

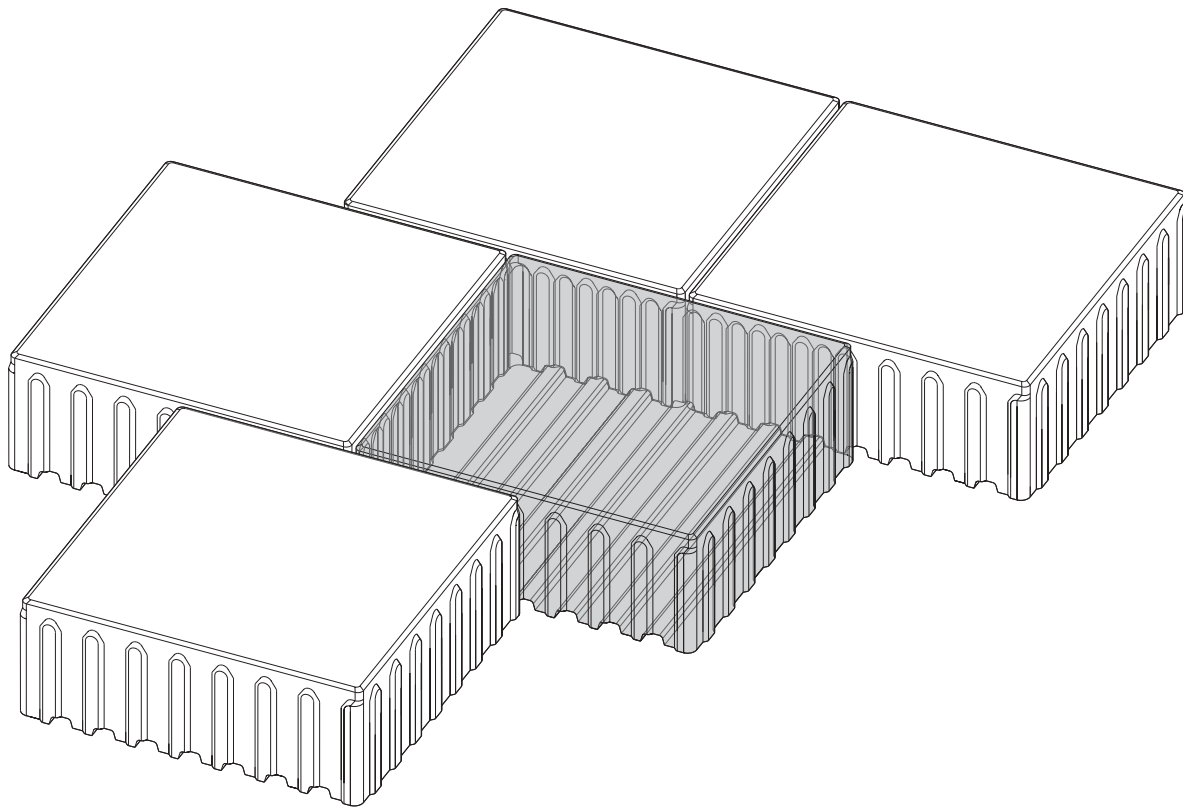


VS 5[®]

The Kooperation partners have the opportunity to add the shifting prevention characteristics and the underside profiling to their own existing products.

In this data sheet, VS 5 is explained using the example of products with the 37.5 mm design grid.

Inquire at the manufacturer for additional product data, such as quality classes, tolerances, etc., that is not specified in this data sheet.



Date: 8/6/2002



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General Information	<h1>VS 5[®]</h1>	
Product	<p>VS 5 - Shifting Prevention on Five Sides: Shifting prevention measures are located on the four sides of the stone. The shifting prevention measures are designed in such a way that the stones will always fit together, regardless of how they are rotated. The stone's underside is profiled – creating the fifth side of shifting prevention. Within the grid, the stone formats can be combined in any way necessary.</p>	
Material	<p>Concrete</p>	
Standard Dimensions/ Nominal Dimensions	<p>300 x 300/100: 300 x 150/100: 150 x 150/100: Diagonal Stone 300/100: Curve Set/100:</p>	<p>296 x 296 x 100 mm 296 x 146 x 100 mm 146 x 146 x 100 mm 424 x 287 x 100 mm 9 Different Stones: 296 x (145.5 to 295.5) x 100 mm</p>
Weight (stone thickness/ stone height: 100 mm)	<p>300 x 300/100: 300 x 150/100: 150 x 150/100: Diagonal stone 300/100: Curve Set Stones:</p>	<p>approx. 21 kg (stone height 88 mm: approx. 17 kg) approx. 10.5 kg about 5.3 kg (stone height 88 mm: approx. 4.3 kg) approx. 18 kg approx. 10.6 to 21.2 kg</p>
Requirement (including joint)	<p>300 x 300/100: 300 x 150/100: 150 x 150/100: Diagonal Stone 300/100: Curve set/100:</p>	<p>approx. 11.1 stones/m² approx. 22.2 stones/m² approx. 44.4 stones/m² approx. 2.36 stones/m (13 pieces/m²) individual calculation (1.48 pieces/m²)</p>
Protection Rights	<p>Patent registered in Germany on 10/5/2001 (No.:101 49 250.2), in priority for all countries; VS 5 is a registered brand of SF-Kooperation GmbH in Germany (No.: 301 55 219), date of registration: 10/22/2001; EU brand registration on 7/9/2002 (No.: 2770 279).</p>	
Installation	<p>Roads, public squares, industrial areas, generally high-traffic areas (RstO 01 from building class III) Mechanical and manual installation should be performed by expert personnel in accordance with applicable health and safety protection regulations. Due to the profiling on the underside of the stone, VS 5 stones require vibratory settling of 200 kg to approximately 600 kg operational weight with approximately 30 to 60 KN centrifugal power. The vibratory plate should always be equipped with a sliding plate device.</p>	
	<p>Product VS 5</p>	<p>Sheet 2 of 22</p>
	<p>Product Group Decorative Paving</p>	<p>Date 06.08.02</p>



Product	VS 5[®]	
	The following information applies to VS 5 with a stone thickness/stone height of 80 mm.	
	Material	Concrete
	Standard Dimensions/ Nominal Dimensions	300 x 300/80: 296 x 296 x 80 mm 150 x 150/80: 146 x 146 x 80 mm
	Weight (stone thickness/ stone height: 80 mm)	300 x 300/80: approx. 17 kg 150 x 150/80: approx. 4.3 kg
Requirement (including joint)	300 x 300/80: approx. 11.1 stones/m ² 150 x 150/80: approx. 44.4 stones/m ²	
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<p>Product</p> <p>Product Description</p> <p>Sketch 1</p>	<p>VS 5[®]</p> <p>VerschiebeSicherung [Shifting Prevention] on 5 stone sides</p> <p>The designation of the individual stones means: 300 x 300/100</p> <ul style="list-style-type: none"> └── Stone height/stone thickness 100 mm └── Grid size 300 x 300 mm <p>Shifting prevention measures are located on the stone's four sides. The stones are designed to be diagonally symmetrical so that the stones always fit together – regardless of how they are rotated.</p> <p>The undersides of the stones are profiled – creating the fifth side with shifting prevention measures. This "clawing effect" in the pavement bed increases frictional resistance by 54% compared to non-profiled stones.</p> <div style="display: flex; justify-content: space-around;"> <div> <p>Vertical Deformation Track Grooves</p> </div> <div> <p>Horizontal Deformation</p> </div> </div> <p>The shifting prevention design transfers vertical and horizontal forces to neighboring stones. The profiling on the undersides of the stones produces a clawing effect in the pavement bed.</p>	
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Product

