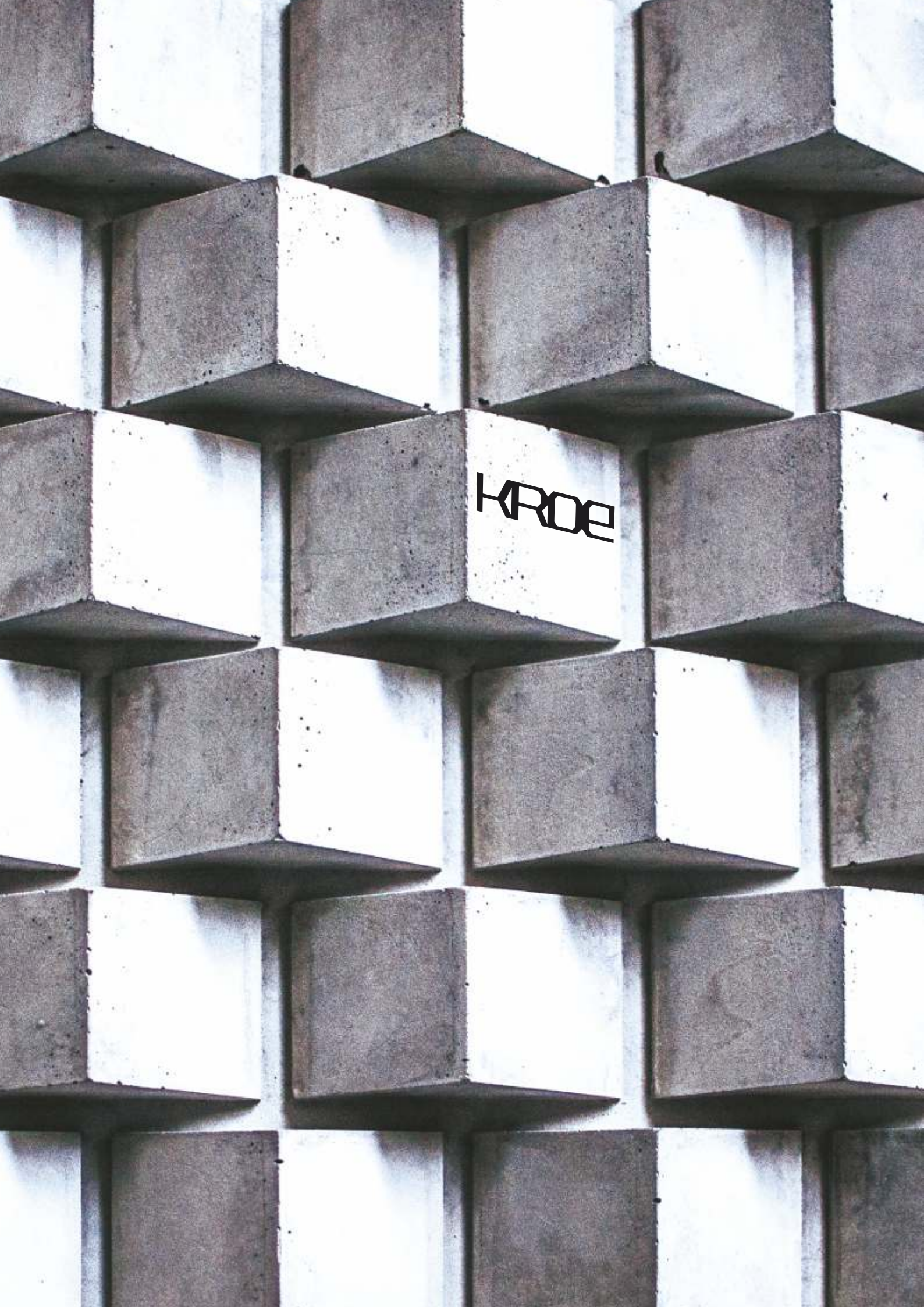

KROE

KROE is created by people brought together by creativity, optimism, and experience.

