WHITEPAPER
HYGIENIC INDUSTRIAL FLOORING

Sika® Ucrete® DESIGN, SELECTION AND CHECKLIST

BUILDING TRUST

Process area floors in the food and beverage industry must provide a safe and hygienic production environment, be fit for purpose and durable. Good floor selection, design and construction reduces accidents, hygiene risks and lost production.

The aim of this white paper is to identify the best practice for floor design and specification to achieve a long lasting functional flooring solution.
While particular reference is made to the food and beverage industry, much of the guidance is applicable to other aggressive process environments.

Our production processes take place on the floor. If the floor provides a safe and attractive environment for the workers and is hygienic and easy to clean, production efficiency will be high. However, in all too many cases the floors begin to fail, compromising food safety and eventually leading to lost production while repairs are undertaken. But getting a floor right is not rocket science. There are many 20 – 30 year old floors in arduous food and beverage industry environments which continue to give good service.

There are three basic reasons a floor will be long lasting and perfectly functional:

- floor finish is fit for purpose
- good design and construction of the substrate
- proper and correct application.

We will discuss how to avoid such problems and achieve a long lasting flooring solution.

Arla Foods, Leeds, United Kingdom

FLOOR SELECTION

The floor finish has several different functions in a factory, it must:

1. provide a hygienic and easy to clean surface
2. not support biological growth
3. provide a safe working environment
4. be durable, which may require resistance to chemicals and thermal shock, as well as mechanical abrasion and impact

1. HYGIENIC AND EASY TO CLEAN SURFACE

As part of its HACCP quality system a producer must assure himself that a floor will not compromise food safety. The easiest way to do this is to use a flooring system which has appropriate third party certification for use in food handling facilities. Also a floor should be dense, impervious and with bacterial cleanability comparable to stainless steel.[1]

2. NO SUPPORT OF BIOLOGICAL GROWTH

Floors must not support the growth of bacteria or mould. One practical test method[2] involves contaminating floor samples with, for example, the black mould Aspergillus niger or the bacteria Bacillus subtilis, applying cleaning/sanitizing solutions to the surface and counting the number of colony forming units at 1, 24 and 72 hours.Ensure floors have been independently tested to confirm their hygienic performance.

Efficacy of a range of sanitizers on a Sika® Ucrete® floor

Initial germ* content 1'500'000 KbE/25cm²			
Disinfectant	KbE/25cm² after reaction time of		
	1 h	24 h	72 h
p-chloro-m-cresol, 0.3%	647/403	194/252	<10/<10
Alkyl dimethyl benzyl ammonium chloride, 0.1%	136/176	270/59	<10/<10
p-toluene sulfon chloroamid-Na, 5%	155/165	<10/<10	<10/<10
Formaldehyde, 5%	10/7	<10/<10	<10/<10
Ethanol, 70%	313/282	30/34	<10/<10
Water	4400/2800	402/379	<10/<10

** Bacillus subtilis*

3. SAFE WORKING ENVIRONMENT

The floor must provide a safe working environment for operatives so it must have an appropriate level of slip resistance. There are two widely used standards for measuring the slip resistance of floors: the ramp test described in DIN 51130[3] and the pendulum test described in EN 13036-4[4].

The correct level of slip resistance, for any given area will depend upon activities taking place. BRG 181[5] gives specific guidance.

Barton Meats, Manchester, United Kingdom

[1] *Taylor, J.H. and Holah, J. T. (1996) "A comparative evaluation with respect to the bacterial cleanability of a range of wall and floor surface materials in the food industry"; Journal of Applied Microbiology, 81, 257-26*
[2] *Following Standard Method 14 of the Deutsche Gesellschaft für Hygiene and Mikrobiologie*
[3] *DIN 51130 Testing of floor coverings – Determination of the anti-slip property – Workrooms and fields of activities with slip danger, walking method – Ramp test*
[4] *EN 13036 Road and airfield surface characteristics – Test methods, Part 4: Method of measurement of the slip/skid resistance of a surface: The pendulum test.*
[5] *BRG 181 Fußböden in Arbeitsräumen und Arbeitsbereichen mit Rutschgefahr; Hauptverband der gewerblichen Berufsgenossenschaften*

4. DURABLE CHEMICAL AND THERMAL SHOCK, MECHANICAL ABRASION AND IMPACT RESISTANT FLOOR

Durability comes from a combination of physical and chemical properties. Resin floors even made with the same type of resin binder can have very different properties depending on the formulation of the mortar and in particular the resin content. Low resin content materials are cheap but they often rely on a thin surface sealcoat for their hygienic properties. Such a surface coat has a short life expectancy, especially when subject to hard wheeled traffic; once it has gone the mortars underneath have poor durability, chemical resistance and cleanability.