VS 5[®]

Sketch 2

No. 9

No. 8

No. 1

VS 5

Curve Set
Change of direction 3°

VS 5
300 x 300

VS 5
300 x 150

VS 5
150 x 150

Diagonal stone 300

	<p>Product VS 5</p>	<p>Sheet 5 of 22</p>
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VS 5[®]

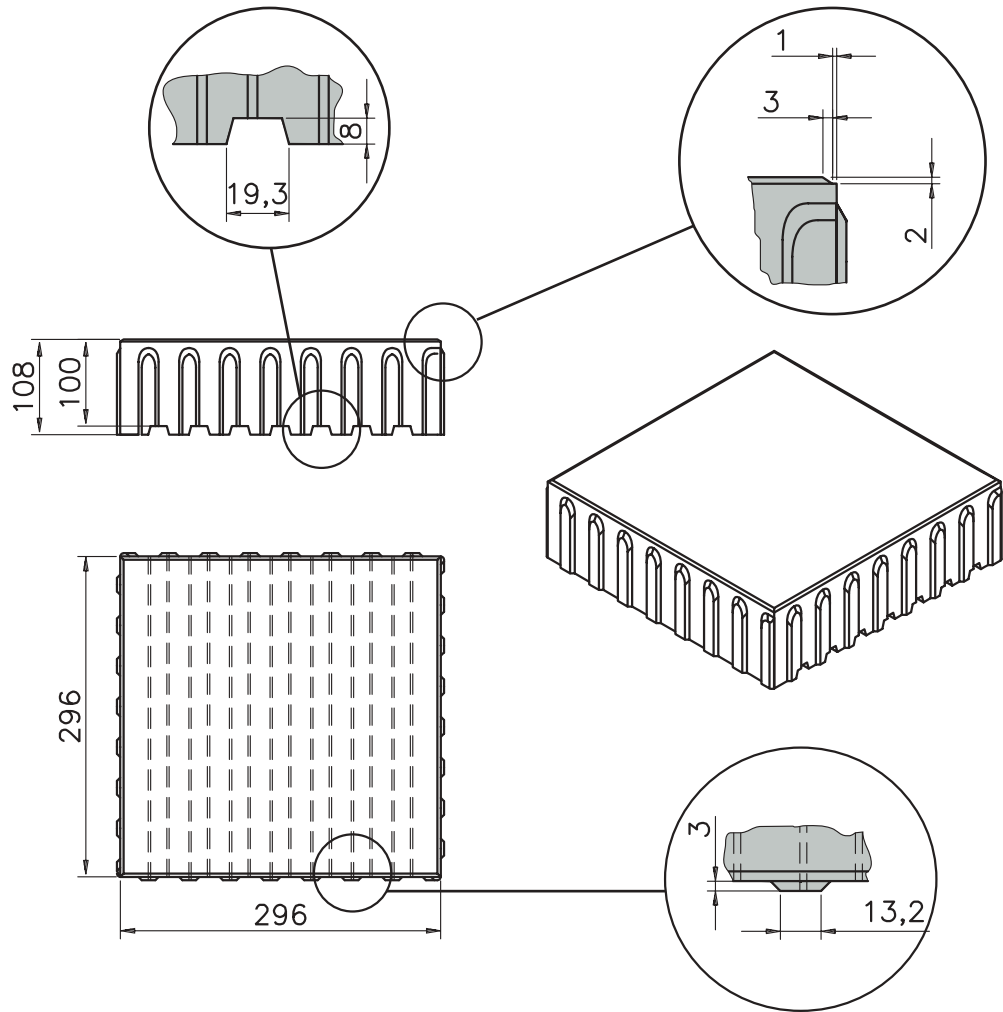
All dimensions in mm

Individual stones

300x300/100

Nominal dimensions/
Standard dimensions

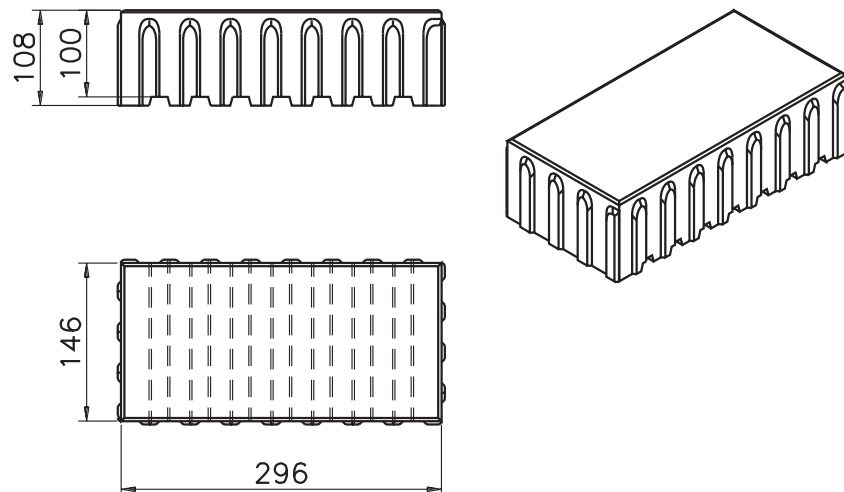
Sketch 3



300x300/100

Nominal dimensions/
Standard dimensions

Sketch 4



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VS 5

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VS 5[®]

