vdw Mortar Systems

Planning and Application Notes

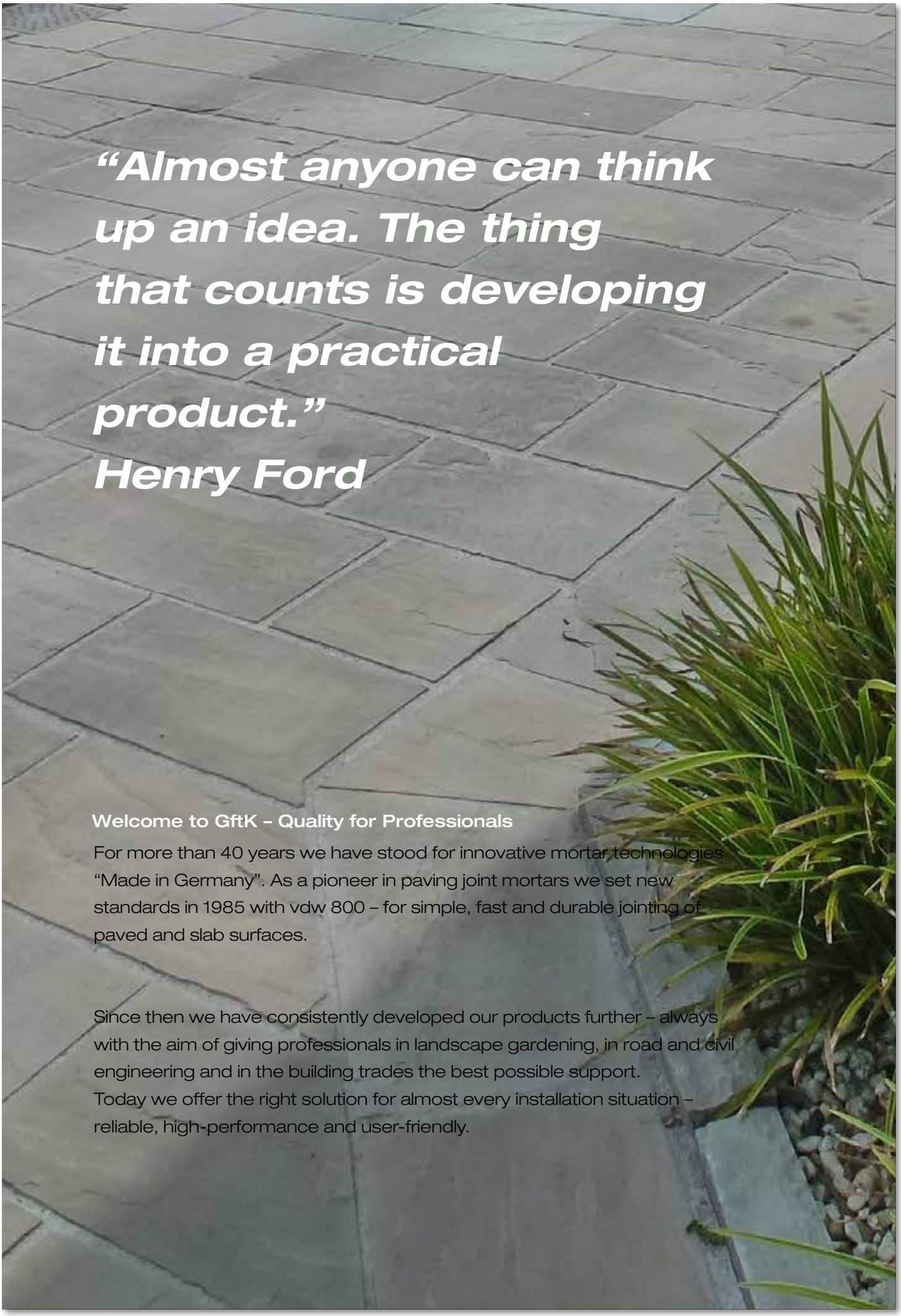
Proven systems
for long-lasting structures

System solutions
for different requirements

Practice-oriented
for planning and application

GftK

Quality for Professionals



“Almost anyone can think up an idea. The thing that counts is developing it into a practical product.”
Henry Ford

Welcome to GftK – Quality for Professionals

For more than 40 years we have stood for innovative mortar technologies “Made in Germany”. As a pioneer in paving joint mortars we set new standards in 1985 with vdw 800 – for simple, fast and durable jointing of paved and slab surfaces.

Since then we have consistently developed our products further – always with the aim of giving professionals in landscape gardening, in road and civil engineering and in the building trades the best possible support.
Today we offer the right solution for almost every installation situation – reliable, high-performance and user-friendly.

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Notes

1. Introduction

1.1 Welcome to GftK

For many years GftK has stood for high-quality mortar systems for producing permanently functional paving, slab surfaces and ceramic outdoor areas. Our products are used wherever surfaces are to be convincing not only visually, but also to remain load-bearing, easy to look after and economical to use in the long term.
Whether a private terrace, garden path, driveway, prestige outdoor area or a more heavily used traffic area – every surface places its own demands on planning, material selection and execution. That is precisely why it is not enough to select a single product. What is decisive is the technically coordinated interaction of substrate, base course, bedding, paving, joint, movement joints and drainage.
With these application notes we want to give planners, contractors, trade partners and clients practical guidance. The brochure combines technical principles with experience from everyday application and shows which factors are decisive for outdoor surfaces that stay attractive and functional.

1.2 Aim and benefit of these notes

These notes are intended to help avoid typical mistakes in planning and execution. Much of the damage to paved and slab surfaces is not caused by the visible surfacing alone, but by inadequate coordination of the construction as a whole. Unsuitable bedding, joint widths that are too narrow, missing movement joints or substrates without sufficient load-bearing capacity can lead to considerable defects even with high-quality paving.
The aim of this brochure is therefore to present technical relationships in an understandable way and to show practical solutions. It should help to classify construction methods correctly, to assess paving materials and formats professionally, to select suitable system components and to take account of the later use and care of the surface.
We welcome suggestions as to which topics or details of paving construction should be added in future editions.

1.3 Who this brochure is intended for

These application notes are addressed to everyone involved in planning, advising, selling, executing or assessing outdoor surfaces. They include in particular landscape gardening companies, paving and natural stone contractors, planning offices, architects, engineers, builders' merchants, municipal clients, commercial developers and quality-conscious private clients.
The content is structured so that it can be used both as technical guidance during the planning phase and as practical support on site. At the same time it gives trade partners a basis for sound advice.

1.4 System solutions, not single products

Outdoor surfaces must always be regarded as a complete system. A jointing mortar can only function permanently if the bedding, sub-base, paving, joint width, drainage and movement joints are matched to one another as well.
GftK therefore sees its products as part of coordinated system solutions. Selecting a suitable mortar is always bound up with the question of which construction method, which paving material, which use and which boundary conditions the surface is to be built for.

1.5 Fields of application from private areas to traffic areas

The fields of application range from walkable private surfaces to more heavily used outdoor areas. Terraces, garden paths and seating areas mainly place demands on appearance, comfort, ease of maintenance and permanent evenness. Driveways, parking spaces and carports additionally have to take manoeuvring and wheel loads. Public or semi-public areas are frequently stressed by cleaning vehicles, delivery traffic, winter service or a high frequency of use.

GftK Jointing Mortar Product Planner

www.gftk-info.de/Produktplaner

GftK Consumption Calculator

www.gftk-info.de/verbrauchsrechner

2. Engineering & planning

2.1 Relevant codes of practice and standards

Anyone planning or carrying out paved or slab surfaces today is faced with a large number of standards, guidelines and technical bulletins. Depending on the type of project and on the client, different requirements apply – and it is often unclear which set of rules is binding when no specific agreement has been made.
Our recommendation:
A clear description of the work, with reference to a set of rules where appropriate, gives certainty in planning and execution. Depending on the contractual basis and the field of use, different codes of practice apply:

ATV DIN 18318
ATV DIN 18318 is a technical contractual basis for paving, slab surfaces and edge restraints and forms part of VOB/C. It describes requirements for building materials, execution, tolerances and services and applies in principle to unbound as well as to bound construction methods.

ZTV-Wegebau
ZTV-Wegebau is of particular practical importance for landscape gardening. It describes surfacings outside classic road traffic areas and assigns them to use categories. It is therefore an important and practice-oriented basis of rules, above all for terraces, garden paths, seating areas, driveways and comparable outdoor areas.

ZTV-Pflaster-StB
ZTV Pflaster-StB matters above all in public road and traffic area construction. It supplements the relevant technical contract conditions for paving, slab surfaces and edge restraints on traffic areas subject to road construction loading.
It applies in particular where higher traffic loads, municipal traffic areas, carriageways, more heavily loaded edge restraints or road-related special details are involved. In such cases it is to be used together with the other FGSV codes of practice and, where applicable, with the RStO (guidelines for the standardisation of the pavement of traffic areas).

FGSV codes of practice
On more heavily loaded or public traffic areas, FGSV codes of practice may additionally be decisive. These include in particular rules on the dimensioning of the pavement, on bound construction methods and on the accompanying road construction requirements.

Planning certainty through system solutions
Besides the codes of practice, the technical data sheets of the respective products must always be observed. They contain binding information on fields of application, application, layer thicknesses, joint widths, joint depths, load capacity and curing.
Even though codes of practice do not give exact specifications for every case, they offer reliable guidance and in most cases count as recognised rules of engineering.
GftK mortar systems are developed for all of these requirements – from walkable paths to heavily trafficked traffic areas.

2.2 Use categories and traffic loading

Codes of practice distinguish between different load classes. This classification helps to choose the right combination of base course, bedding and jointing mortar.

In the **ZTV Wegebau** the application areas are divided into three use categories (N1–N3).

- **Use category N 1** – walkable areas only
- **Use category N 2** – trafficable paving for vehicles up to 3.5 t outside public road traffic areas,
- **Use category N 3** – trafficable as category N 2, but with occasional vehicle load up to 20 t, wheel load ≤ 5 t outside public road traffic areas

In the **ATV DIN 18318** the application areas are likewise divided into three use categories according to traffic loading (walkable – trafficable up to 3.5 t – trafficable over 3.5 t).

- **Walkable**
- **Trafficable, vehicles up to 3.5 t**
- **Trafficable, vehicles over 3.5 t**

vdw products carry pictograms that make it easy to assign them to the right category.