Poor formulations can jeopardize food safety

Many suppliers and installers use lean resin mortars to produce coved skirting details, these have low resin content and so are porous and should be avoided. When these are used on insulated panel walls, it is not unknown for bacteria and moisture to pass through a cove, under a wall and through the cove on the other side of the wall to contaminate the adjacent environment. It is important to use resin rich thixotropic coving mortars which are dense and impervious throughout their thickness. Alternatively, the use of concrete curbs, or preformed curbs made of stainless steel or polyester concrete, minimize the risk of bacteria passing under an insulated panel wall.

Good formulations also affects the mechanical performance of a floor

Mechanical durability comes not just from the resin content but also from the size and quality of the aggregates used. Quartz or silica sands are relatively weak so the big stones in the floor should be harder minerals such as calcined flints, granite, basalt or bauxite for example. Generally the bigger these fillers are, the better the scratch and abrasion resistance. Larger and harder aggregates are also required to ensure the retention of slip resistance over the lifetime of the floor, particularly where textured floors are used in locations trafficked by hard plastic or steel wheels, such as meat bins, tray racks and mixing vessels, for example.

Chemical resistance

In the food and beverage industry a wide range of chemicals are encountered. Both acids and alkalis are used in cleaning compounds. Organic acids, from the oxidation of vegetable oils and animal fats, lactic acid from milk, citric acid from fruit and acetic acid, which is often used to clean food contact surfaces, will degrade epoxy resin based materials including resin grouts used in tiled floors. Phosphoric acid also attacks many epoxy resin based materials.

CHECKLIST FLOOR SELECTION

- ☐ Is the floor finish HACCP compliant?
- ☐ Is this supported by independent verification?
- ☐ Can the flooring manufacturer demonstrate that his floor is non-tainting, is easy to clean and does not support microbial growth?
- ☐ Is this confirmed by third party certifications?
- ☐ Does the floor finish have the required chemical, temperature and thermal shock resistance?
- ☐ Does the floor finish meet the various needs for slip resistance?
- ☐ In areas subject to hard wheeled traffic, does the floor finish use the hard aggregates required to maintain the slip resistance for the life of the floor?
- ☐ Where relevant, can the floor finish be installed onto high moisture content concrete, or does it require the use of special primers?
- ☐ Can the floor finish be put back into service within the required time interval?
- ☐ Are coving mortars dense and impervious throughout their thickness to prevent moisture ingress?
- ☐ Can the manufacturer demonstrate a successful track record in similar environments over many years?

SUBSTRATE DESIGN & CONSTRUCTION

The first impact of the substrate design and construction on the final floor is the presence, or not, of joints. Joints are a weak point in the floor. The joint sealant is weaker than the surrounding floor, it has poorer chemical resistance and is likely to have poorer hygiene characteristics. Joints are maintenance items and, therefore, they must be visible for inspection and accessible for maintenance.

HOW TO DEAL WITH JOINTS

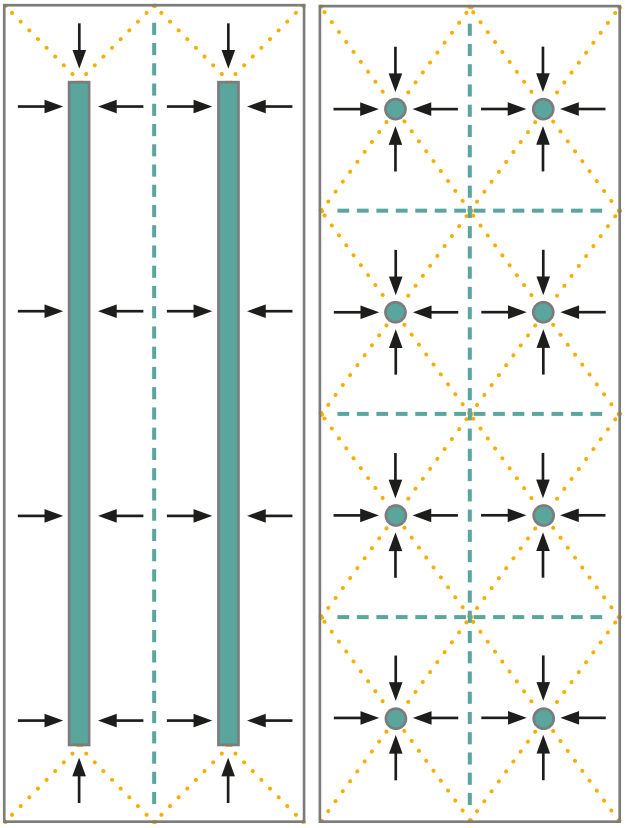
Joints should be positioned away from areas subject to chemical or high temperature discharges. They must be well detailed to protect the edges from mechanical damage caused by small hard plastic or steel wheels. The amount of movement expected affects the size of the joint and flexibility of the joint sealant, so any joint should be a designed part of the structure. The best sealant for any joint will depend upon a number of factors:

- amount of movement at the joint
- chemical resistance required
- in-service temperatures
- type of traffic

Harder sealants usually perform better where floors are trafficked by small hard wheels, while more flexible sealants can accommodate greater movement. In larger production halls, long channel drains can produce a simpler fall pattern that is easier to build and use than a series of envelope falls and gulleys.

In areas where there is likely to be high temperature spillages (thermal shock), steel reinforcement, including steel fibre reinforcement, should be at least 20 mm below the surface of the substrate concrete, otherwise the differential movement between the steel and the concrete can lead to cracking.

Examples of easy and complex to build fall patterns



A floor designed with channels (figure on the left) is easier to build than a floor with isolated gulleys (figure on the right).

Windau Specialty Sausages and Hams, Harsewinkel, Germany

CHECKLIST SUBSTRATE DESIGN

- ☐ Is the drainage positioned where it is visible and accessible? Consider the impact on the design of the concrete floor of drainage.
- ☐ Have the substrate concrete and screeds been designed to reduce the number of joints? Are the joints visible, accessible and positioned in non-critical areas?
- ☐ Are the substrate concrete and screeds designed to accommodate the stresses of the in service environment?

INSTALLATION & CONSTRUCTION

With good design of the concrete floor slab, almost all joints in the substrate concrete can be eliminated. Those few joints that are still necessary can be positioned in low risk and technical areas locations where they can be effectively inspected, cleaned and maintained with minimum disruption to production. Such a well-designed floor slab together with a seamless resin floor finish enables continuous joint free floors to be achieved.

The whole flooring system should be properly designed and specified, not only the location of joints and drainage and the levels and slopes of the floor, but also the mix design / quality and reinforcement of the screeds and concrete that make up the floor. There must also be good site control to ensure that the floor is built as designed. Compromising on good floor design to achieve initial savings can lead to ongoing maintenance costs long after the project is completed. It is worth bearing in mind the cost in lost production should the plant have to close for floor refurbishment sometime in the future.

Good communication with the construction company is essential to ensure that the design specifications are adhered to on site. Failure to do so can lead to joints in undesirable locations, random cracking and premature floor failure.

CHECKLIST INSTALLATION

- ☐ Does the construction company understand the concrete floor and screed design and commit to build as required?
- ☐ Has the specialist flooring contractor experience with the chosen floor finish and can he demonstrate a track record on similar installations within the food and beverage industry?
- ☐ Are special primers and topcoats, if required, included and itemized in the floor finishes contractor's tender documents?
- ☐ Are the construction company and the floor finishes contractor working together to ensure that the floor is installed to the correct levels, falls and tolerance, with substrate preparation, detailing and application as required to achieve the best floor possible?

Grimsby, United Kingdom

CONCLUSION

There are a very large number of floor finishes available, different types of resins and types of tiles, different thicknesses specifications, quality and technical performance, often with very similar looking datasheets. In all cases it is advisable to insist on seeing the independent test reports to support any claim and to see old floors still in service in similar environments.