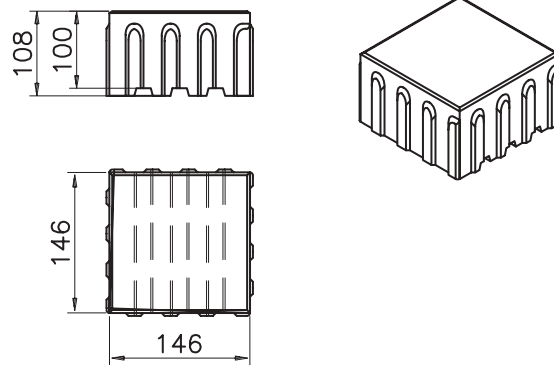
All dimensions in mm

Individual Stones

150x150/100

Nominal dimensions
Standard dimensions

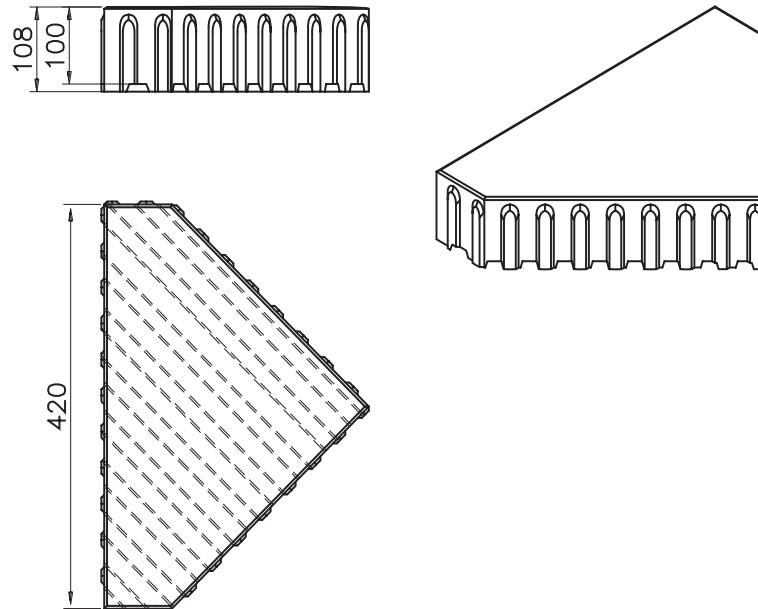
Sketch 5



Diagonal stone
300/100

Nominal Dimensions/
Standard Dimensions

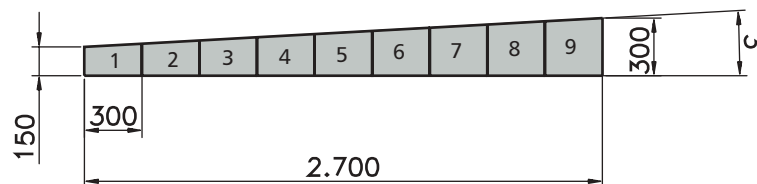
Sketch 6



**Curve set/
100
Grid
Dimensions**

VS 5 curve sets enable the formation of technically flawless curves. The curve set consists of nine specially shaped stones and corresponds to an installation width of 2.70 m. Each curve set results in a directional change in the road of about 3°.

Sketch 7



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VS 5[®]

All dimensions in mm

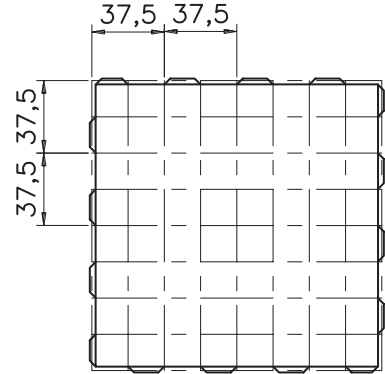
Grid

Depiction of a typical grid unit: 37.5 mm (selected for SF-Kooperation's rental molds)

Construction Grid

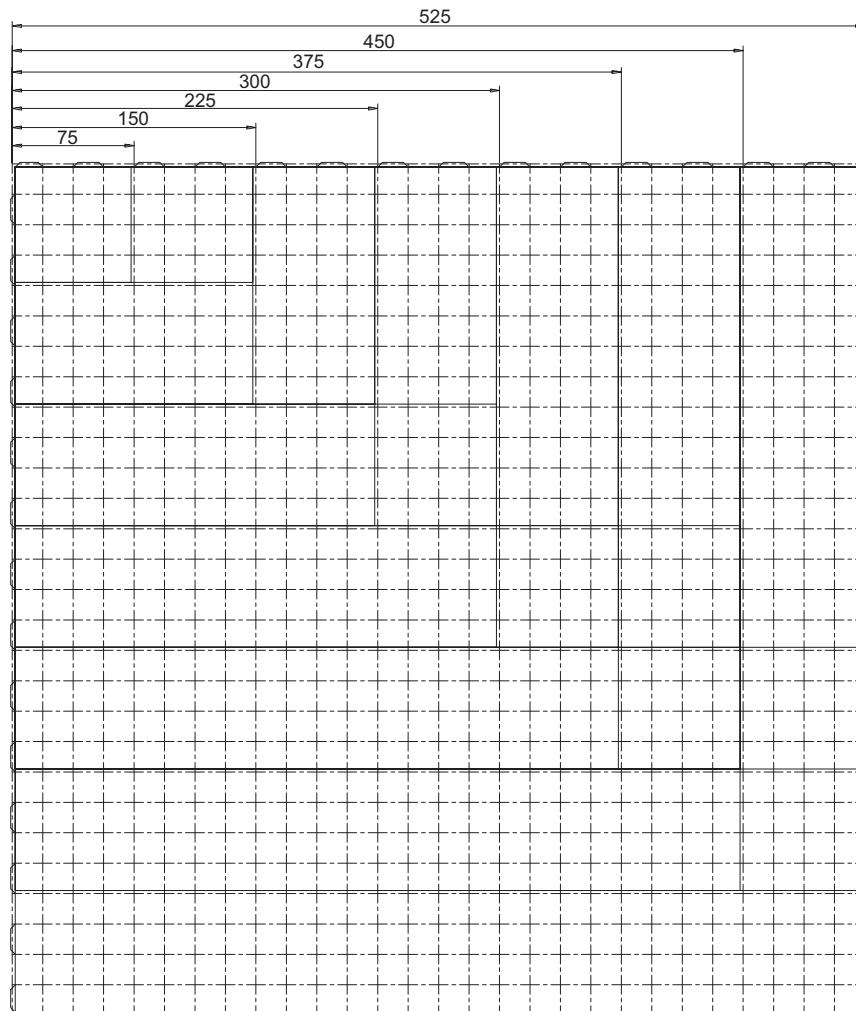
Due to their design, the individual stones can be combined with each other only in the specified grid dimensions. The reason for this lies with the design requirement that the stones be diagonally symmetrical in order to facilitate combining and rotating the stones in any way desired.