N 1 / walkable

N 2 / vehicles up to 3.5 t

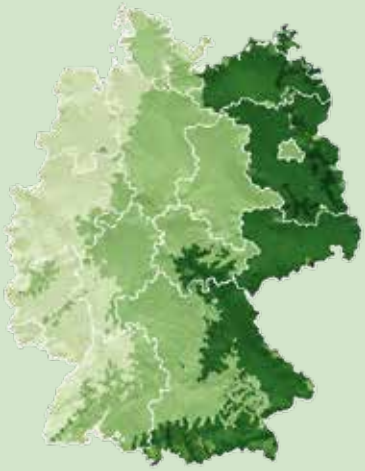
N 3 / vehicles over 3.5 t

3. Engineering in detail

3.1 Frost-resistant pavement construction

Outdoors, every paving construction must be planned and built so that it is permanently resistant to frost action. Constructions in which water is stored inside the pavement are particularly critical. If this moisture freezes, increases in volume and stresses arise that can lead to heave, loosening, displacement or structural damage.
A frost-resistant pavement consists of adequately dimensioned and compacted layers that drain water in a controlled way and transfer the loads that occur safely into the subgrade. Essential requirements are a load-bearing subgrade, suitable anti-frost and base courses, capillary-breaking layers and functioning surface and subsurface drainage.
As traffic loading increases, so do the demands on the dimensioning of the pavement. While smaller layer thicknesses are often sufficient for purely walkable surfaces, trafficked areas need more powerful and more load-bearing constructions.
If the construction is not sufficiently frost-resistant, damage can occur after only a few winter periods. The pavement must therefore always be planned to suit local conditions and the later use.
The frost susceptibility classes to ZTV E-StB and the frost exposure zones of the RStO are used in particular to assess frost action. They form the basis for selecting suitable building materials and for the necessary dimensioning of the pavement.

Frost exposure zones in Germany



Frost susceptibility		Soil type	planned base course
frost exposure zone **F1**	**not frost-susceptible**	coarse-grained soils	sands and gravels
frost exposure zone **F2**	**slight to medium frost-susceptible**	highly plastic clays	organic soils (mixed-grained soils)
frost exposure zone **F3**	**very frost-susceptible**	other fine-grained soils: clays and silts	mixed-grained soils with a high fines content

The frost exposure zones describe the climatic conditions in Germany and serve as a basis for the frost-resistant construction of traffic areas.

3.2 Base courses

The base course is the load-bearing backbone of the pavement. It distributes loads, ensures dimensional stability and contributes to frost resistance. A base course that is poorly dimensioned or inadequately compacted frequently leads to settlement, rutting, puddles or cracks.
Depending on the construction method, the base course can be built unbound or bound.

3.3 Bedding mortar

The bedding forms the immediate support plane for the sett or slab paving. It compensates for minor dimensional tolerances, takes up loads and passes them on into the base course. In bound systems the bedding mortar additionally performs stabilising functions and helps to absorb shear forces.

Flexible and economical production

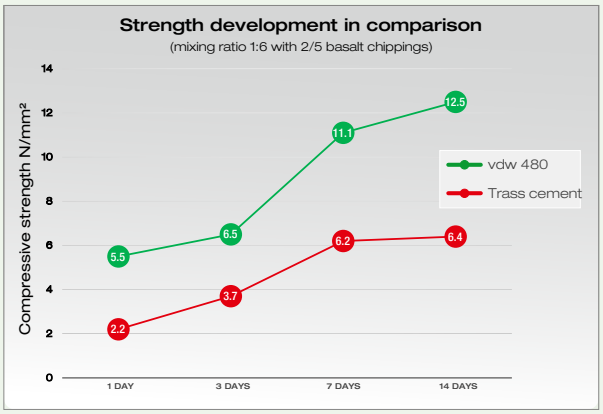
directly on site!

Chippings
suitable aggregate

vdw 480 Bedding Compound

Water
add in metered doses

Free-draining bedding mortar
mixed homogeneously and ready to work



- Significantly higher early strength after just 24 hours
- Rapid progress on site
- Earlier access on foot and jointing

Ready-to-use alternative vdw 470 Bedding Mortar
Ready-to-use, factory pre-mixed bedding mortar for consistent quality and easy application.

• pleasant consistency and no tearing when spreading	➡ easier working, hardly any build-up on the screeding tool and therefore rapid progress on site
• high strengths	➡ up to 30 N/mm² possible
• very high yield	➡ At a mixing ratio of 1:6 for load class N3 or 1:8 for load class N1 of the ZTV-Wegebau
• rapid hardening	➡ walkable early, can be jointed 24 h after installation
• optimised formula	➡ no efflorescence despite the rapid hardening
• capillary-passive effect through high-grade polymer modification	➡ prevents rising capillary moisture with fine chipping gradings

WHY IS THE BEDDING SO IMPORTANT?

The bedding is not merely a levelling layer. It performs essential tasks in load transfer, drainage and durability for the paving construction as a whole. The quality and properties of the bedding mortar directly influence how well the entire construction works.

3.4 Bonding slurries / adhesive slurries

Adhesive slurries secure the bond between the paving and the bedding mortar. Without a sufficient bond the slab can come away from the bedding or end up sitting on voids.
The adhesive slurry must be used in a way that suits the system and within the correct application window. With ceramic paving and large-format slabs in particular, laying with few voids, or fully bedded, is of central importance. Point supports lead to increased stresses and can cause edge spalling or cracking. The adhesive slurry therefore does more than promote adhesion: it also supports even load transfer within the construction.

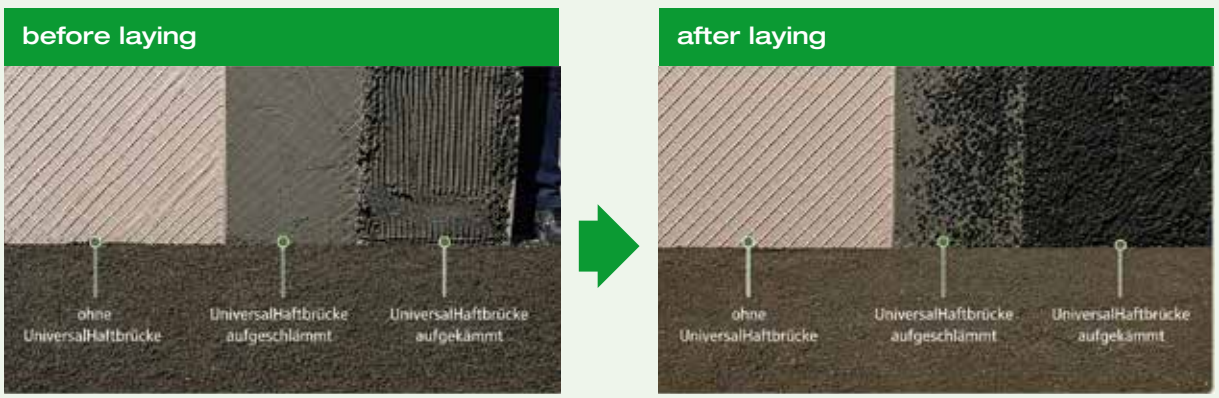
Granite setts in bedding mortar
Dipping the setts into the **vdw 495 Universal Adhesive Slurry** at a slurry consistency

Dipping
The slurry consistency allows the underside of the slab to be wetted completely and thus gives optimum adhesion in the bedding mortar.

Ceramic terrace elements
Combing the **vdw 495 Universal Adhesive Slurry** onto the back of the slab

Combing
The combed adhesive slurry ensures a reliable bond over the whole area for a permanently functioning construction.

Ceramic terrace elements, and porcelain stoneware slabs in particular, have very low water absorption because of their dense structure. This makes them especially frost-resistant and easy to look after, but it places higher demands on the bond within the construction.
Unlike absorbent natural or reconstituted stone, the bedding mortar can key into the back of the slab only to a limited extent. A suitable adhesive slurry is therefore decisive in bound construction. It creates a permanent, positive bond between the ceramic and the bedding mortar and improves load transfer within the system.
The adhesive slurry is thus an essential part of permanently functional ceramic paving outdoors.



3.5 Jointing mortar

Flexible jointing mortars are not the same as permanently elastic joints. Even deformable systems have limits in terms of movement absorption and load-bearing capacity. Suitable jointing mortars must therefore always be chosen with the use, the temperature exposure, the paving format and the construction method in mind.
The joint is a technical functional element. It influences load distribution, positional stability, water management, maintenance behaviour and movement absorption. Depending on the application, water-permeable, impermeable, cement-based or resin-bound jointing mortars may be appropriate.
The choice depends on the type of paving, the joint width, the use, the construction method and the drainage. Trafficked areas call for different requirements from a private terrace. With large-format ceramics, in turn, joint width and adhesion need particularly careful planning.

3.6 Heavy-duty jointing solutions

Heavily loaded areas call for jointing solutions that can permanently withstand shear forces, changing loads, cleaning and weathering. These include driveways, parking bays, delivery zones, public areas and fire brigade access routes.
What matters is that the joint is not considered in isolation. A heavy-duty joint also needs a matching bedding, sufficient joint depth and joint width, and an edge restraint.

3.7 What must a jointing mortar achieve within a paved surface?

The relevant codes of practice DIN 18332 (natural stone work) and DIN 18333 (reconstituted stone work) say relatively little about the properties of the jointing material.
ZTV-Wegebau names the type of binder for the jointing mortar to be used (depending on the construction method and the use category) and sets requirements for its compressive and flexural tensile strength and for its de-icing salt resistance. It also defines minimum and maximum joint widths in relation to the paving format and makes statements on minimum joint depths.
What must joints and jointing mortars be like if cracking within them is to be avoided?
As a rule, cracking cannot necessarily be ruled out even when every technical specification is observed.

Isolated cracks more than 0.2 mm and up to about 0.8 mm wide may occur. From a visual point of view they can usually be disregarded, but their effect on the service life of the paving should be assessed in relation to the traffic load present.

Every building material has a particular coefficient of expansion, which describes how much a component changes in length when the temperature changes. The colour of the surface is likewise of major importance for the loads in the joint. The darker the shade, the higher the surface temperature and hence the temperature difference between the warm and the cold season.
For these reasons the horizontal stresses resulting from thermally induced changes in the length of the paving materials, and any residual shrinkage of concrete products, cannot be defined precisely in kind or magnitude in advance.

