METHOD STATEMENT
Joint Sealing of Road and Pavement joints with Sikaflex®-406 KC

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BUILDING TRUST

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1 INTRODUCTION

This method statement describes the application of Sikaflex-406 KC with Sikaflex-406 KC Booster in pavements like in construction/saw cut floor joints, movement floor joints and connection floor joints.

This method statement does not treat the application in rail superstructures, please refer to the method statement: Joint Sealing of Rails in Track Superstructures with Sikaflex®-406 KC

Following this guideline will help to ensure good sealant performance.

Since conditions vary by project, these statements are not intended to be a complete and comprehensive quality assurance program. Field adhesion tests according are required to ensure good sealant performance and verify installation methods. Always follow instructions given in the most recent product data sheet (PDS).

2 SYSTEM DESCRIPTION

The rapid completion and re-opening of areas to traffic is a key requirement on infrastructure projects, especially during refurbishment works. Their closure to traffic for any extended periods is always an issue, which has become even more difficult with increasing traffic, be this at a road junction or a roundabout, on an airport apron or for a suburban tramline. Full traffic access with normal service demands needs to be returned as soon as possible, ideally within just a few hours so that vehicles can pass again without delay.

Sikaflex®-406 KC is a one-part, self-levelling, elastic joint sealant, with high mechanical and chemical resistance. Rapid and homogeneous curing throughout the entire sealant is achieved by the addition of Sikaflex®-406 KC Booster.

The system Sikaflex®-406 KC with Sikaflex®-406 KC Booster is designed for:

- **Construction/contraction/saw-cut joints** in concrete pavement/slabs with low movement
- **Connection joints** between steel, asphalt (defined types), concrete, granite, rails in track superstructure with medium movement
- **Movement/expansion joints** in road and airport pavements, parking decks, driveways, pedestrian and traffic areas with high movement

3 JOINT DIMENSIONING AND CONSUMPTION

The joint width must be dimensioned to accommodate the expected movements, mainly thermal expansion and compression of the adjacent elements e.g. concrete. The movement capability of Sikaflex-406 KC with Sikaflex-406 KC Booster is ±25% according EN 15651-4 and 35 % according to EN 14188-2 and ISO 11600.

Remark:

- Small joints width of 6 – 8 mm are also possible with Sikaflex-406 KC with Sikaflex-406 KC Booster but are difficult to cast directly from the pail. For such small joints we recommend either to refill in a smaller container or to use Sikaflex PRO-3 or Sikaflex PRO-3 SL from a foil pack with 600 or 1800 ml.

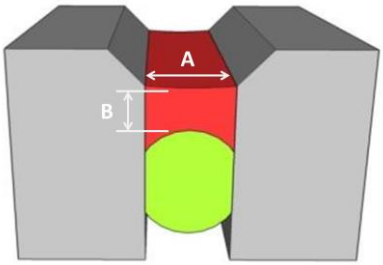
3.1 MOVEMENT/EXPANSION JOINTS

To ensure Sikaflex-406 KC with Sikaflex-406 KC Booster performs properly; the joint must be dimensioned according to the following guidelines:

- The joint width shall be ≥ 8 mm and ≤ 35 mm. Depending on the traffic load wider joints are possible up to 70 mm. For these larger joints please contact Sika Technical Service.
- In order to install an appropriate closed cell backing rod the total joint depth has to be ~ two times the joint width.
- The sealant depth shall be 0.8 times the joint width but always ≥ 8 mm.
- The sealant must always be recessed 3-6 mm below the adjacent surface since it is not designed to withstand wheel traffic.

Refer to the table and drawing for **standard joint dimensions** and consumption:

Dimension	Value
Dimension A	min. 8 mm max. 35 mm
Dimension B	min. 8 mm max. 28 mm
Ratio A:B	approx. 1:0.8



Standard joint widths for joints between concrete elements for interior applications.