Sketch 8



Possible Grid Dimensions

Sketch 9



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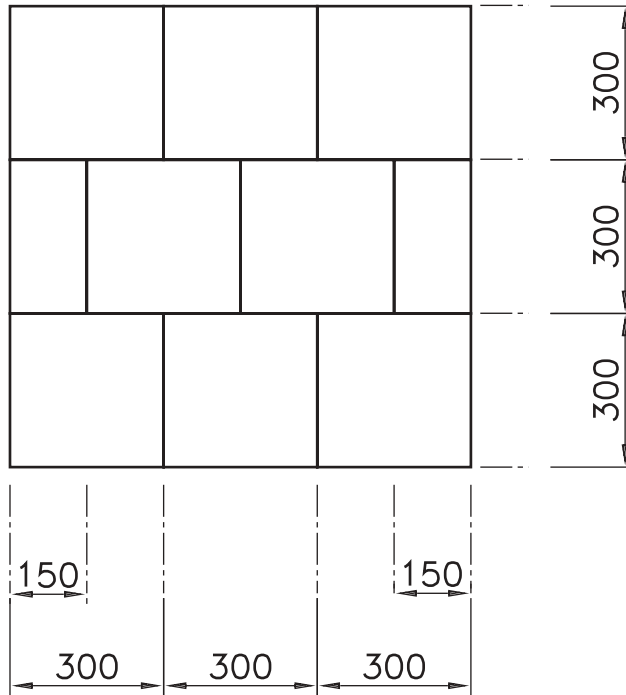
VS 5[®]

All dimensions in mm

Grid

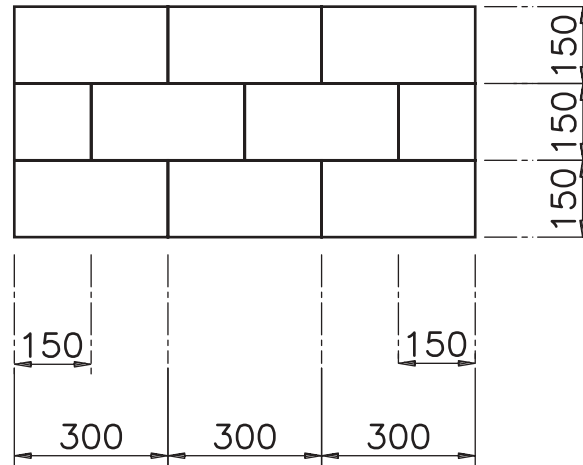
Installation
Grid
300 x 300

Sketch 10



Installation
Grid
300 x 150

Sketch 11



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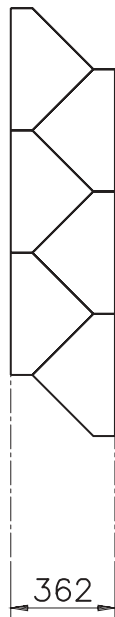
VS 5[®]

All dimensions in mm

Grid

Installation
Grid
Diagonal

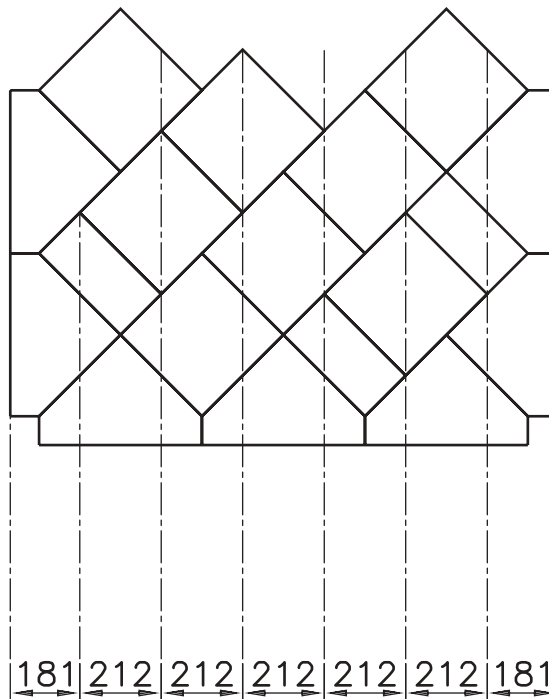
Sketch 12



When VS 5 is installed diagonally, the grid depicted in sketches 12 and 13 will be the result.

Installation
Grid
Diagonal

Sketch 13



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VS 5[®]

All dimensions in mm

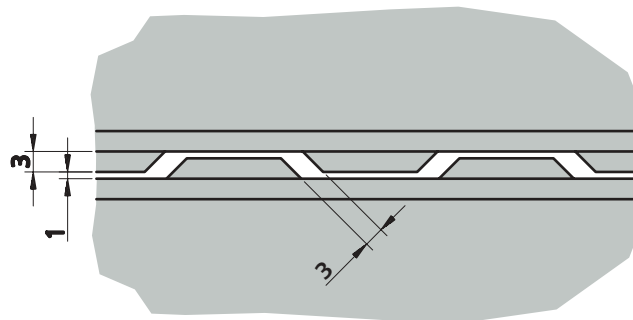
Installation

Shifting Prevention

Protrusions and recesses on the sides of the stones create the shifting prevention effect. The proportion of joint filling material in the joint is approximately 38.5%.

Sketch 14

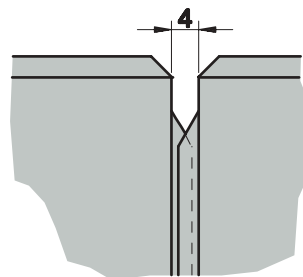
Top view



Joint Detail

Sketch 15

Side view



The visible joint width is approximately 4 mm. The distance between the spacer and the neighboring stone should be approximately 1 mm.

The joints of the VS 5 product are filled with 0/2 mm sand. In order to ensure the filter stability of the pavement bedding,, this should be produced from a material with a grain size of 0/5 mm.