Product requirements cement jointing mortar

Use category / load class		Compressive strength in MPa			Bond strength in MPa		
		ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB	ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB
N1	walkable	≥ 10.0	≥ 10.0	≥ 10.0	≥ 0.4	≥ 0.4	≥ 1.5 mean value ≥ 1.2 single value
N2	trafficable, vehicles up to 3.5 t	≥ 20.0	≥ 20.0	≥ 20.0	≥ 0.8	≥ 0.8	
N3	trafficable, vehicles over 3.5 t	≥ 30.0	≥ 30.0	≥ 30.0	≥ 1.0	≥ 1.0	

Use category / load class		Static E-modulus in MPa			Frost/de-icing salt resistance in g/m²		
		ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB	ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB
N1	walkable	≥14,000 and ≤ 22,000	≥14,000 and ≤ 22,000	≥17,000 and ≤ 22,000 (Type A) ≥14,000 and ≤ 17,000 (Type B)	≤ 500	≤ 1000	≤ 1000
N2	trafficable, vehicles up to 3.5 t						
N3	trafficable, vehicles over 3.5 t						

Product requirements reaction-resin jointing mortar

Use category / load class		Compressive strength in MPa			Bond strength in MPa		
		ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB	ZTV Wegebau	DIN 18318	TL Pflaster (geb.) – StB
N1	walkable	≥ 5.0	≥ 5.0	≥ 30.0	≥ 0.2	≥ 0.4	≥ 1.0 mean value ≥ 0.8 single value
N2	trafficable, vehicles up to 3.5 t	≥ 15.0	≥ 15.0		≥ 0.8	≥ 0.8	
N3	trafficable, vehicles over 3.5 t	≥ 25.0	≥ 25.0		≥ 1.0	≥ 1.0	

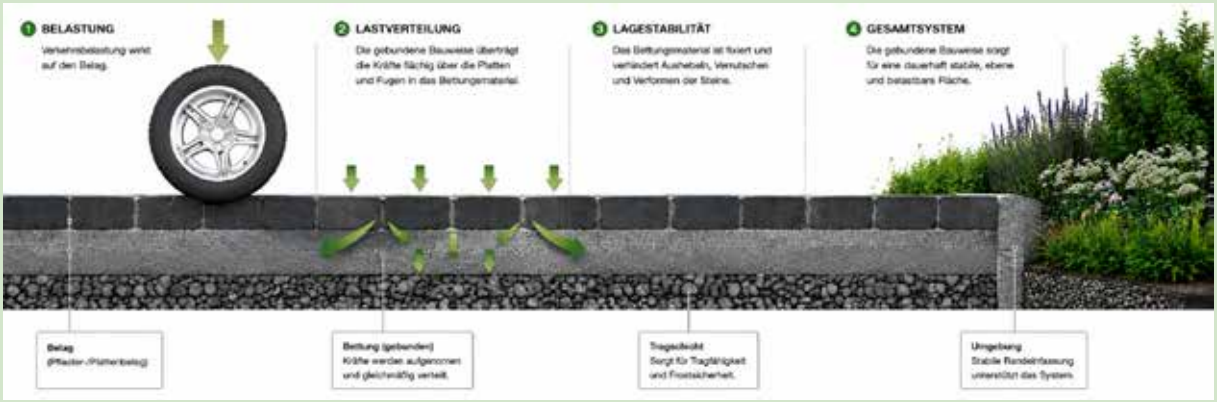
3.8 Load-bearing capacity and load transfer

The compressive strength of individual building materials alone says nothing about the durability of a surface. What is decisive is how loads are distributed and taken up within the system as a whole. Even high-strength jointing mortars cannot compensate for structural weaknesses in the pavement. What counts is the interaction of paving, joint, bedding and base course. With large formats and thin ceramic paving in particular, increased bending stresses arise if loads are not distributed evenly.

The load-bearing capacity of a sett or slab surface describes the ability of the whole layered construction to take up the loads that occur permanently and to transfer them into the substrate without damage. What is decisive is not the strength of the visible paving alone, but the interaction of all the layers.
Loads are first taken up by the paving, then passed on through joint and bedding and finally distributed via the base course and the substrate. The better this load distribution works, the lower the stress on the individual layers. If, on the other hand, a layer is under-dimensioned or poorly executed, local stresses, settlement or movement occur.
Areas with manoeuvring traffic, braking and starting forces, bends, sloping stretches or occasional heavy goods traffic are particularly critical. Here considerable horizontal forces act alongside the vertical loads. Such stresses must be absorbed by a suitable construction method, stable joints, adequate bedding and load-bearing base courses.

The paving format also influences load transfer. Large-format slabs react more sensitively to voids, point supports and uneven bedding. With thin ceramic elements, inadequate support can quickly lead to rocking, cracks or edge spalling.

How the bound bedding works



Car wheel load: 500 kg
contact area 200 cm²
= 0.5 MPa

Car wheel load: 1000 kg
contact area 200 cm²
= 1.0 MPa

Truck wheel load: 7.5 t
contact area 500 cm²
= 0.8 MPa

Truck wheel load: 20 t
contact area 400 cm²
= 1.43 MPa

3.9 Construction methods

Alongside classic sett and slab surfaces, infiltration-capable construction methods, greenable traffic areas, water-impermeable special constructions and ceramic outdoor surfaces on balconies and roof terraces are becoming increasingly important today. Each of these constructions places different demands on drainage, stress relief and the choice of materials.

In essence, codes of practice such as ATV DIN 18318 or ZTV-Wegebau distinguish between unbound and bound sett and slab paving. The construction concerned must always be regarded as a complete system. Individual components such as the paving, the bedding or the jointing material can only fulfil their function permanently if they are technically matched to one another.

Use category to ZTV Wegebau	**N1** walkable		**N2** trafficable vehicles up to 3.5 t		**N3** trafficable vehicles over 3.5 t	
Use classification to DIN 18318	**ZTV Wegebau 2022**	**DIN 18318 2018**	**ZTV Wegebau 2022**	**DIN 18318 2018**	**ZTV Wegebau 2022**	**DIN 18318 2018**
Unbound construction	✔	✔	✔	✔	✔	✔
Mixed construction with unbound bedding	✔	✔	✘	✘	✘	✘
Mixed construction with bound bedding	✔	✔	✔	✘	✘	✘
Fully bound construction	✔	✔	✔	✔	✔	✔

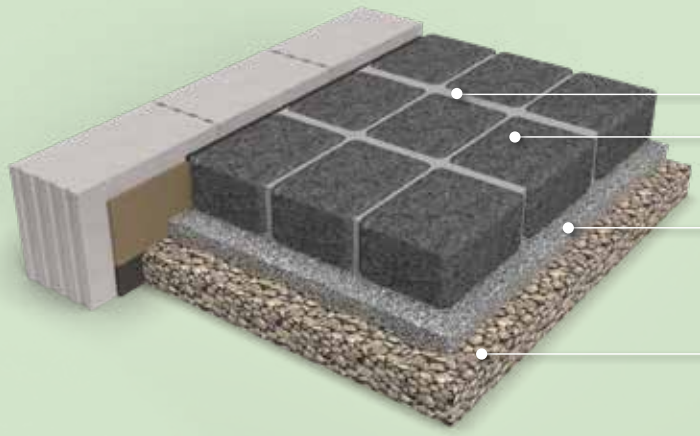
✔ permitted ✘ not permitted

Unbound construction

Both DIN 18318 and ZTV-Wegebau treat unbound construction as the classic standard method for sett and slab surfaces. Bedding and joints are produced without binders. Loads are transferred by interlock, friction and the areal distribution of load within the pavement. Unbound systems have a comparatively high capacity for deformation and can absorb movement and stresses within the construction well. At the same time, however, they react sensitively to:

- inadequate compaction,
- missing edge restraints,
- unsuitable bedding materials,
- migration of material

unbound construction



Joint

vdw VarioSand

Concrete block paving

Unbound bedding

Mineral aggregate mixes, e.g. in grain sizes 1/3, 2/4, 2/5, 2/8

Unbound base course

Minimum thickness approx. 21 cm

Bound construction

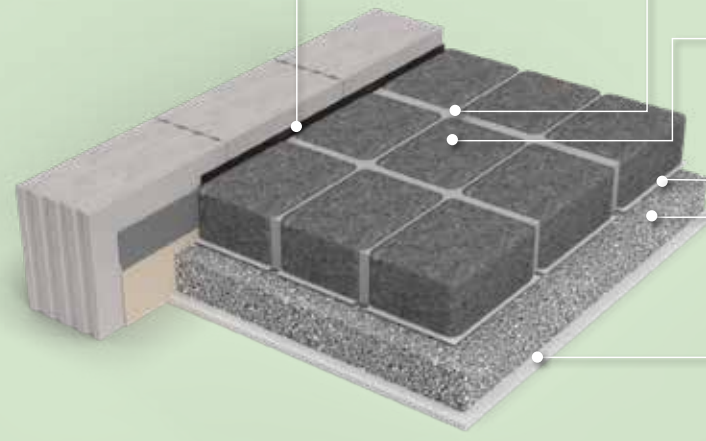
In bound construction, bedding and joints are produced using binders. This gives the construction a considerably stiffer overall system and prevents individual paving units from shifting. The focus here is on the increased stability against horizontal forces and shear stresses. At the same time, however, the demands on planning and execution rise. Bound construction methods react more sensitively to:

- thermal stresses,
- missing drainage,
- insufficient movement joints and workmanship errors

fully bound construction

Movement joint

vdw 885 plus FugenFlex
At least at adjoining structures



Bound joint

Reaction-resin and cement-based products
e.g. vdw 850 plus 2K Paving Joint Mortar
vdw 400 Cement Based Jointing Mortar

Paving sett

Minimum thickness: 6 cm

Adhesive slurry

vdw 495 Universal Adhesive Slurry
Layer thickness: 1 – 3 mm

Bound bedding

hydraulically bound bedding mortar/ drain mortar using
vdw 480 Bedding Compound

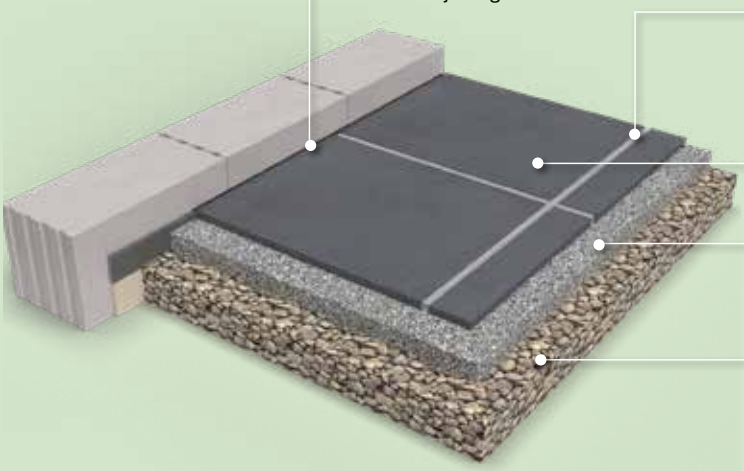
Hydraulically bound drainage concrete base course

e.g. using
vdw 480 Bedding Compound
Minimum thickness 15 cm

Partially bound / mixed construction methods

ZTV-Wegebau additionally describes partially bound or hybrid construction methods that lie between unbound and bound systems in structural terms.
The aim of these systems is to combine the advantages of both construction methods.