Temperature difference of 40°C

Joint distance [m]	Min. joint width [mm]	Total joint depth [mm]	Min. sealant depth [mm]
2	10	20	10
4	10	20	10
6	10	20	10
8	15	30	12
10	18	36	15

Standard joint widths for joints between concrete elements for exterior application.

Temperature difference of 80 °C

Joint distance [m]	Min. joint width [mm]	Total joint depth [mm]	Min. sealant depth [mm]
2	10	20	10
4	15	30	12
6	20	40	17
8	28	56	22
10	35	70	28

All joints must be correctly designed and dimensioned in accordance with the relevant standards, before their construction. The basis for calculation of the necessary joint widths are the type of structure and its dimensions, the technical values of the adjacent building materials and the joint sealing material, as well as the specific exposure of the building and the joints. For larger joints please contact our Technical Service Department.

3.2 CONNECTION JOINTS

These joints are the connection between the different materials like concrete and asphalt or inserts in the pavement like gutters. Their main task is to prevent water ingress and particle penetration.

Connection joints are made to overcome the different movements of the materials and are designed as movement joints.

In case of asphalt, the sealant dimensions of connection joints to asphalt are always as deep as the asphalt cover layer. Usually, the asphalt cover layer is 50 mm. Without this high sealant thickness, the asphalt would slowly flow under the sealant under load. The top level of the joint sealant should be kept at least recessed 3-6 mm than top of the adjacent surfaces.

3.3 CONSTRUCTION/CONTRACTION/SAW-CUT JOINTS

These joints are designed for crack control related to shrinkage of the cast concrete pavement slabs. Therefore, 6-8 mm wide joints are cut into the fresh concrete slab after 1 to 2 days. The sealant is only exposed to minimal movement and its main task is to prevent liquid (water, chemicals, fuel) ingress and particle penetration. Generally a backer rod is not needed or if, to prevent the sealant from flowing

In special cases, like on airport aprons, hardstands, taxiways etc., recessed joints of around 20 mm are specified. The use of a backer rod is recommended.

Consumption

Joint length [m] per 10 liter pail	Joint width [mm]	Joint depth [mm]
100	10	10
55	15	12
31	20	16
20	25	20
13	30	24

4 SEALING PROCEDURE

The following steps summarize the application procedure for Sikaflex-406 KC with Sikaflex-406 KC Booster:

1. Surface preparation: Good adhesion is the key to durable tight joints
2. Backing: Enable movement by preventing 3 flank adhesion and also preventing the sealant to flow away
3. Priming: Enable durable adhesion by creating a strong interface
4. Sealant and booster mixing: Enabling rapid curing
5. Sealant application: Sealing the joint
6. Curing behaviour: Opening the joints to traffic
7. Optional: Broadcasting the sealant for early release to traffic (not for airports)
8. Cleaning

4.1 SURFACE PREPARATION

4.1.1 CONCRETE

The joint surface/substrate must be clean, sound and homogeneous, free from oils, grease, dust and loose or friable particles. The bond strength is directly dependent on the substrate condition, so it is especially important that any weaker layer or cement laitance be removed so that the sealant can bond directly to sound concrete. Weak, loose, or foreign material between the sealant and substrate will cause a failure point. The joint surface should be checked e.g. with a clean cloth on the surface, which should come away clean and free of dust or contaminants. It is important that this condition is achieved for the entire surface where the sealant will adhere, taking into consideration the sealant recess.

Concrete surface preparation procedures:

Different cases may require slightly different processes for surface preparation. The following steps can be taken, as required:

1. Grinding or wire brushing
   - Typically done with angle grinder
   - Only recommended on joints that have not been saw cut
   - For removing cement laitance or significant foreign material
   - Avoid grinding of residual sealant as it will burn from the friction and form a non-adhering carbon layer
2. High pressure cleaning with water
   - Mandatory after saw-cutting to remove resulting residue
3. Sandblasting
   - Recommended to remove any residual laitance or foreign material. Only possible on wider joints
   - Directed at both sides of joint at close range
4. High pressure air clearing
   - With air free of oil and water
   - For removing sand and remaining foreign materials

Note: Typically joints are saw cut for crack control in in-situ built concrete pavements. Here it is important to first pressure wash the joints after saw-cutting to get rid of the residue and loose material. At this point, the joint should be inspected to decide the further necessary steps.