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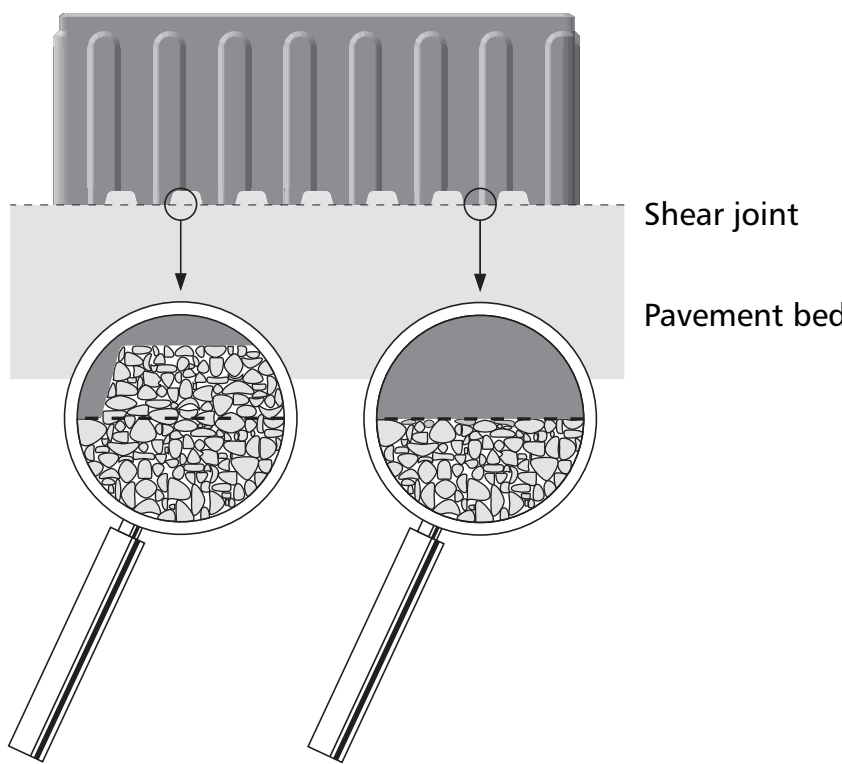
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<p>Installation</p> <p>Profiling on the Underside of the Stone</p> <p>Sketch 16</p>	<p>VS 5[®]</p> <p>Profiling on the undersides of all VS 5 stones increases their positional stability.</p>  <p>The bedding material in the stones' profiling increases the roughness and thereby the coefficient of friction in the shear joint as well.</p> <p>The coefficient of friction between concrete and bedding material is smaller because the concrete exhibits less roughness.</p> <p>Up to 54% greater coefficient of friction as a result of profiling.</p> <p>Documented by: Dr. Klaus Krass, Professor Professor of road building and railway construction at the Ruhr-Universität in Bochum, Germany Test of the shearing behavior of profiled paving stones, August 2000.</p>	
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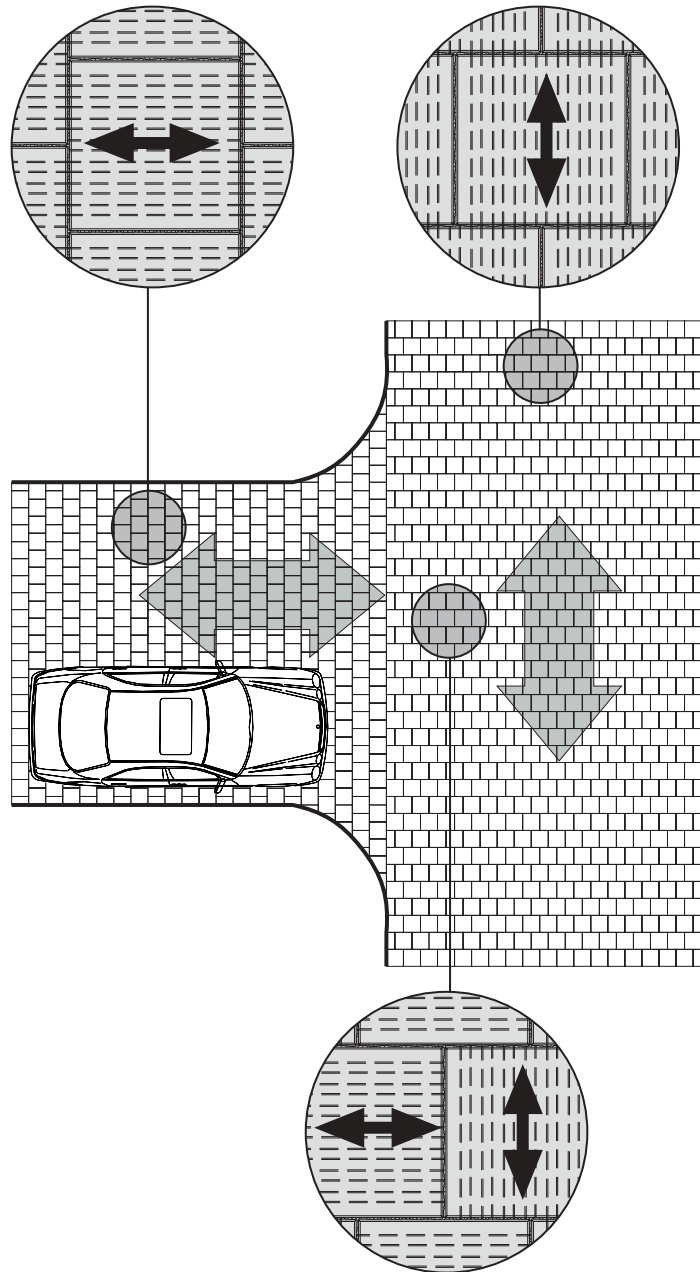
VS 5[®]

Installation

The profiling on the undersides of the stones should run parallel to the direction of travel because this reduces the amount that the stones shift towards the edge of the roadway.

Direction of Profiling

Sketch 17



The directions of the profiling change in the transitional areas.

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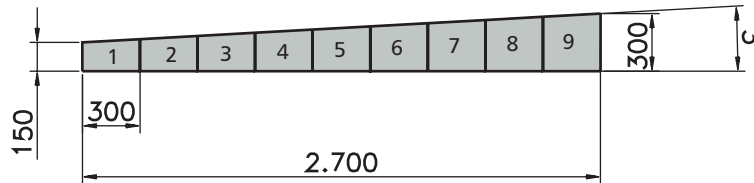
VS 5[®]

All dimensions in mm

Installation

VS 5 curve sets enable the formation of technically flawless curves. The curve set consists of nine specially shaped stones and corresponds to an installation width of 2.70 m. Each row of curve stones produces a directional change in the road of about 3°.

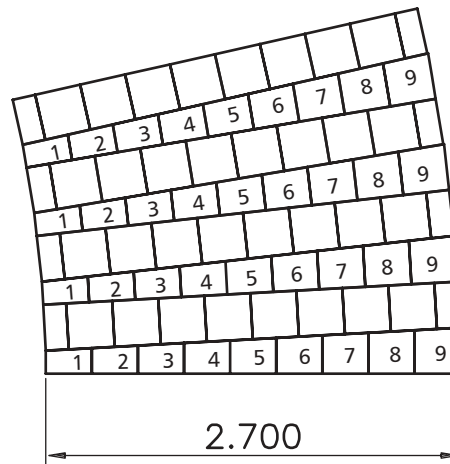
Grid Dimensions of Curve Set



Sketch 18

Sketch 19 depicts a typical curve with a road width of approximately 2.70 m and an inner radius of approximately 8 m. The installation method alternates between rows of curve stones and full stones, consisting of stones with grid dimensions of 300 x 300 mm. It is also possible to install one curve set after another, also in half-bond, in order to achieve very small inner radii (see sketch 22).