Mixed construction with unbound bedding/slab paving



Movement joint
vdw 885 plus FugenFlex
At least at adjoining structures

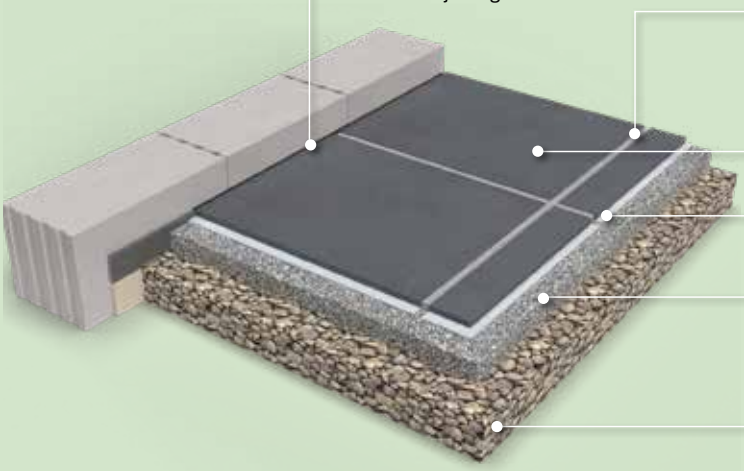
Bound joint
Reaction-resin joint on an epoxy or polybutadiene base
vdw 815 ultra 2K Slab Joint Mortar/
vdw 840 plus 1K Jointing Mortar

Slab paving
Minimum thickness: 2 cm

Unbound bedding
Mineral aggregate mixes, e.g. in grain sizes 1/3, 2/4, 2/5, 2/8

Unbound base course
Minimum thickness approx. 21 cm

Mixed construction with bound bedding/slab paving



Movement joint
vdw 885 plus FugenFlex
At least at adjoining structures

Bound joint
Reaction-resin and cement-based products
e.g. vdw 815 plus 2K Slab Joint Mortar
vdw 850 plus 2K Paving Joint Mortar
vdw 415 Cement Based Jointing Mortar Color

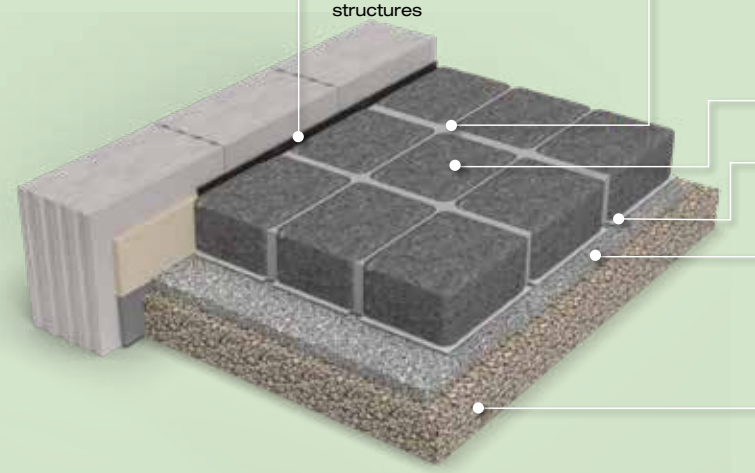
Slab paving
Minimum thickness: 2 cm

Adhesive slurry
vdw 495 Universal Adhesive Slurry
Layer thickness: 2–5 mm

Bound bedding
hydraulically bound bedding mortar/ drain mortar using
vdw 480 Bedding Compound
Bedding thickness: 4 – 10 cm

Unbound base course
Minimum thickness approx. 21 cm
depending on the frost protection zone

Mixed construction with bound bedding/sett paving



Movement joint
vdw 885 plus FugenFlex
At least at adjoining structures

Bound joint
Reaction-resin and cement-based products
e.g. vdw 850 plus 2K Paving Joint Mortar
vdw 400 Cement Based Jointing Mortar

Paving sett

Adhesive slurry
vdw 495 Universal Adhesive Slurry
Layer thickness: 1 – 3 mm

Bound bedding
hydraulically bound bedding mortar/ drain mortar using
vdw 480 Bedding Compound
Bedding thickness: 4 – 10 cm

Unbound base course
Minimum thickness approx. 21 cm
depending on the frost protection zone

3.10 Capillarity and moisture effects

Partly covered areas in particular can develop different moisture zones. While freely weathered areas dry out regularly, moisture often stays inside the construction for longer under a roof. This produces uneven evaporation and soiling patterns. Permanently damp areas also encourage biological growth such as algae and moss.

Water is one of the most frequent causes of damage and visual impairment on outdoor surfaces. Besides rainwater, moisture transport within the layered construction plays a major role. Capillarity describes the ability of a building material to transport water against gravity in fine pores.

Capillary-active layers can draw water up from deeper areas. Dissolved constituents, salts or fine particles may be carried along with it. When the water evaporates at the surface, residues are left behind. This can lead to efflorescence, staining, damp patches and soiling marks.
Fine-grained bedding, cohesive soils, poorly drained layers and partly covered areas are particularly critical. Under carports or roofed terraces certain areas receive less rain, but moisture can still be drawn up from the sub-base. This frequently produces uneven damp and soiling patterns.

Capillary-breaking, free-draining layers reduce this risk. They ensure that water does not migrate upwards uncontrolled but is carried away in a controlled manner. With high-quality natural stone, reconstituted stone or ceramic surfaces in particular, this is of great importance for visual and technical durability. Capillarity is therefore not merely a theoretical material effect but a practical factor influencing serviceability and value retention.

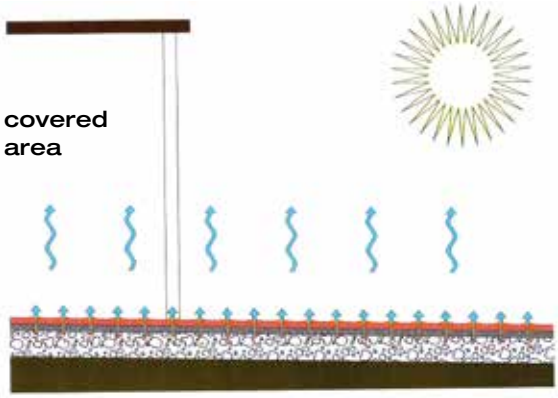
Good to know: capillarity
On slab and sett surfaces in unbound and bound construction, the water permeability of the layers should increase from top to bottom. Rainwater – including the substances dissolved in it – can then drain away better. A natural counterpart to this is the capillary effect: in fine pores or narrow gaps, water rises against gravity.

In unbound construction in particular, this capillary rise of moisture can carry salts and minerals from the substrate up to the surface. The visible consequences are often efflorescence, which stands out above all on partly covered areas: where no rain reaches, the residues remain on the surface because they can neither seep away nor be washed off. This typical appearance is also known as the “carport effect”.
To counteract this effect, care must be taken when selecting the bedding and base courses to ensure that they are sufficiently capillary-breaking. This means that the materials used should be such that they suppress the capillary rise of water as far as possible.

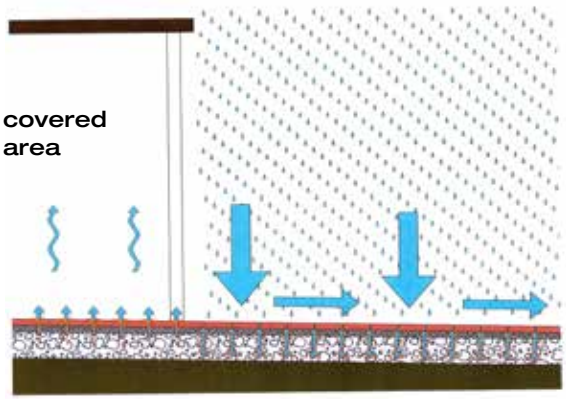
❶ Basalt chippings 1 – 3
❷ Basalt chippings 2 – 5
❸ Quartz gravel 1.4 – 2.5
❹ Quartz gravel 2.0 – 3.1
❺ Diabase 2 – 5
❻ Marble chippings 4 – 8
❼ vdw 490 Trass Drain Mortar
❽ Basalt chippings 2-5 +
vdw 480 Bedding Compound, mix ratio 1:5

CARPORT effect

Under covered areas, capillary water transport through the bedding, the joints and the paving – carrying fine particles and salts with it – can lead to staining and to deposits of substances on the surface once the water has evaporated.



(Fig. 1)



(Fig. 2)

(Fig. 1) In dry weather / sunshine, capillary water transport through the bedding, joints and paving, carrying fine particles and salts with it; the substances are then deposited on the surface and the water evaporates across the whole area.

(Fig. 2) In precipitation /water ingress into the pavement through joints and paving, and surface run-off carrying away fine particles and salts, only in the freely weathered area.

3.11 Drainage and water management

Bound construction methods also need controlled water management. Modern free-draining bedding and jointing mortars are not intended to hold water back completely, but to discharge it in a controlled way within the construction. The surface fall required depends on the paving material, the surface texture and the use. Building connections, channels, gullies and transitions to sealed constructions deserve particular attention.

Functioning drainage is one of the most important prerequisites for durable outdoor surfaces. Water must be led away in a controlled manner both at the surface and within the layered construction. Without a coherent drainage concept, frost damage, efflorescence, puddling, loosened joints and moisture problems at connection areas can occur.

The surface needs an adequate and sensibly aligned fall. Water should be led away from buildings, door thresholds, plinths and sensitive components. Channels and gullies must be arranged so that rainwater can be reliably collected and discharged.

Drainage is therefore not only a question of fall, but of the system as a whole. Paving, joint, bedding, base course, edge connections and gullies must work together.

3.12 Paving types and material properties

The choice of paving material influences not only the design but also the technical function. Reconstituted stone, natural stone, ceramic, clinker and composite slabs differ considerably in water absorption, dimensional accuracy, strength, surface texture, thermal behaviour and maintenance requirements.
The material should therefore never be chosen on looks alone. What matters is whether it suits the intended use, the construction method, the format size, the drainage and the maintenance requirements.

Reconstituted stone

Reconstituted stone paving is among the most widely used paving materials outdoors. It is industrially produced and available in a wide variety of formats, surfaces, colours and edge finishes. This makes it possible to build both functional areas and high-quality designed outdoor spaces economically and reliably.

Technically, particular attention must be paid to water absorption, frost/de-icing salt resistance, edge stability, dimensional tolerances and surface condition. Depending on the product, temporary efflorescence, damp patches or slight variations in shade may occur. These phenomena are typical of the material and are not automatically to be regarded as a technical defect. What matters is whether serviceability, durability or traffic safety are impaired.