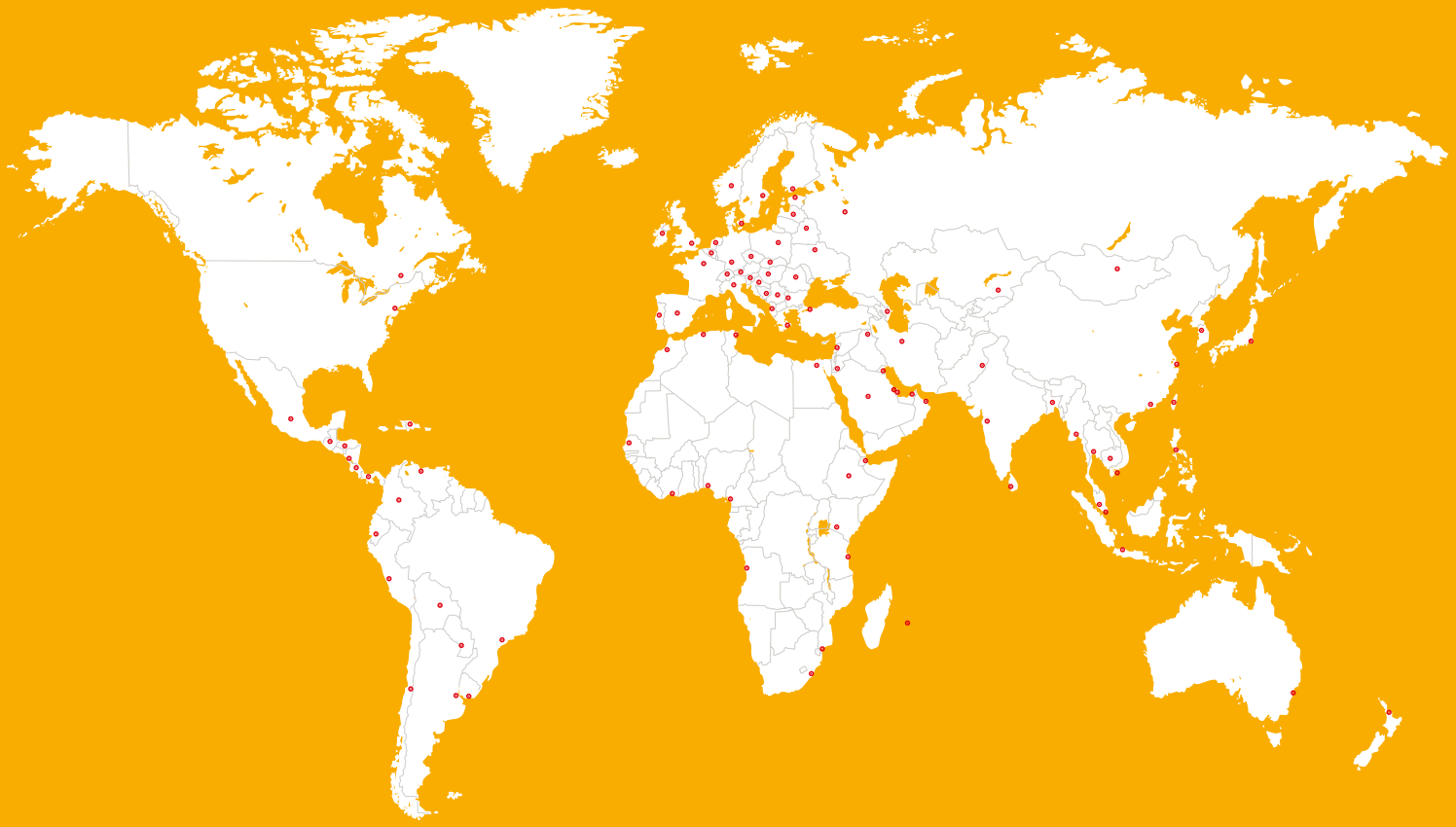
The most expensive floors are those that fail, leading to accidents and lost production and all the costs associated with managing the floor failure and the necessary repair works. It is usually best to choose floor finishes that can demonstrate their longevity. Ensuring the correct installation of the substrate concrete is key.

It is equally important to ensure that the floor finish is correctly installed by an experienced specialist applicator, that is familiar with the flooring system to be installed and can be relied upon to do the work in accordance with the manufacturer's instructions and good site practice.

On refurbishment projects, the flooring contractor should be experienced with working within a food industry environment. It is important that the routes of access to the work area and facilities, the location of the mixing station and the areas for storage of materials and waste are agreed and adhered to, so that contamination of adjacent production areas can be avoided.

Namet meat factory, Çayırova, Turkey

GLOBAL BUT LOCAL PARTNERSHIP



FOR MORE INFORMATION ON Sika® Ucrete®:

WHO WE ARE

Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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