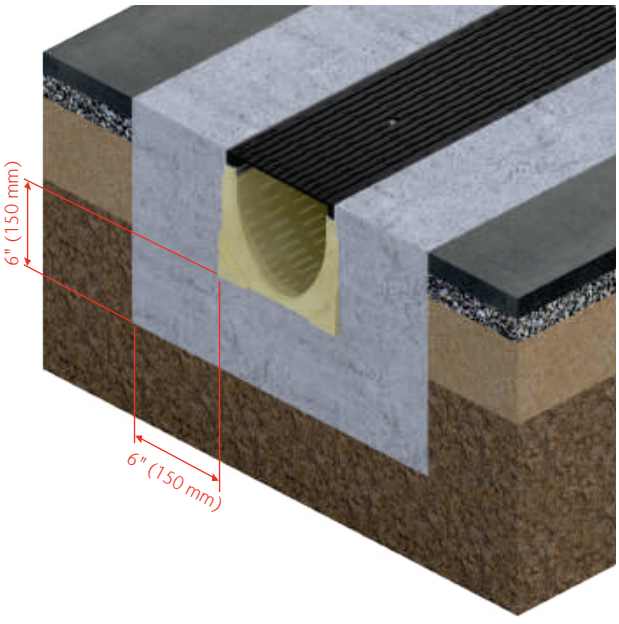
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Installation brackets on FG200 require a minimum 10" (250 mm) surround.

8" (200 MM) CHANNELS
ASPHALT - EN 1433 CLASS C



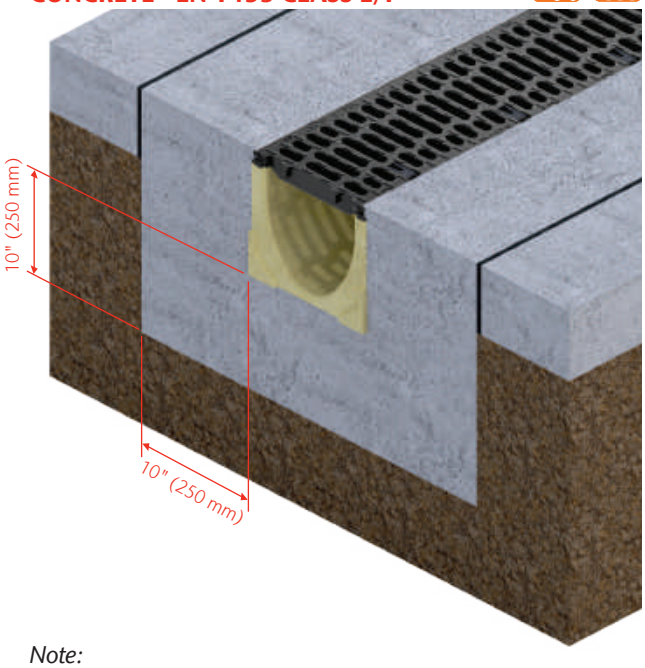
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Installation brackets on FG200 require a minimum 10" (250 mm) surround.
3. Care should be taken with asphalt rolling machines to avoid damage to channel edge and/or grate.

8" (200 MM) CHANNELS
ASPHALT - EN 1433 CLASS C



Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Installation brackets on FG200 require a minimum 10" (250 mm) surround.

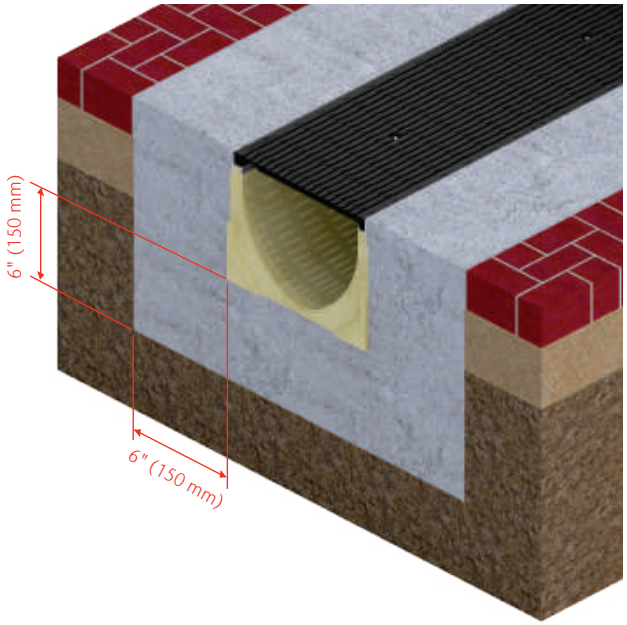
8" (200 MM) CHANNELS
CONCRETE - EN 1433 CLASS E/F



Note:
1. Grate should be 1/8" (3 mm) below pavement surface.
2. Installation brackets on FG200 require a minimum 10" (250 mm) surround.