Reconstituted stone (setts and slabs)

Natural stone

Natural stone stands for high-quality, individual outdoor surfaces with lasting appeal. Every natural stone surface is shaped by the colour, structure, texture and geological origin of the material. It is precisely this natural variety that makes natural stone so attractive in design terms, but it also calls for careful technical assessment.

Natural stone is not a uniform building material. Granite, basalt, gneiss, porphyry, sandstone, limestone, travertine and slate differ considerably in compressive strength, flexural strength, water absorption, porosity, frost resistance, tendency to discolour, sensitivity to acid and thermal behaviour. A general statement on the suitability of natural stone can therefore only be made to a limited extent. What is decisive is always the specific material data, the format, the thickness, the surface, the later use and the intended construction method.

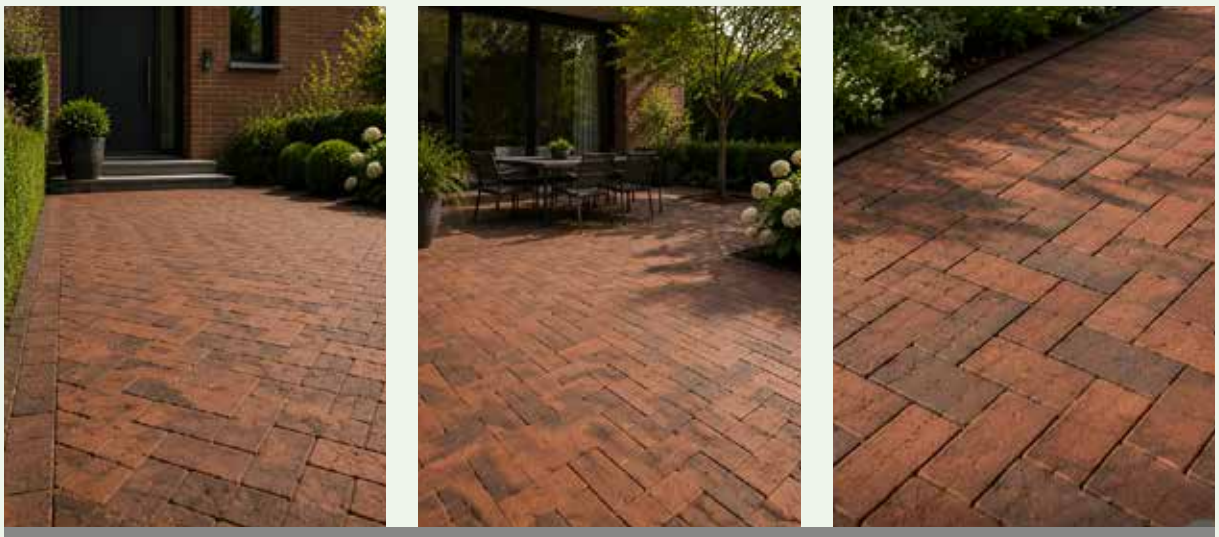
Particular attention should be paid to natural stones with increased water absorption, stones prone to discoloration and materials with pronounced bedding planes. Moisture, salts, unsuitable laying mortars, the wrong cleaning agents or standing water can lead to discoloration, rim marks, efflorescence or damage to the stone structure. Acid-sensitive natural stones, and calcareous stones in particular, must also be treated with corresponding care during cleaning and maintenance.

Natural stone (setts and slabs)

Clinker paving

Clinker paving has a long tradition outdoors and is used in both private and public spaces. It is characterised by high resistance, good colour stability and a distinctive, often very high-quality surface appearance. Clinker pavers in particular are popular for paths, yards, squares, driveways and historically influenced designs.

Technically, it must be borne in mind that clinker can have different water absorption, dimensional tolerances and edge finishes depending on the production process, the format and the surface condition. The joint width and the jointing material must therefore be matched to the particular product, the laying pattern and the later use. On trafficked areas, care must also be taken to ensure sufficient sett or slab thickness, stable edge restraints and adequate positional stability.

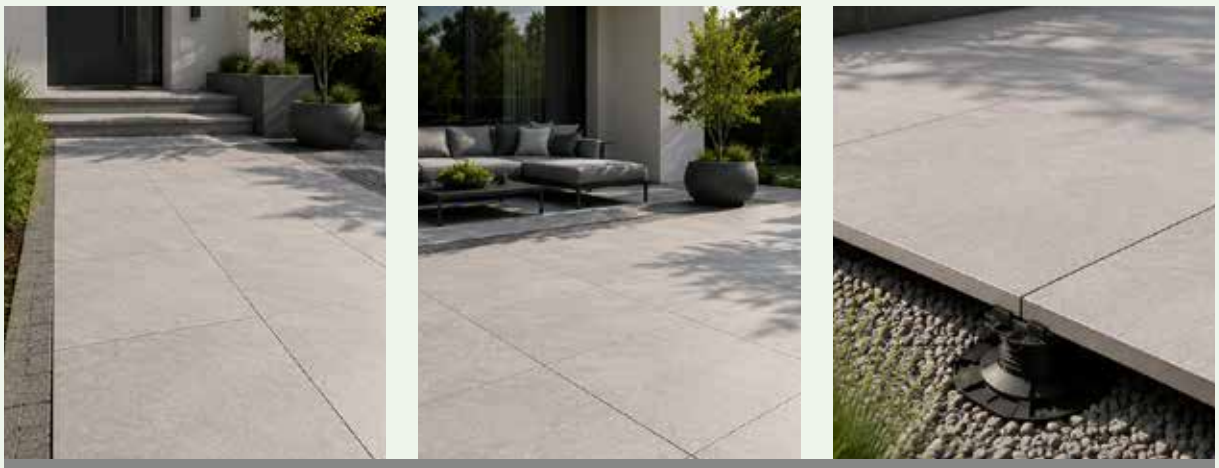


Clinker paving

Ceramic paving / ceramic terrace elements

Ceramic paving, and porcelain stoneware slabs for outdoor use in particular, has gained considerably in importance in recent years. It is convincing thanks to its modern look, high dimensional accuracy, low water absorption, good colour stability and a surface that is normally very easy to care for. Ceramic paving is used especially on terraces, roof terraces, pool surrounds and architecturally designed outdoor areas.

Large-format ceramic terrace elements in particular are technically demanding. They react sensitively to uneven substrates, voids, point supports and thermally induced stresses. Because of their high dimensional accuracy there is often a wish for very narrow joints. From a technical point of view, however, joints must be wide enough to allow for dimensional tolerances, temperature movement, water flow and stress relief. Joints that are too narrow can lead to edge contact, restraint, joint break-out or edge damage.



Ceramic terrace elements

Ceramic composite slabs

Ceramic composite slabs combine a ceramic wearing layer with a carrier body, often made of concrete or a comparable mineral material. They thus combine the visual and maintenance advantages of ceramic surfaces with a higher dead weight and, in some cases, more favourable bedding characteristics than pure, thin porcelain stoneware slabs.

Thanks to the carrier body, ceramic composite slabs can in individual cases be more robust to handle and less sensitive to certain laying conditions. Nevertheless they are multi-layer paving elements, and the properties of the composite structure as a whole have to be taken into account.

Even where the carrier body offers structural advantages, it is no substitute for proper substrate preparation or project-specific planning. With large-format elements or trafficked areas in particular, the suitability of the product concerned must be checked carefully.

Ceramic composite slabs

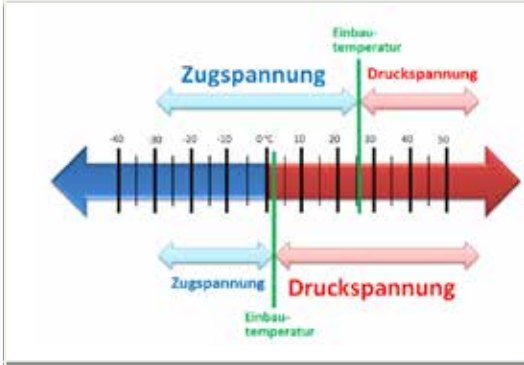
3.13 Paving sizes, large formats and mega formats

As paving elements get bigger, the demands on planning and execution rise considerably. Large formats create a calm, modern surface effect and are used above all on terraces, roof terraces, pool surrounds and prestigious outdoor areas. At the same time they react more sensitively to unevenness in the substrate, voids and thermal stresses.
Joint width is an important point. The larger the format, the smaller the proportion of joints per square metre. The joints that are there therefore have to do more. They compensate dimensional tolerances, carry water, distribute loads and relieve stresses. With large formats, joints that are too narrow can lead to edge contact, restraint, edge spalling or incomplete filling.
Thermally induced changes in length must also be taken into account. Every paving material expands when it warms up and contracts when it cools down. With small formats the absolute change in length is slight; with large slabs and mega formats it becomes considerably more relevant. Dark surfaces, strong sunlight and large continuous areas increase the stresses further. Larger formats therefore always require careful planning.

Brochure
Planning notes for laying terrace slabs with a ceramic surface

3.14 Movements & stresses / movement joints

Outdoor surfaces are not rigid. Changes in temperature, sunlight, changes in moisture, traffic loads and settlement cause movement in the paving and in the substructure. If this movement is not allowed for structurally, stresses build up which can show as cracks, joint break-out, delamination or upward buckling.
Large continuous areas, dark paving, large formats, ceramic surfaces and rigid abutment details are particularly at risk. Movement joints serve to take up these stresses in a controlled way. They are to be planned at buildings, rising components, fixtures, changes of material, changes of geometry and within larger areas.
The arrangement of movement joints is not purely a craft decision on site but part of the planning. It depends on the material, the format, the construction method, the size of the area, the use and the temperature loading. Strong sunlight and large continuous areas increase the stresses further. Larger formats therefore always require careful planning.



Installation temperature:
The installation temperature has a considerable influence on the stress behaviour (tensile or compressive stresses) of the paving surface. At lower installation temperatures more compressive than tensile stresses occur; at higher installation temperatures it is the other way round and the tensile stresses are higher.