Our modern technology of concrete creation shows piratically unlimited possibilities of its application in contemporary construction, architecture, interior and industrial design.

This catalogue is a collection of information on technical aspects of GRC concrete covering with specialized KROE impregnating coatings, material characteristics, its visual aspects, and methods of fixing.

European Funds
Smart Growth

European Union
European Regional
Development Fund

KROE Sp. z o.o.(limited liability company) realizes project financed with the European Funds the “Development of KROE Sp. z o.o. export activities through realization of promotional activities provided in the Programme for construction and finishing industry promotion.”

The aim of the project is to promote, based on realized promotion activities, KROE’s products (GRC concrete with impregnating coating) on selected prospective markets (Norway, Russia), and to promote Polish Economy Brand (PEB).

GLASSFIBER REINFORCED CONCRETE (GRC, GFRC)

KROE GRC CONCRETE TECHNICAL SPECIFICATIONS

FIXING

RULES OF CONDUCT AT CONSTRUCTION SITE

INTERIORS

ORDER

GRC Concrete - basic information

Glassfiber Reinforced Concrete (GRC, GFRC) - concrete reinforced with fibre glass - is a commonly known and used trademark. In fact, this composite should be treated as hardened sand cement mortar with addition of spatially dispersed fibre glass. In case in which the binder is Portland cement, these must be AR alkali resistant fibres. This material is characterised, in comparison to traditional mortars, by much better durability, strength, and resistance to brittle fracture. It is a material which contains only mineral resources, it is environment friendly, fully suitable for recultivation. One of its variations - e-GRC - in its composition includes cements with admixture of nanometric titanium oxide which also holds self-cleaning properties.

Manufactured with prefabrication method, these products include: thin-walled cladding elements for both internal and external applications, thin-walled road infrastructure elements, sanitary accessories, apartment and garden furnishing, decoration. In quantitative terms, the most common are cladding elements. It should be stressed that aside flat panels also large non-symmetrical panels are manufactured: arches, L and U profiles, thin-walled three-dimensional and perforated elements.

So unusual in comparison to traditional concrete, the use of GRC prefabricates makes their aesthetics more and more significant, especially the aesthetics of exposed surfaces. The products can be coloured (both in mass colored as well on the surface), and also often their surfaces are textured (in accordance with recipient's requirements). Broad extent of possibilities of shaping both the form and the aesthetics of concrete prefabricates have brought the attention of largest international designers, especially in realization of prestigious, non-standard investments.

Material characteristics

Flexural strength depends on project requirements.
5-20 MPa

Compressive strength depends on project requirements.
40-90 MPa

GRC concrete specific weight is 1900-2100 kg/m3
The weight of GRC flat panel of dimensions 1000 x 1000 x 15mm = about 33kg

Concrete fire resistance - A1 class means non-flammable material, of minimal combustion heat.

Concrete water resistance - W-1 with application of KROE water-repellent waterproofing KROE impregnation.

Frost resistance - above F-50 it means that GRC KROE concrete is resistant to alternate freezing/defrosting above 50 cycles, which simulates extreme winter conditions (temperature change from -20 up to +20 Celsius within a day).

KROE concrete panel complies with PN-EN 14992:2010: standard: Precast concrete produstc. Wall elements.

Individualism in creation - GRC concrete gives you almost unlimited possibilities in shaping, creating and adjusting the visual concept of an object using this material.

Depending on the size of production, proper time for molds preparation, production, concrete curing time (4 weeks), packing, and transport is necessary.