Curve example 1



Sketch 19

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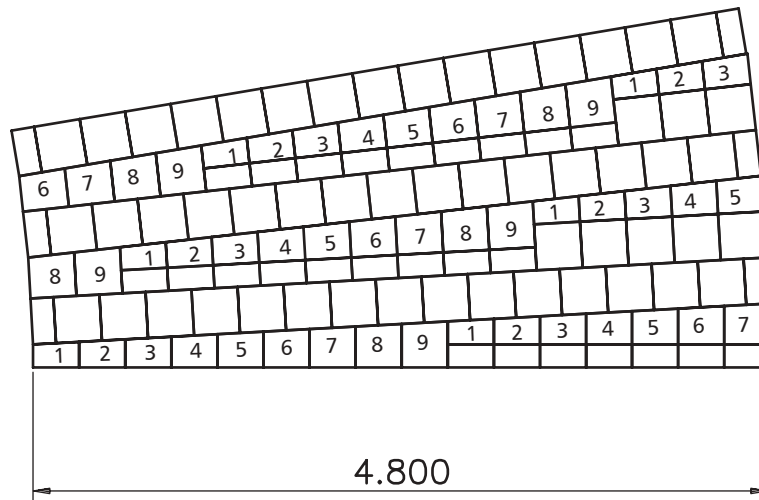
All dimensions in mm

Installation

Example of a street width with 16 stones:
 Alternating rows of full stones and curve stones (here **full stone grid dimension 300 x 300 mm**) produce in this example an **inner radius of approximately 9 m**.
 All individual stones of the curve set will be used. After installing the first 9 + 7 curve stones, the next row of curve stones will begin with stone No. 8.
 The transition from curve stone No. 9 to curve stone No. 1 is depicted in sketch 22.

Curve example 2

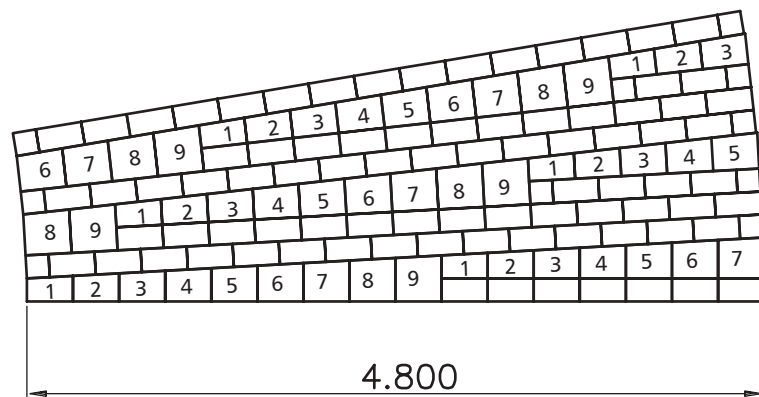
Sketch 20



Example of a street width with 16 stones:
 Alternating rows of full stones and curve stones (here **full stone grid dimension 300 x 150 mm**) produce in this example an **inner radius of approximately 6.5 m**.

Curve example 3

Sketch 21



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All dimensions in mm

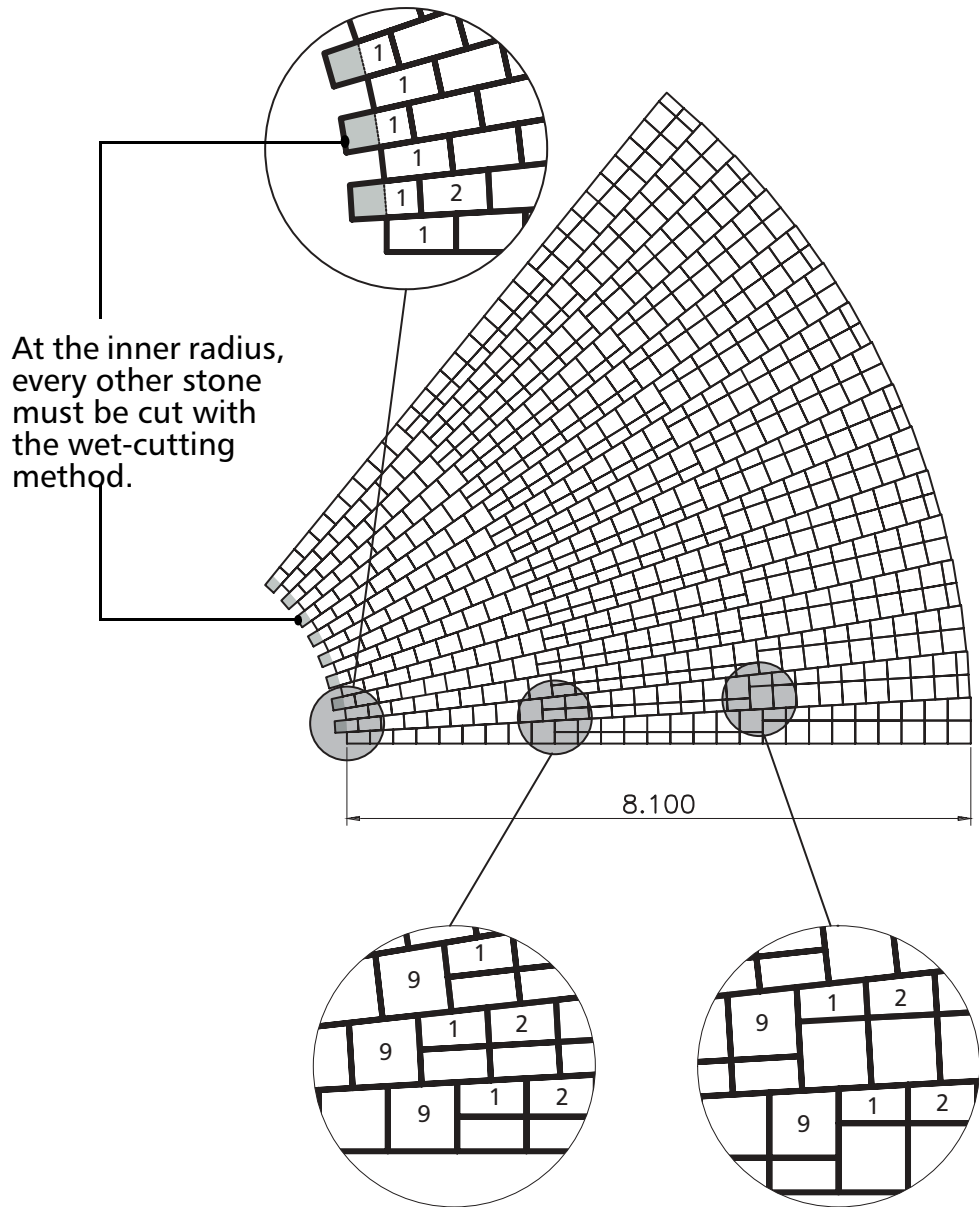
VS 5[®]

Installation

Example of a street width with 27 stones:
 If the pavement width, as measured by the number of stones, is a factor of 9 (9, 18, 27, etc.), this is considered a special case because the inner radius always starts with curve stone No. 1. If one curve sets are installed on top of the other, this will produce the **smallest possible inner radius of approximately 2.70 m.**