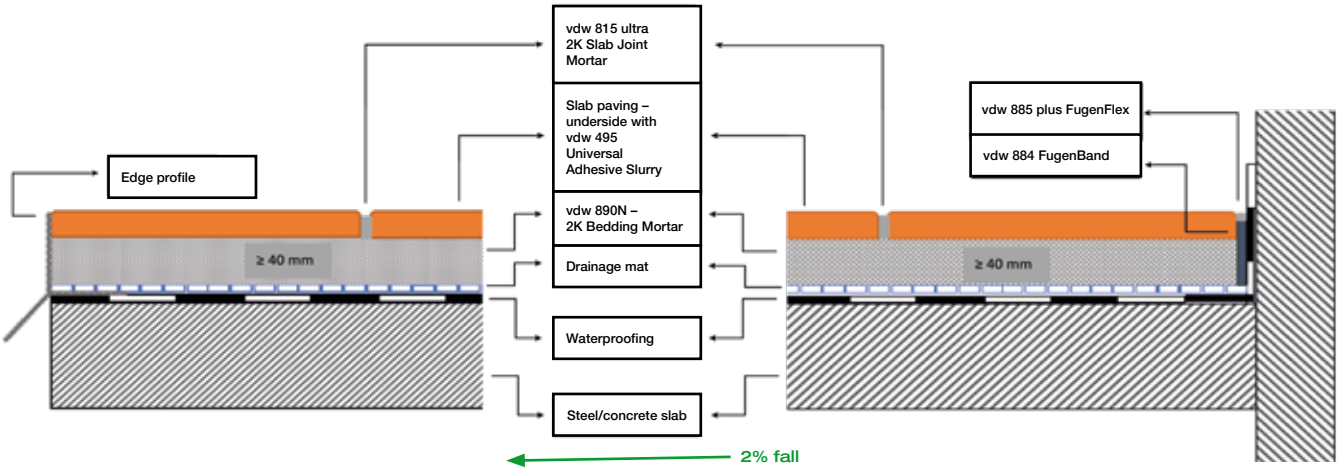
www.gftk-info.de/bewegungsfugen-planungshilfe/

3.15 Slab paving on balconies and roof terraces

Paving constructions with slabs of natural stone, reconstituted stone or ceramic in a bound bedding layer on waterproofed substrates – for example on balconies, roof terraces or ground-supported terraces on a continuous concrete or reinforced concrete slab – do not fall within the scope of the ZTV Wegebau or the ATV DIN 18318.
Guidance on proper construction build-ups on such waterproofed substrates is to be found, if at all, in the technical bulletins of the Deutscher Naturwerkstein-Verband or of the Fachverband Fliesen und Naturstein.

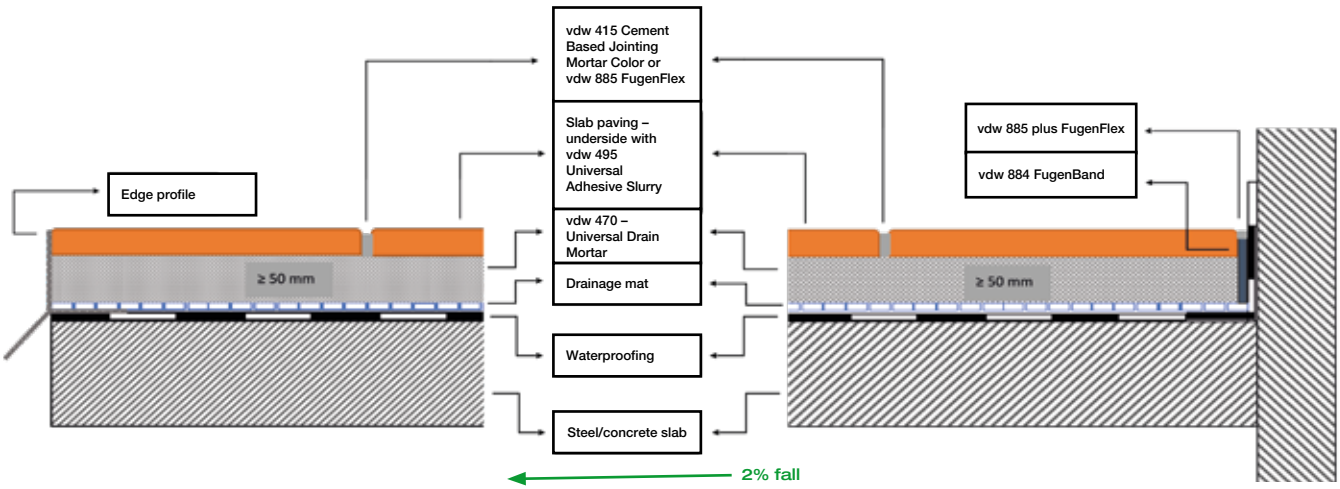
The following system build-ups are intended as guidance for proper constructions with slabs of natural stone, reconstituted stone or ceramic laid firmly in a bedding mortar and jointed with a water-permeable joint.

Slab paving in a bound bedding layer on a waterproofing level (substrate not permeable to water)
Water-permeable jointing (vdw 815 plus)



The following system build-ups are intended as guidance for proper constructions with slabs of natural stone, reconstituted stone or ceramic laid firmly in a drain bedding mortar and jointed with a water-impermeable joint.

Slab paving in a bound bedding layer on a waterproofing level (substrate not permeable to water)
Water-impermeable jointing (vdw 400 plus or vdw 885 FugenFlex)



4. From practice, for practice

4.1 Site preparation

Successful execution begins before the first material is installed. Site preparation means checking levels, falls, drainage, material storage, access and the protection of adjoining components in good time. With high-quality paving or sensitive surfaces in particular, materials must not be allowed to become soiled or damaged, or to be worked under unfavourable conditions.
Planning details should also be settled before work starts. These include the construction method, layer thicknesses, joint widths, movement joints, drainage points and connections to buildings or fixtures. Unclear details often lead to improvised solutions on site which can later be prone to damage.

4.2 Checking the substrate

The substrate must be checked carefully before work begins. It must be load-bearing, adequately compacted, frost-resistant and prepared to the correct level. Inhomogeneous fill, subsequently backfilled service trenches, organic constituents or moisture-sensitive soils must be assessed critically.
Defects in the substrate often only take effect later. Settlement, puddling, cracks or rocking slabs frequently have their cause not in the paving but in the layers below. Checking the substrate is therefore an essential part of quality assurance.

4.3 Weather, temperature and installation conditions

Mortar systems react to temperature, moisture, wind and sunlight. Temperatures that are too low can delay hardening or cause frost damage. High temperatures, strong sun or wind can lead to rapid drying out. Rain can wash out fresh mortar or impair surfaces.
Application should therefore only take place within the conditions stated by the manufacturer. Fresh surfaces must be protected against harmful weather influences. This applies in particular to cement-based systems, reaction-resin systems, fresh joints and large-format ceramics, which can heat up considerably in sunlight.

4.4 Installing the bedding

The bedding forms the immediate support plane for the paving and must be produced evenly, to the correct level and in a way that suits the system. Unevenness, varying layer thicknesses or voids can impair load transfer and lead to later damage.
With bound beddings the application requirements regarding moisture, pot life and bond must additionally be observed. With large-format slabs and ceramic paving in particular, care must be taken to bed them with as few voids as possible. Point supports or voids can lead to increased stresses, rocking, cracking or joint break-out.

From a technical point of view the so-called fresh-in-fresh method is the preferred way of working. Here the paving elements are laid directly into the freshly placed bedding mortar using a suitable bonding slurry. This method allows the paving elements to be embedded optimally, gives a reliable bond and permits the level to be corrected during laying.

Alternatively, paving can be laid on a bedding layer that has already hardened and been prepared to the correct level. In this case the bond is made via a correspondingly thicker bonding slurry or adhesive layer. It must be borne in mind that unevenness in the bedding then has to be compensated through the bonding slurry and that subsequent corrections to the level are only possible to a limited extent. Care must also be taken to ensure that the bonding slurry does not get into the joint areas. Otherwise the joint cross-sections may be partly closed, which can impair the water permeability and the drainage function of the construction.
The bedding thus performs a central function for the durability, load-bearing capacity and reliability of the paving construction as a whole.

4.5 Laying setts and slabs

When laying, attention must be paid to joint widths, bond pattern, level, evenness and edge connections. The joint must not be seen as a purely visual detail. It performs technical functions and must be wide and deep enough for the jointing mortar to be placed properly.
Paving elements are to be laid in such a way that no harmful restraint occurs. Rigid connections to buildings, steps, channels or fixtures are to be avoided. Movement joints must be planned and executed cleanly.

4.6 Laying large-format ceramic slabs

Large-format ceramics require a high degree of precision. The substrate must be even, load-bearing and free of settlement. The bedding must support the slab with as few voids as possible, and a suitable adhesive slurry must be used in accordance with the system. Joint widths must not be determined on visual grounds alone; they must allow for thermal movement and reliable application.
Allowing for temperature stresses is particularly important. Large ceramic slabs can heat up considerably in sunlight. Without sufficient joints and movement zones, stresses can arise that lead to cracks, delamination or edge crushing.

4.7 Joint depth and joint width

For permanently stable joints, a sufficient joint depth is decisive alongside complete filling. Incomplete filling of the joint reduces stability and increases the risk of joint break-out. The joint flanks must be clean and free of loose material so that a positive bond can develop.

Note on the joint width:
The minimum joint width stated in our technical data sheets does not describe the target joint width to be planned or built for the paving. Rather, it indicates the joint width from which our jointing mortars can be applied reliably and functionally – including in those parts of a joint that may turn out locally narrower, e.g. because of dimensional tolerances of the paving materials.
The planning and execution of joint widths always follow the recognised rules of engineering, in particular the requirements of ZTV-Wegebau, ZTV-Pflaster-StB, ATV DIN 18318 or other relevant standards and guidelines for paving and slab surfaces. These define the minimum joint widths required for different construction methods and load classes to ensure a permanently functional construction.
Work cleanly while jointing. Tools, brooms, rubber squeegees and shoes can spread binder residues over the surface. With high-quality or absorbent paving in particular, careful cleaning is decisive in avoiding haze, stains or glossy patches.

4.8 Exposing chamfers and cleaning surfaces

Exposing the chamfers properly reduces edge crushing and supports even load transfer within the surface. At the same time, careful cleaning contributes considerably to avoiding visual complaints on high-quality paving.
After jointing, chamfers and edges must be cleanly exposed. This is not only a question of appearance: it also reduces the load on the edges and gives a clean joint pattern. The surface is to be cleaned in a way that suits the material, without damaging fresh joints.
With reaction-resin joints a thin binder film can form for system reasons; it is broken down by weathering and UV exposure. Aggressive cleaning measures immediately after laying must be considered carefully, as they can damage joints and surfaces.

Example of simply exposing the chamfers on slab edges

Watch the video example here:

4.9 “Clean” working

Once a paved surface has been built, jointing is the last step that gives the whole job its finishing touch – the icing on the cake, so to speak. Especially when jointing with a two-component epoxy resin mortar, working cleanly is what produces an optimal result.
What should be watched particularly closely?
All tools should be cleaned frequently during jointing. This includes the coconut broom, the rubber squeegee and the work boots. If they are not cleaned often, or at short intervals, the sole keeps spreading the binder film over the paving surface. This repeated application of the binder film, sometimes several layers on top of one another, can leave footprints visible on the finished paving.