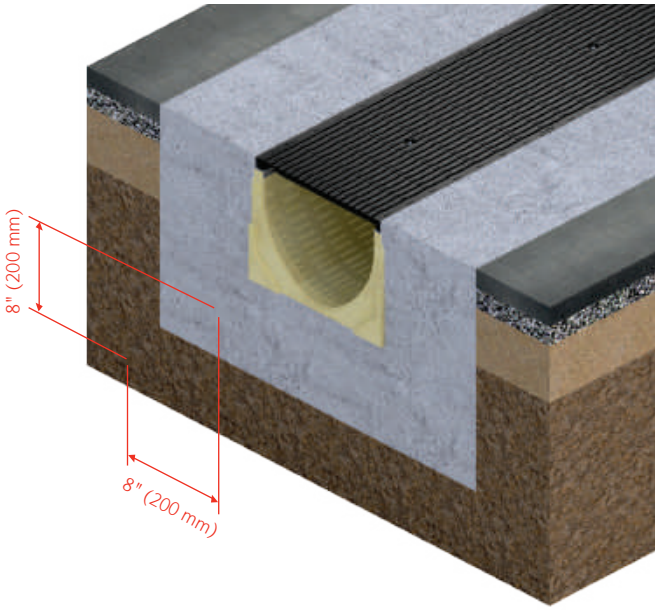
Installation Sections

12" (300 MM) CHANNELS BLOCK PAVERS - EN 1433 CLASS B



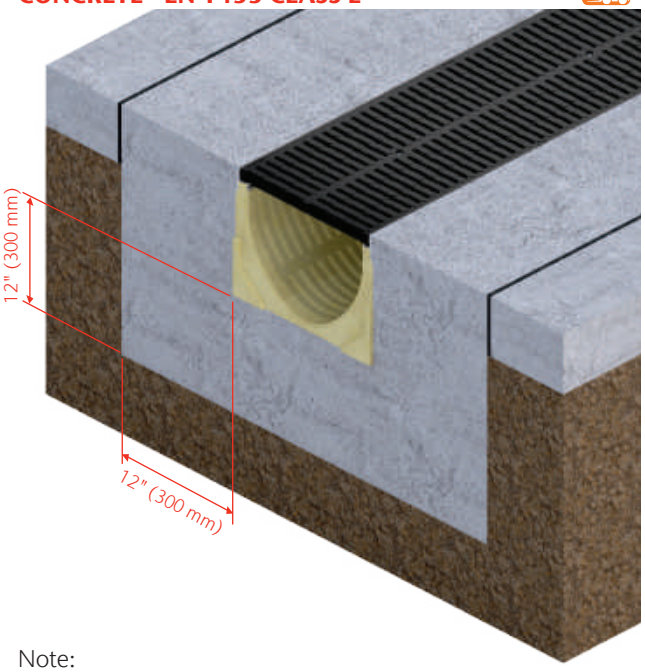
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.

12" (300 MM) CHANNELS ASPHALT - EN 1433 CLASS C



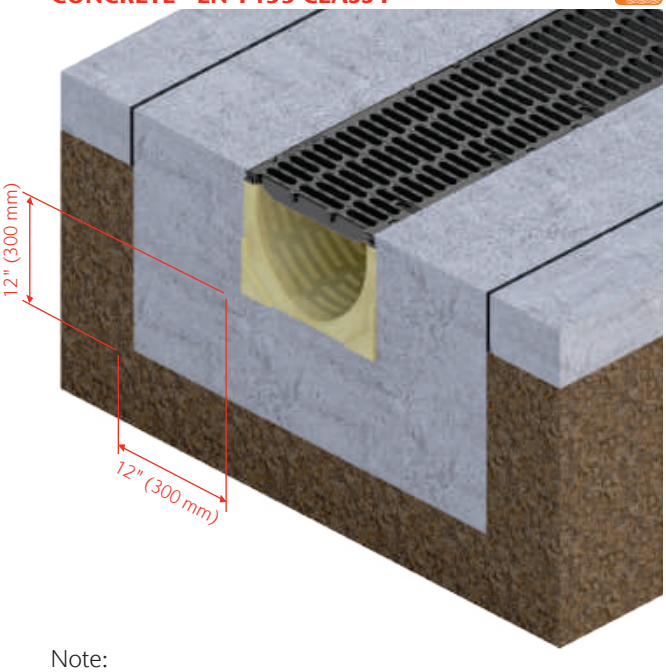
Note:
1. Grate should be 1/8" (3 mm) below pavement surface.

12" (300 MM) CHANNELS CONCRETE - EN 1433 CLASS E



Note:
1. Grate should be 1/8" (3 mm) below pavement surface.

12" (300 MM) CHANNELS CONCRETE - EN 1433 CLASS F



Note:
1. Grate should be 1/8" (3 mm) below pavement surface.

askACO

Every project brings its own requirements and challenges. In addition to our products, ACO offers you our knowledge and services to jointly develop tailor-made solutions from planning to after-sales support. With our extensive network of sales and support representation, ACO strives to ensure that the needs of your project are professionally and efficiently met.

Information and further education

At ACO, we share the expertise of the global ACO Group with architects, engineers, installers, and distributors who value quality. We invite you to benefit from it.

Planning and optimization

There are many drainage solutions to consider when planning a project. But which option leads to the most economically and technically safest solution? We help you to find the right answer.

Construction advice and presence

To prevent unpleasant surprises between planning and implementation stages, we advise and support you on a project-specific basis.

Inspection and maintenance

ACO products are designed and produced to last. With our after-sales support, we ensure that ACO will exceed your standards for years to come.

askACO: Over the Phone
Hello? We are here to help equip you with the knowledge you need to begin quickly and confidently.

askACO: Face-to-Face
Lunch & Learn. Our team will visit your required location to share their extensive expertise and support your project from the start. We will also provide lunch!

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Anytime you want. Dedicated expert and advanced support online.

ACO ON THE WEB

You will find further information for our products on the ACO USA website. This allows you to access technical data, images, specifications, and installation instructions during planning.

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