Dry concrete: Clean as described above. Apply Sika® Primer-115 or Sika® Primer 3N

Humid concrete (e.g. from rain or washing): Remove any standing water from the joint and clean the surface as described above. Apply Sika® Primer-115.

Green 2-3 days old **and wet concrete:** Remove any standing water from the joint and clean the surface as described above. Apply “Sikadur®-32 Normal" as primer.

4.1.2 ASPHALT

Asphalt is a mix of aggregates and a bitumen based binder. The sealant only adheres to the clean aggregates and not to the bitumen. Therefore, the contact surfaces must be solid, clean, dry and free from oil, fat and loose particles.

Hot rolled asphalt according to EN 13108-1: The joint is made by cutting the asphalt with a diamond saw to achieve a proper surface. Minimum 50% of the surface must be gravels. Clean the cut joint area by pressure washing or sandblasting and remove all cutting residuals and loose particles by vacuuming. Let dry the substrate properly, do not use gas heater or electrical heater above 40°C air temperature to ensure not melting the asphalt. Use Sika® Primer-115 or Sika Primer 3 N (flash-off time of > 30 minutes < 8 hours).

Hot poured asphalt mastic asphalt according to EN 13108-6: The joint usually is made by a temporary filler, which is removed when the asphalt has solidified and is not cut. To achieve a minimum 50% of clean aggregate surface the joint must be sand blasted. Aggregate surface must be free of binder. Remove all residuals and loose particles by vacuuming. Use Sika® Primer-115 or Sika Primer 3 N (flash-off time of > 30 minutes < 8 hours).

Note: If there are leaks in the asphalt after removing the temporary fillers, then flame them with a non-oiling flame before sand blasting.

4.1.3 STEEL

Steel is a common substrate in road and floor applications, be it as a gully, drain or rail. Often the surface is corroded and needs treatment to secure good and durable adhesion. Steel shall be free from dirt, grease and oil and then blast cleaned to SA 2 ½ „Near White Blast Cleaning“ or ST 3 – „Power Tool Cleaning“ according to ISO 12944, part 4. Prime with Sika® Primer-3 N or Sika Primer-115. For an optimum corrosion protection, use SikaCor® -299

4.1.4 RUBBER

There are many rubbers and often the rubber surface has remains of demolding or extrusion agents. Special cleaning and priming are mandatory and adhesion and compatibility tests have to be carried out. Please contact local Sika Technical Services Department for advice.

4.1.5 REPLACING EXISTING SEALANTS

When replacing existing sealants, the best performance is obtained when the existing sealant is completely removed mechanically and a sound, clean concrete substrate is exposed for the new sealant to bond to. The method for removing the existing sealant will depend on its condition. The best results are achieved by saw cutting the joint again with a slightly wider blade. Sometimes the existing sealant can be completely removed by hand or by using a claw-like metal ripper device to expose the concrete substrate. This can be machine driven. In both cases, it is important to follow the procedure described in section 4.1.1 or 4.1.2 after sealant removal.

In rare cases, if the existing sealant is in good condition, has good adhesion and is of polyurethane basis, then a layer of existing sealant can be left bonded to the substrate for the new sealant to bond to. Primer must be applied. This practice is not recommend however, since the seal is only as strong as the weakest point and the existing sealant will likely have a shorter service life and be the point of failure.

Chemical compatibility must be considered when an existing sealant is in place. Most polyurethane sealants will not cause problems with Sikaflex®-406 KC but contact with silicones can cause adhesion loss and compatibility issues such as plasticizer migration, therefore, existing silicones must be completely removed including some of the concrete substrate. For other sealant technologies, contact Sika Technical Service.