Watch the video example here:

The same can happen if the coconut broom is not cleaned. The broom is meant to smooth the joints and to remove excess aggregate and the binder film from the paving. As the bristles can only take up a limited amount, the binder may, as cleaning progresses, merely be spread around instead of being picked up. It is therefore advisable to briefly clean the broom every 4 – 5 m² with a

Watch the video example here:

Working cleanly also means protecting all adjoining surfaces from adhering binder by masking them beforehand or likewise pre-wetting them.

5. Cleaning, care and use

5.1 Regular cleaning

Maintaining the value of an outdoor surface begins with regular cleaning. Leaves, soil, dust, organic residues, pollen, tyre abrasion or grease should be removed early. The longer soiling is left to act, the harder it is to get rid of.
The cleaning method must suit the paving. Dense ceramic surfaces are usually easier to clean than open-pored natural stone or heavily textured reconstituted stone. The type of joint also influences how easy a surface is to clean.

5.2 High-pressure cleaning

Rotating point-jet nozzles or nozzle distances that are too short can cause considerable damage, particularly on sensitive surfaces and joints. Besides roughening of the surface, washing out of joints and edge damage are also possible.
High-pressure cleaners can be useful, but they must be used in a way that suits the material and the system. Excessive pressure, too short a distance or rotating point-jet nozzles can wash out joints, roughen surfaces or damage edges.
Gentle cleaning is usually more effective in the long term than aggressive one-off measures.

5.3 Algae, moss and organic growth

Most of the black, green and – increasingly often – red discoloration on paving blocks or on concrete is algae. Areas that lie mainly in the shade are the most frequently affected. Moss often forms on such areas as well.
However, this increasingly applies to places that are permanently exposed to direct sunlight too, where algae and moss would not normally survive. Many dry algae can also survive for a long time without moisture.

Moss and algae obtain their energy from photosynthesis and are absolutely dependent on water or moisture for their growth. They do not, however, destroy the substrate. They are therefore an effect of the environment and of the site on the area in question, and have nothing to do with the jointing material installed.

The following distinctions can be drawn:

Red algae
Red algae (Rhodophyta) are red-coloured algae. They have become more common in Germany over the past ten years or so – above all in garden ponds, but increasingly also on façades, on roofs and on outdoor surfaces. Several experts attribute this to the rising temperatures and the increase in humidity in our latitudes.

Green algae
Green algae occur in fresh water, but also in the sea and on land (on tree bark, for example). The presence of green algae indicates an elevated phosphate or nitrate level in the paved surface – and hence an excessive moisture content.

Black algae
Black algae are a form of the algae described above.

Mosses

Mosses have no roots but rhizoids (cell filaments), which is why they grow only a few centimetres high. The rhizoids do not conduct water; they serve purely to hold the plant in place. The water balance of mosses is determined by the moisture of their surroundings – that is, they can only take up water from the air or from precipitation, and not from the ground, as they have no water-conducting system.

Commercially available algae and moss removers can be used to get rid of algae. The best method is scrubbing with a hard broom, a wire brush or a scrubber and plenty of water. Using a high-pressure cleaner can only be recommended with reservations. It does give quick results, but the smooth surfaces of paving blocks and concrete are scratched and roughened. As a consequence, algae and moss can take hold ever more easily and quickly.

Water-permeable drain blocks must not be hosed down with a high-pressure cleaner. The high pressure clogs the pores of the blocks with sediment and plant remains, and the blocks are no longer permeable. Soft timbers, too, do not tolerate being hosed down with a high-pressure cleaner.

5.4 Stains and discoloration

Binder films, differing weathering, UV exposure or natural ageing processes can also affect the appearance of outdoor surfaces. Not every visual change constitutes a technical defect.

Stains can have many causes. Moisture, leaves, rust, oil, grease, organic substances, efflorescence or unsuitable cleaning agents can cause visual changes. Not every discoloration is a technical defect.

Natural stones react differently depending on the type of rock. Reconstituted stone can show temporary efflorescence or damp patches. Ceramic is usually easy to care for, but its appearance can be affected via joints, edge zones or trapped moisture.

Cleaning appropriate to the material is important. Acidic or aggressive cleaners may only be used once material compatibility has been reliably established. Stains can have many causes. Moisture, leaves, rust, oil, grease, organic substances, efflorescence or unsuitable cleaning agents can cause visual changes. Not every discoloration is a technical defect.

5.5 Deposits, binder films and cement haze after jointing

General

Immediately after jointing, visual changes can appear on the surface of sett and slab paving. These include in particular binder films, differences in gloss, deepening of the colour, cement haze or other residues from the jointing process.

Such phenomena occur depending on the paving material, the surface texture, the weather, the working conditions and the type of jointing mortar used. Rough, porous or textured surfaces in particular can retain small amounts of binder or fine particles for reasons of production or application.

Gloss formation / deepening of colour after jointing

In many cases these are purely visual phenomena which do not impair the technical function, the serviceability or the durability of the construction.

Binder films with resin-bound jointing mortars

With one-component paving joint mortars on a polybutadiene basis and with two-component reaction-resin jointing mortars on an epoxy resin basis, the matched formulation and the application with water ensure that binder residues on the paving surface are largely avoided.

For system reasons a very thin binder film, often only a few micrometres thick, can nevertheless remain on the paving surface under certain circumstances. At first it is frequently hardly visible, if at all, and may show itself only as a slight deepening of the colour or a minor difference in gloss.

Natural weathering, UV radiation, rainfall and mechanical loading normally break this binder film down gradually and permanently. In heavily sheltered areas, for example under roof overhangs or in courtyards little exposed to the weather, the process can take longer.

While the film weathers away, a slightly whitish or greyish appearance can appear temporarily, particularly where the binder layer is thicker. This is a natural degradation process of the binder and not a technical defect.

Cement haze with cement-based jointing mortars

With cement-based jointing mortars, what is known as cement haze can form after jointing. It is caused by fine cement particles which are carried onto the paving surface with the water during cleaning and dry there.

The risk of such deposits is higher on rough, textured or absorbent surfaces in particular. How pronounced the cement haze is depends among other things on the weather conditions, the paving material, the time of cleaning and the way the final cleaning is carried out.

Light cement haze is often broken down by natural weathering or becomes considerably less visible in the course of use.

Cleaning recommendations

Visual residues, binder films or light cement haze should first be exposed to natural weathering for a reasonable period. With resin-bound jointing mortars in particular this is often the gentlest and most effective method. Immediate chemical cleaning is generally not advisable, as unsuitable cleaning agents can permanently damage both the paving surface and the joint structure. If cleaning is necessary, only cleaning agents suitable for the paving material concerned may be used. Before use, the material compatibility must be tested on an inconspicuous spot. The instructions of the paving manufacturer and of the cleaning agent manufacturer must also be observed. In case of doubt we recommend consulting the manufacturer or technical adviser concerned.

5.6 Carport effect and moisture patterns

The causes in terms of building physics often lie in different rates of evaporation and drying within the surface. Partly roofed areas dry considerably more slowly and therefore often show more pronounced moisture or soiling patterns.
This can produce darker areas, evaporation rims, efflorescence or zones of soiling. Such phenomena can often be explained by building physics and are not automatically to be regarded as a product defect. A free-draining, capillary-breaking construction can reduce the risk of them occurring.

5.7 Winter service and de-icing salt

Winter conditions are particularly demanding for outdoor surfaces. Freeze-thaw cycles, snow clearing, de-icing salts and standing water can put a strain on paving and joints. Mechanical clearing equipment must be used in a way that protects the material; sharp-edged blades or point loads can damage surfaces and edges.
Depending on the material and the construction, de-icing salts can have a damaging effect. Only suitable grit materials may be used, and the information given by the paving and product manufacturers must be observed.

5.8 Care of outdoor surfaces

Outdoor surfaces are regarded as easy to look after, but they too need regular cleaning. Lime deposits, greasy films, soiled joints or organic growth can occur here as well. It is particularly important that cleaning agents are matched to the ceramic and to the joint material.
Movement joints and connection joints must be checked regularly, as elastic joints are subject to natural ageing. Detachment, cracks or embrittlement should be remedied at an early stage.

6. Damage patterns and causes

6.1 Joint break-outs and joint cracks

Break-outs at joint flanks, cracks, surfaces that have become sandy or missing sections of joint are frequently caused by a combination of insufficient joint depth, joints that are too narrow, inadequate joint filling, movement in the paving or overloading.
The joint is a technical functional element. If it is expected to take up movements for which it was not dimensioned, or if the paving itself is not stable in position, damage occurs. Driveways, bends, sloping stretches and areas with manoeuvring traffic are particularly critical.

6.2 Loosening and tilting

Loose or rocking slabs indicate impaired stability of position. The causes frequently lie in an uneven bedding, voids, inadequate bond, settlement or an unsuitable construction method.
Large formats are particularly sensitive. If a slab is loaded near its edge and is inadequately supported, it can act like a lever. Joints and edges are then put under additional strain.

6.3 Voids under slab paving

Voids occur when the paving and the bedding are not adequately bonded over the full surface. They can be noticeable acoustically, but can also lead to cracks, edge break-outs or detachment. Voids are particularly critical with ceramic paving and large-format slabs, because loads are then introduced at individual points. Possible causes are missing adhesive slurries, soiled slab undersides, an unsuitable mortar consistency or inadequate workmanship. A hollow sound is not, however, a compelling indication of insufficient adhesive tensile or tensile strength. Because of the pore volume in the free-draining bedding, a hollow sound cannot be avoided.

6.4 Puddling and drainage problems

Puddles can be caused by missing falls, settlement, unevenness, blocked outlets or wrongly positioned drainage points, but also by the adhesion behaviour of the water. Because of adhesion and surface tension, water and drying residues remaining on the paving surface cannot be prevented even where a fall is provided – particularly with large-format slab paving.
Standing water must be avoided at all costs where the paving abuts buildings.

6.5 Displacement of the paving

Displacement of the paving shows itself in opened joints, twisted setts or an irregular joint pattern. The cause is frequently missing edge restraints, insufficient capacity to take up shear forces, manoeuvring traffic or incompletely filled joints.
In driveways, parking spaces and bends in particular, horizontal forces must be taken into account at the planning stage.

6.6 Efflorescence

Efflorescence occurs when water transports soluble constituents and these crystallise out at the surface. It is often temporary and is not automatically to be regarded as a technical defect. Recurring or very pronounced efflorescence can, however, indicate moisture problems, capillary transport of water or inadequate drainage.

6.7 Visual changes and colour deviations without technical defect

Outdoor surfaces change through weathering, ageing and use. Differences in shade, damp patches, slight differences in gloss, binder films, efflorescence or the formation of a natural patina can be phenomena typical of the material and of its use.