Curve example 4

Sketch 22



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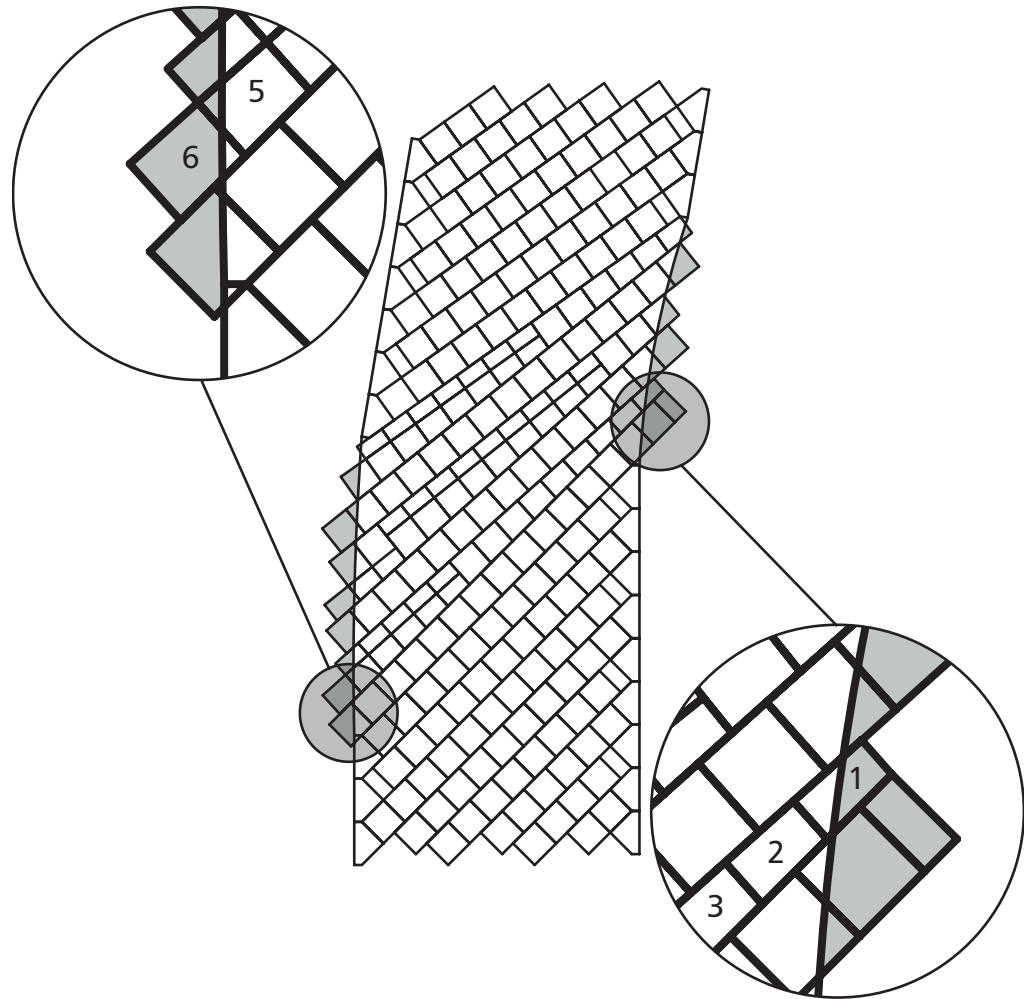
VS 5[®]

Installation

It is also possible to use the entire curve set in a diagonally installed street pavement. To achieve a straight edge finish, it will be necessary to cut a few of the stones (gray areas on the drawing) with the wet-cutting method.

Curve Example Diagonal Installation

Sketch 23



Always observe the requirements set forth by ZTVP-StB 2000 with regards to the sizes of the stones that are cut.

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VS 5[®]

All dimensions in mm

Installation

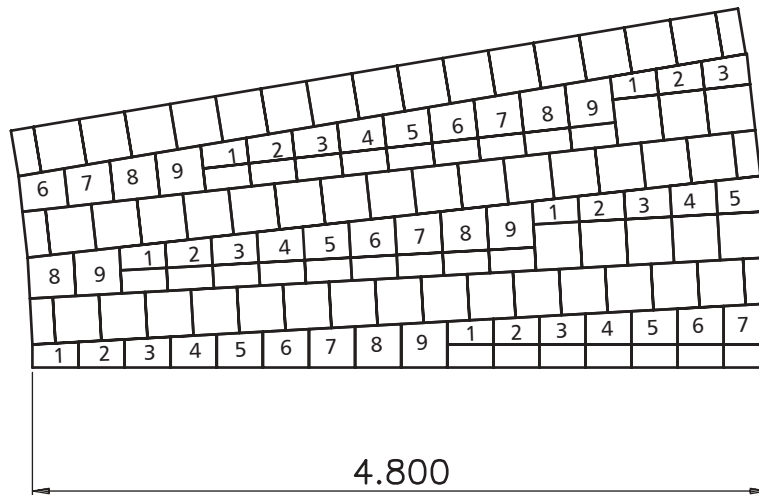
Example calculation for determining the number of curve sets

Example of the calculation:

Street width: $b = 4.80 \text{ m}$
 Curve angle: $\alpha = 9^\circ$
 Curve set length: $L = 2.70 \text{ m}$
 Directional change per curve set: 3°

Curve Set Calculation

Sketch 24



Required number of curve sets [n]:

$$n = \frac{\text{Curve angle } \alpha [^\circ]}{3^\circ} \cdot \frac{\text{Street width [m]}}{\text{Curve set length 2.70 m}} \quad [\text{number of stones}]$$

In our example:

$$n = \frac{9^\circ}{3^\circ} \cdot \frac{4.8 \text{ m}}{2.70 \text{ m}} = 5.33 \Rightarrow 6 \text{ curve sets}$$

Accordingly, **six curve sets**(rounded up) will be needed for the curve. Remember to evenly distribute the curve sets throughout the length of the curve. In other words: In our example, we will install alternating rows of curve stones and full stones.