4.2 BOND BREAKER INSTALLATION

Sikaflex®-406 KC should adhere to only two sides of the joint in order to perform properly. To allow extension and compression, the bottom surface of the sealant must be free to deform. If the bottom of sealant adheres, this can cause the sealant to rupture in order to deform. Backer rods or bond breaker tapes are used to prevent adhesion to the bottom of the joint and limit the sealant depth.

It is recommended to use closed-cell polyethylene backing rods. If the joint is not deep enough to allow space for a backer rod, a bond breaking tape (e.g. polyethylene) can be used. To provide sufficient backpressure during sealant application, the backing rod should be sized ~25% larger than the joint width. Sizing differs among backing rod types; refer to the manufacturer recommendations.

Apply the backing rod into the joint using a blunt tool. Make sure that the backing rod skin is not damaged as this can cause gassing out of the backer rod into the sealant. On longer stretches, a roller can be used to easily install the backer rod at a proper depth (see photo right).

Check the depth of the backer rod as calculated in accordance with Section 3. Remember to consider both the sealant depth (thickness) and the sealant recess when determining the backer rod depth. To prevent leakage of sealant during application, backing must be tight e.g. sometimes it's necessary to seal crossings of the backer rods with a non-sag sealant like Sikaflex PRO-3.

Picture1: Application of the backing rod with a tool

4.3 PRIMER APPLICATION

The primer is applied after the backing is inserted. Although Sikaflex®-406 KC with Sikaflex®-406 KC Booster adheres quite well without primers and/or activators especially for exterior application the pretreatment of the joint is mandatory. Water from rain, spillage, washing goes through the porous concrete to the interface of the sealant. The liquid primer can penetrate the concrete and “protect, strengthen” the interface.

The primer is applied by hand using a clean brush. For primer and application method, the following points apply:

- Apply the primer according to the application rate in the PDS. This is basically applying the primer as thin as possible, while still completely covering the joint bonding surface.
- Applying too much primer can cause failure within the primer.
- The primer must be allowed to flash off at least the minimum flash off time given in the PDS, but no more than the maximum prior to sealant application. Any surfaces primed but not sealed within maximum flash off time must be re-cleaned and re-primed before sealant application.
- The primer reacts with moisture in the air. Opened containers should be closed between use and air exposure time limited during application. In addition, limit the time the primer being applied is exposed to air.

Different substrates may require slightly different processes for surface preparation:

4.3.1 POROUS SUBSTRATES

Concrete, aerated concrete and cement based renders, mortars and bricks shall be primed using Sika Primer 3 N or Sika Primer-115 applied with a brush. Before sealing, allow a flash-off time of > 30 minutes (< 8 hours).

4.3.2 NON-POROUS SUBSTRATES

Aluminum, anodized aluminum, stainless steel, galvanized steel, powder coated metals or glazed tiles have to be cleaned and pre-treated using Sika® Aktivator-205, wiped on with a clean towel. Before sealing, allow a flash-off time of > 15 minutes (< 6 hours).

Metals, such as copper, brass and titanium-zinc, also have to be cleaned and pre-treated using Sika® Aktivator-205, wiped on with a clean towel. After the necessary flash-off time, use a brush to apply Sika® Primer-3 N and allow a further flash-off time of > 30 minutes (< 8 hours) before sealing the joints.

PVC has to be cleaned and pre-treated using Sika® Primer-215 applied with a brush. Before sealing, allow a flash-off time of > 30 minutes (< 8 hours).

4.3.3 HOT ROLLED ACC. TO EN 13108-1 AND MASTIC ASPHALT ACC. EN 13108-6

After surface perpetration as described in section 4.1.2. The sealant only adheres to the clean aggregates and not to the bitumen. Therefore, the contact surfaces must be solid, clean, dry and free from oil, fat and loose particles before the primer is applied. Use Sika® Primer-3 N or Sika® Primer-115 (flash-off time of > 30 minutes < 8 hours) on the fresh cut/sandblasted and cleaned surface. For more detailed advice instructions please contact the local Sika Technical Services Department.