Visual changes can also occur on jointing mortars in the course of use. They include, for example, slight variations in shade, differences in the appearance of individual areas or changes resulting from weathering, soiling and ageing processes. Such phenomena are regularly of a purely visual nature and permit no conclusions to be drawn about the technical function or the durability of the construction.

Particular attention should be paid to colour differences between sample displays, sample sticks, brochure illustrations and the joint as actually executed. Slight colour deviations can likewise occur with subsequent deliveries or from different production batches. One reason for this is the use of natural raw materials, especially natural sands and mineral aggregates, whose colour, grain structure and mineralogical composition are subject to natural variation. Even with an unchanged formulation, complete colour uniformity across different production batches can therefore not be guaranteed.

In addition, the effects of moisture, differing drying conditions, the surface condition of the aggregates used and ageing processes caused by use and weather can influence the visual appearance of the joint. Such variations in shade, caused by batch, raw material and environment, cannot be completely avoided in technical terms with mineral and resin-bound jointing mortars, and they do not constitute a defect provided that the agreed technical properties, the serviceability and the durability of the construction are ensured.

7. Important notes and environmental aspects

7.1 General information

• All times given in our data sheets usually refer to 20 °C and 65 % relative humidity (high temperatures shorten these times, low temperatures lengthen them).
• Because of different minerals, binders and aggregates, colour differences between the various vdw mortar products are unavoidable.
• Colour prints in the product information are only indicative and correspond only approximately to the original colours of the vdw jointing mortars.
• Experience has shown that there are types of stone which can show discoloration after jointing. A test area should therefore always be laid. The test areas count as reference areas.
• With particularly absorbent slab paving, for example some granites and sandstones, darkening can occur as a result of rising moisture from the bedding.
• Contact with animals must be avoided during the application and curing phase.
• As a matter of principle, a strength test should be carried out before the areas are put into service.
• Chamfers must be exposed after jointing (for further information see page 28).

7.2 Cement-based products

• Varying quantities of mixing water and different moisture levels in the substrate can lead to differences in shade in the joint with cement-based mortars. This is not a quality defect.
• Protect the setting mortar from drying out too quickly (direct sunlight, draughts) and from frost and temperatures < 5 °C and > 30 °C.

7.3 Synthetic resin products

• With some types of stone, for example granite, Asian natural stones, clinker and reconstituted stone, the binder film remaining on the surface can produce particular effects such as darkening. On white or light-coloured paving this change of colour can also appear yellowish. These phenomena result from the contact between the vdw mortars and the paving surface and are not a workmanship defect.
• With critical types of stone it is therefore essential to pay particular attention to careful final cleaning.
• To reduce the remaining binder films and dark discoloration we recommend pre-treatment with **vdw 950 ultra Fughilfe rapid**.
• On absorbent slab and sett paving, more pronounced and longer-lasting deepening of the shade can occur at the surface, which may also be irreversible. There we recommend jointing with vdw Cement Based Jointing Mortar.
• For jointing concrete block paving with treated (impregnated, coated) surfaces we recommend vdw 840 plus 1K Jointing Mortar. The technical data sheets of the concrete product manufacturers must be observed!
• vdw synthetic resin jointing mortars are not suitable for sealing paving surfaces.
• If washing and cleaning off are inadequate, a binder film can remain on the paved surface.

7.4 Safety notes

Occupational safety:
• When using vdw mortar systems avoid contact with skin and wear safety goggles and protective gloves.
• Further product-specific information is given in the current safety data sheet for the product concerned.

Cleaning the tools:
• While still fresh, the tools can be cleaned with water or with vdw Cleaning Wipes; once cured, only mechanically.

7.5. Environmental and water-protection relevance

Liquid epoxy resin and hardener components can, depending on their composition, be hazardous to water and harmful to aquatic organisms. The current safety data sheets of the components concerned are authoritative for the assessment.

Once fully cured as intended, epoxy resin systems are solid, cross-linked materials. Compared with the liquid starting components, the release of ingredients is considerably reduced. Product-related information on environmental and water relevance is given in the respective technical documents and safety data sheets.

Removal and recovery:
Fully cured polybutadiene and epoxy resin systems are solid, cross-linked binders. When components containing them are removed, processed and recovered, the composition of the material arising, possible contamination and the requirements of the processor or waste disposal contractor concerned must be taken into account.

When crushing work is carried out, suitable measures must be used to prevent or capture dust. Whether the material is suitable for material recovery must be agreed with the responsible processor in each individual case.

With recycled material containing a correspondingly high proportion of organic binders, thermal recovery may also be considered. The local acceptance conditions and the applicable disposal requirements are decisive.

Disposal:
• Do not allow cement-based products, liquid reaction resin components, cleaning water and uncured product residues to enter the sewer system, watercourses or the soil.

• Before disposal, mix the resin and hardener components completely in accordance with the application instructions and let them cure, provided this is possible safely and as intended.

• Fully cured product residues must be disposed of according to their composition and in accordance with local and statutory requirements.

• Suitability for material or thermal recovery must be agreed with the processor or waste disposal contractor concerned.

• Containers emptied of residues can be disposed of through the certified contract partner provided for this purpose. Further information is available at Technik@gftk-info.de.

• For product-related information please refer to the container labelling and the current safety data sheets.

8. Glossary

Important technical terms explained simply

Void
Area without adequate bond or full-surface support between paving and bedding. Voids can lead to tilting, cracking or edge break-outs.

Thermal change in length
Expansion or contraction of paving caused by the material as a result of changes in temperature. Particularly relevant with large formats and dark surfaces.

Subsoil
The naturally occurring or engineered ground on which the pavement construction is founded. Its load-bearing capacity and frost susceptibility influence the durability of the whole area.

Substrate
General term for the load-bearing level below the pavement construction. The substrate must be adequately load-bearing, even and compacted.

Pavement construction
All the layers above the substrate, for example frost protection layer, base course, bedding and paving.

Base course
Layer that takes up and distributes loads. It must be load-bearing, dimensionally stable and, depending on the system, water-permeable or designed accordingly in structural terms.

Frost protection layer
Layer intended to prevent frost damage. It serves to drain water, distribute loads and avoid frost heave.

Bedding
Layer immediately below the paving. It provides support, height adjustment and load transfer. Beddings can be built unbound or bound.

Bedding mortar
Bound bedding made of mineral constituents and binder. It provides stable support and, depending on the system, can be free-draining.

Adhesive slurry / bonding slurry
Material for improving the bond between the underside of the paving and the bedding mortar. Particularly important with dense paving, natural stone slabs and ceramic terrace elements.

Joint
The space between setts or slabs. The joint performs technical functions such as dimensional compensation, load transfer, water routing and stress relief.

Jointing mortar
Bound jointing material for producing permanently stable joints. Depending on the product it can be water-permeable, impermeable to water, cement-based or resin-bound.

Drainage capability
The ability of a layer or a system to take up water and drain it away. Free-draining systems reduce trapped water and frost damage.

Capillarity
The ability of a building material to transport water against gravity in fine pores. Capillarity can promote efflorescence, damp patches and frost damage.

Movement joint
Joint of elastic or structural design for taking up movements. It relieves stress and prevents damage caused by restraint.

Use category
Classification of an area according to the type and intensity of use, for example walkable, trafficable by cars or occasionally more heavily loaded.

Joint width
Distance between paving elements. The joint width depends on the material, the format, the construction method and the thermal loading.

Joint depth
Depth of the filled joint. An adequate joint depth is important for stability and durability.

Large format
Paving element with larger dimensions than the classic sett or slab formats. Large formats place higher demands on evenness, bedding and joint planning.

Ceramic terrace element
Densely fired ceramic slab, frequently of porcelain stoneware, with low water absorption. Technically demanding in terms of bond, joint width and accommodation of movement.

With the notes in this brochure we wish to advise to the best of our knowledge on the basis of our tests and experience. Please always observe the detailed application instructions for the individual products. You will find them in our range catalogue or on our web site www.gftk-info.de. Because of the many possible applications and the storage and application conditions of our products, which are beyond our control, we cannot however accept any warranty for the work result in individual cases. Carry out your own tests!
Our technical advisory service is always available at Technik@gftk-info.de. Subject to change.

No direct legal liability can be derived either from the notes in this product information or from verbal advice, unless the content of the advice is expressly confirmed by us in writing. With the publication of this product information all previous versions become invalid.

Rheinbach-Flerzheim, August 2026

9. Notes & service

9.1 Notes on standards and codes of practice

Standards and codes of practice form the technical basis for planning and execution. Depending on the field of application, DIN 18318, ZTV-Wegebau, ZTV Pflaster-StB, the FGSV codes and further technical data sheets may be relevant.
Which codes are binding depends on the contractual agreement and on the specific project. It should therefore be established unambiguously in the tender and the quotation which technical bases apply.

9.2 Observe the product data sheets

Technical product data sheets contain binding information on application. They describe fields of application, application temperatures, mixing ratios, working times, joint widths, joint depths, layer thicknesses, load capacity, curing times and storage conditions.
Even high-quality products can only work permanently if they are used in accordance with their technical specifications. Deviations can impair strength, adhesion, appearance and durability.

9.3 Project-specific planning obligation

These application notes provide practical technical orientation. They do not, however, replace project-specific planning. Every construction project has its own boundary conditions.
Subsoil, use, drainage, paving, format, movement joints, connection details and climatic effects must be assessed in each individual case.
Special building tasks, exceptional loads, existing surfaces or sensitive connections to buildings call for a separate technical assessment.

9.4 Technical advice from GftK

Particularly with demanding constructions or high-quality paving, early consultation with application engineering is advisable. Test areas and project-specific system recommendations can help to minimise technical and visual risks at an early stage.
GftK application engineering supports the choice of suitable systems and answers questions on the construction method, on jointing, on ceramic paving, on refurbishment, on cleaning and on special boundary conditions. Early technical consultation can prevent planning errors, increase certainty of execution and reduce complaints.

9.5 Contact / downloads / service

Current technical data sheets, safety data sheets, application notes, system build-ups, tender texts, care instructions and other documents should always be used in their current version. As products, codes of practice and technical knowledge are developed further continuously, it is particularly important that the documents are up to date.

The information in these application notes is based on experience, tests and technical knowledge at the time of publication. Because of differing site conditions, material properties and application circumstances, no generally valid warranty for every individual case can be derived from it. Project-specific planning, the applicable codes of practice, the technical product data sheets and proper application remain decisive.

vdw Mortar Systems

Build safely in the system!

vdw Jointing Mortar

vdw Adhesive Slurry

vdw Bedding Mortar

How to reach us:

Write to us or give us a call:

contact@gftk-info.de

We are glad to support you with your project!

Your contact

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