Product

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<p>Sales Arguments</p>	<p>VS 5[®]</p> <p style="text-align: center;">Marketing Aids</p> <p>Arrangement of traffic surfaces under load with uninterrupted shifting prevention.</p> <p>Different stone formats in a variety of colors as well as surfaces with the appearance of freestones produce attractive pavement surfaces.</p> <p>Due to a uniform grid, all VS 5 pavement stones fit together without interruption. All VS 5 system stones are diagonally symmetrical and can therefore be installed easily and rapidly.</p> <p>Shifting prevention occurs on five sides of the stone:</p> <ul style="list-style-type: none"> • The four vertical sides of the stone have vertical protrusions and recesses in the joint area. These protrusions and recesses produce chamber joints that exhibit greater resistance to rinsing with water and suction from vacuum cleaners. • The undersides of the stones have 8 mm-deep profiling, thereby producing a clawing effect in the pavement bed. The coefficient of friction in the shear joint between the underside of the stone and the pavement bed is 54% greater than that found in stones with flat undersides. <p>The profiling offers the greatest resistance to horizontal forces (generated by traffic loads) when the direction of the profile runs parallel to the main direction of travel. In areas where the direction of travel alternates (like at intersections), it is possible to alternate the direction of the profiling at each spot without producing visible changes on the surface.</p>	
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Sales Arguments	<p>VS 5[®]</p> <p style="text-align: center;">Marketing Aids</p> <p>Shifting prevention occurs on five sides of the stone:</p> <ul style="list-style-type: none"> • A curve set is part of the VS 5 system. The stones of the curve set are also equipped with the typical shifting prevention characteristics. The curve set produces a directional change of 3°. The curve set is suitable for installation with all stone dimensions. The curve set is designed in such a way that all stones are used in a curve area, regardless of the width of the path, road, or square. The curve set provides a thoroughly stable design throughout the entire pavement surface, even in curve areas subjected to heavy traffic. • VS 5 contains a diagonal edging stone that enables installation of the pavement rows at a 45° angle to the main direction of travel. Diagonal installation considerably reduces the rolling noise produced by vehicles traveling on the surface. • VS 5 is delivered with a stone thickness of 100 mm and therefore complies with the recommendations of the German RStO 01 for building class III. 	
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Safety and Health Notes	<h1>VS 5[®]</h1> <h2>Notes on Safety and Protection of Health</h2> <p>When installing VS 5 always observe the stipulations of the German ordinances "Arbeitsschutzgesetz" [worker safety law] and "Verordnung über Sicherheit und Gesundheitsschutz auf Baustellen" [Ordinance on Safety and Health Protection on Construction Sites]. This also includes implementation of the EC directive 90/269/EEC with regard to safety and health protection during manual handling of loads. Also applicable is "Beurteilung von Lasthandhabungen anhand von Leitmerkmalen" [Judging Load Handling Work on the Basis of Certain Characteristics] according to "Handlungsanleitung zur Beurteilung der Arbeitsbedingungen beim Heben und Tragen von Lasten, LV9, des Länderausschusses für Arbeitsschutz und Sicherheitstechnik" [Instructions for Judging Working Conditions During Lifting and Carrying of Loads, LV9, of the Regional Committee for Worker Protection and Safety Mechanisms]:</p>																																																																							
	<table border="1"> <thead> <tr> <th>Time-weighting</th> <th>Regular repetition of short lifting and moving procedures</th> <th>Work in m²</th> <th colspan="2">Continuous carrying or holding over long periods of time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>< 10 times per shift</td> <td>< 0.5 m²</td> <td colspan="2">Total duration < 30 min.</td> </tr> <tr> <td>2</td> <td>10 to < 40 times per shift</td> <td>< 1.8 m²</td> <td colspan="2">Total duration 30 min. to < 1 hr.</td> </tr> <tr> <td>4</td> <td>40 to < 200 times per shift</td> <td>< 9.0 m²</td> <td colspan="2">Total duration 1 hr. to < 3 hr.</td> </tr> <tr> <td>5</td> <td>200 to < 500 times per shift</td> <td>< 23 m²</td> <td colspan="2">Total duration 3 hr. to < 5 hr.</td> </tr> <tr> <td>6</td> <td>≥ 500 times per shift</td> <td>≥ 23 m²</td> <td colspan="2">Total duration ≥ 5 hr.</td> </tr> </tbody> </table>	Time-weighting	Regular repetition of short lifting and moving procedures	Work in m ²	Continuous carrying or holding over long periods of time		1	< 10 times per shift	< 0.5 m ²	Total duration < 30 min.		2	10 to < 40 times per shift	< 1.8 m ²	Total duration 30 min. to < 1 hr.		4	40 to < 200 times per shift	< 9.0 m ²	Total duration 1 hr. to < 3 hr.		5	200 to < 500 times per shift	< 23 m ²	Total duration 3 hr. to < 5 hr.		6	≥ 500 times per shift	≥ 23 m ²	Total duration ≥ 5 hr.		<table border="1"> <thead> <tr> <th>Load-weighting</th> <th>Posture-weighting</th> <th>Execution-weighting</th> <th>Σ 1 - 3</th> <th>x Time-weighting</th> <th>Point value</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>4</td> <td>0</td> <td>6</td> <td>6</td> <td>36</td> </tr> <tr> <td>2</td> <td>4</td> <td>0</td> <td>6</td> <td>5</td> <td>30</td> </tr> <tr> <td>2</td> <td>4</td> <td>0</td> <td>6</td> <td>4</td> <td>24</td> </tr> <tr> <td>2</td> <td>4</td> <td>0</td> <td>6</td> <td>2</td> <td>12</td> </tr> <tr> <td>2</td> <td>4</td> <td>0</td> <td>6</td> <td>1</td> <td>6</td> </tr> </tbody> </table>					Load-weighting	Posture-weighting	Execution-weighting	Σ 1 - 3	x Time-weighting	Point value	2	4	0	6	6	36	2	4	0	6	5	30	2	4	0	6	4	24	2	4	0	6	2	12	2	4	0	6	1	6
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<p>In Conclusion: <i>Point value 36 and 30:</i> Considerably elevated strain, possibility of bodily over-exertion even for normally resilient persons. Conformational measures are recommended. <i>Point value 24 and 12:</i> Elevated strain, possibility of over-exertion for persons of diminished resiliency. Conformational measures are advisable for persons in this category. <i>Point value 6:</i> Minimal strain, danger to health due to bodily over-exertion is unlikely. In general, installation should be done by machine wherever possible.</p>																																																																								
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<p>Suggested Reading</p> <p>Standards, Regulations, Rules</p>	<p>VS 5[®]</p> <p>Scientific investigations 2002:</p> <ol style="list-style-type: none"> 1. Over roll test, behavior of the pavement surface in the street testing machine, evidence of the vertical and horizontal interlock. 2. Spread test to document horizontal interlock performance 3. Infiltration measurements, recording actual seepage 4. Shear test, determining a coefficient of friction (2001) 	
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<p>Internal</p> <p>Curve set calculation</p> <p>Brochure components and PR material</p> <p>CD-ROM</p> <p>Scientific investigations /expert reports</p>	<p>VS 5[®]</p> <p style="text-align: center;"><i>Internal page</i></p> <p>Internal page</p> <p>A free calculation program is available for the VS 5 curve set. The program not only calculates the number of required sets, but also the distribution of the curve sets in a curve or circle. The program displays and outputs the results visually.</p> <p>Drawings: CAD and data sheet drawings on CD as scan/copies, and as files on CD Installation examples</p> <p>Texts: press release Data sheet</p> <p>Brochure Informational brochure</p> <p>Expert report overview: SF xx, price: xxx,xxx €/100 copies</p> <p>1. Data CD</p> <p>1. Over roll test 2. Spread test 3. Infiltration measurement 4. Shear test</p>	
	<p>Product</p> <p>VS 5</p>	<p>Sheet</p> <p>Appendix 1</p>
<p><small>Datenblatt_VS5.fm</small> Freeseemann / Köster</p>	<p>Product Group</p> <p>Pavements</p>	<p>Date</p> <p>06.08.02</p>