4.3.4 RUBBER

There are many rubbers and often the rubber surface has remains of demolding or extrusion agents. Special cleaning and priming are mandatory and adhesion and compatibility tests have to be carried out. Please contact local Sika Technical Services Department for advice.

Note: Primers are adhesion promoters. Primer application does not a substitute correct cleaning of the surface or does it improve the strength of the surface significantly.

4.4 SEALANT MIXING AND APPLICATION

4.4.1 MIXING

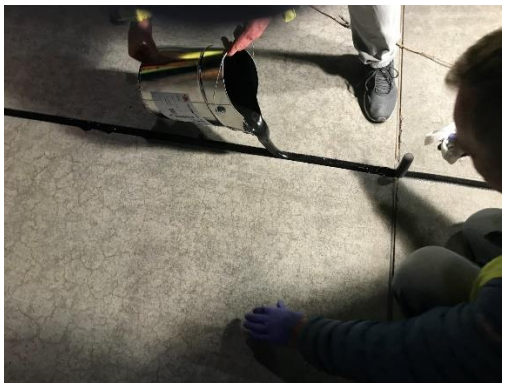
- Before adding the Sikaflex-406 KC Booster the Sikaflex-406 KC has to be premixed for approx. 2 min. The mixing shear-thins the sealant.
- Add Sikaflex®-406 KC Booster to Sikaflex®-406 KC and mix continuously for 2 to 3 minutes until a uniformly coloured mix has been achieved. For mixing a U-shaped stirring device with ~600 rpm has to be used. Avoid air entrainment by mixing in the lower half of the pail.

Picture 2: U shaped mixing device

4.5 SEALANT APPLICATION

4.5.1 MANUAL SEALANT APPLICATION

After mixing, the sealant can be applied into the joint manually by using an open container or directly out of the metal pail with a spout to pour the sealant into the joint.



Picture 3: Application of Sikaflex-406 KC directly out of the pail

4.5.2 PUMP APPLICATION

Sikaflex-406 KC with Sikaflex-406 KC Booster can be applied by pump. For pump application please contact **TECHNICAL** service or ask pump producers for a recommendation.

Note: *The pot-life of the mixed sealant is approximately ~20 min (23 °C / 50 % r.h.). The pot-life decreases with increasing temperature.*

4.6 CURING

The temperature has a strong influence on the reaction kinetics. In the table below the results are summarized. The degree of curing (%) refers to the final hardness of the sealant which is around 28 Shore A.

Curing Times at different temperatures:

Temperature	Cure state in % of final hardness		
	25%	50%	80%
5°C	14 h	24 h	48 h
23°C	5 h	8 h	24 h
35°C	3 h	6 h	24 h

The 100% refers to a Shore A hardness of 28, the fully cured state. At 80% of final hardness it´s considered the sealant as cured enough to bear mechanical load.

4.7 BROADCASTING

Tack-free time: Without sand broadcast: ~3.5 hours, with sand broadcast: ~ 1 hour (@23°C).

Trafficable by pneumatic car tires: After approx. 3 hours (+23°C), based on recessed joints, surface broadcast with sand and for joint widths up to 70 mm.

The joint can be opened to traffic if 30 % of the final Shore A is achieved. If earlier release to traffic is necessary after 2 – 4 hours but:

- Joint must be recessed to avoid wheel contact. Smaller joints are obviously less at risk than large joints.
- Broadcast sealant with quartz sand 0.5 - 0.7 mm after 1 h, 23 °C.

Note: It is not recommended to broadcast joints that are frequently cleaned e.g. airport aprons or runways due to the increased roughness of the surface.

4.8 CLEANING

Clean all tools and application equipment immediately after use with Sika® Remover-208. Once cured, hardened material can only be removed mechanically. For cleaning skin, use Sika® Cleaning Wipes-100.

CAUTION:

- Always refer to the relevant safety data sheet of the recommended cleaner/solvent for proper handling and personal protection procedures.
- Solvents can degrade plastic parts in equipment therefore, limit exposure time and potentially rinse plastic parts with water after cleaning with solvent.

5 FIELD ADHESION TEST

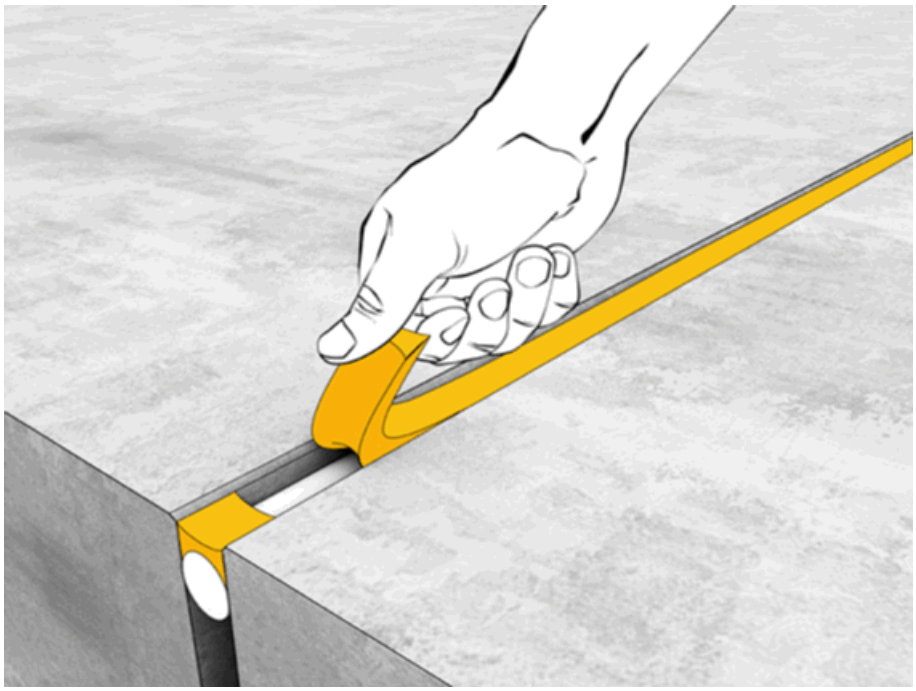
The field adhesion test is a qualitative screening procedure that may help to identify poor installation techniques used in the application of sealants. This will include poor cleaning, incorrect use of primer which could include selection of an unsuitable primer or omitting to use a primer when one is required, poor primer application or improper joint design. To evaluate the sealant adhesion on site, a simple hand pull test can be used at the job site.

Field adhesion testing should be documented. It is suggested that 5 tests for the first 500 meters and one test per 500 meters thereafter are carried out.

The hand pull field adhesion test procedure is as follows (see image below):

- Make a knife cut from one side of the joint to the other (perpendicular to the joint).
- Make two cuts (parallel to the joint) from the horizontal cut approximately 75 mm long, at both sides of the joint, making sure no damage is caused to the substrate surfaces.
- Place a 25 mm mark on the sealant tab.
- Hold a 50 mm piece of sealant firmly just beyond the 25 mm mark and pull at a 90° angle.
- Check the adhesion of the sealant to both substrates separately, even if they are of the same material. This is accomplished by extending the parallel cut along one side of the joint, checking adhesion to the opposite side, and then repeating for the other surface.

- 100% cohesive failure indicates a passed test and sufficient adhesion. If any signs of adhesive failure are observed then Sika Technical Service should be contacted and a more detailed examination undertaken. For specific advice please contact Sika Technical Service.
- While executing the field adhesion test, inspect the quality of the joint section removed. Check if the sealant completely fills the joint, no voids or air bubbles are present and the sealant joint dimensions are in line with those specified on the drawings.
- Record the test results in a project log book so that the results can be included in the project records.



Picture 4. Field Peel Adhesion Test

6 LEGAL NOTE

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. in practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the products suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

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