Residential building
Krakow, Poland

Facade panels
colour: white
texture: air voids
finish: KROE water-repellent impregnation

Cut-through panel
colour: white
texture: air voids
finish: KROE water-repellent impregnation

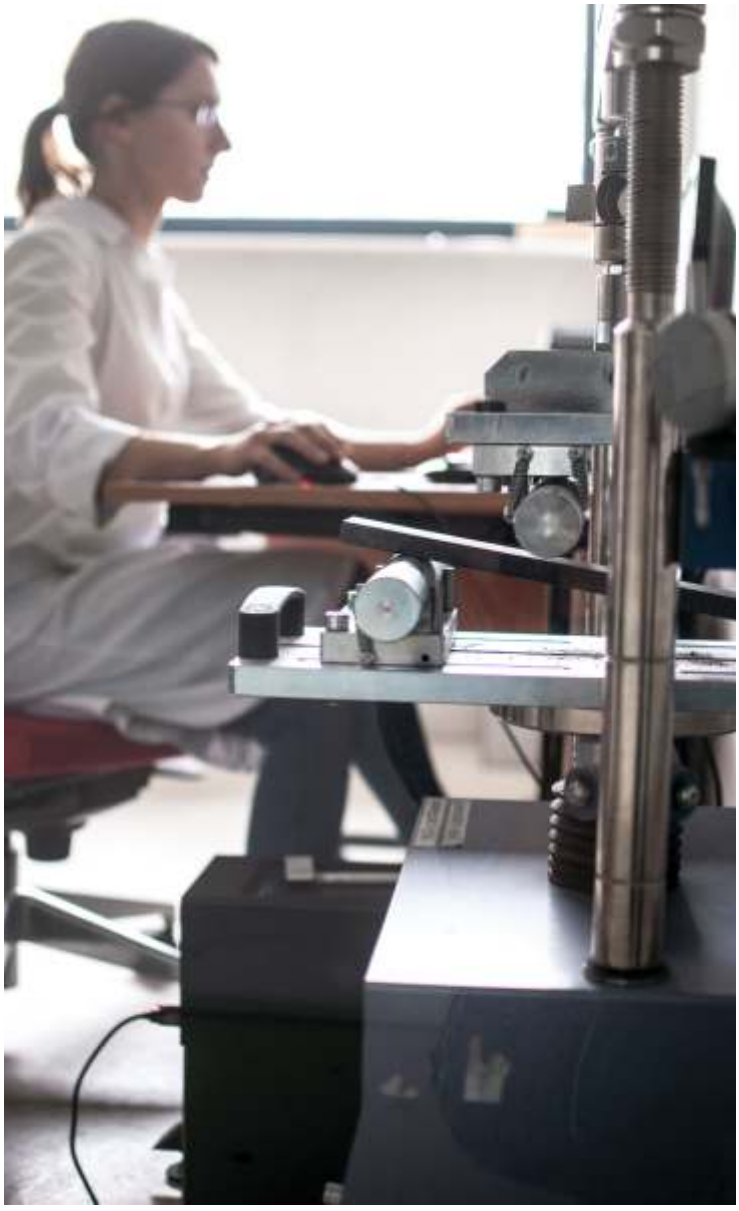

1

All KROE products are subject Factory Production Control (FPC). FPC is a dedicated team of specialized technologists.

KROE possesses own laboratory at production facility which, as one a few in Poland, is equipped with rich facilities within GRC concrete test devices. It also continuously collaborates with research centres of the AGH University of Science and Technology in Crakow and Crakow University of Technology. This allows to perform all necessary test and acquire results needed for introduction material into trading on Polish and international markets.

Within internal quality control, the facility utilizes: testing machines for indicating flexular and compressing strength, specialized equipment for testing the cement and aggregates, climatic chamber for examining the impact of freezing/defrosting on construction materials, salt mist chamber for indicating corrosive immunity of construction materials, a device for indicating depth of pentration of water under pressure.

Special, qualified, and dedicated FPC unit supervises the quality, beginning from examining provided raw materials, through analysing fresh concrete mix and the quantity of dosed alkali resistant fibre glass, ending with the control of finished products.



KROE products are characterized with authenticity and uniqueness of manufacture. The material in 100% is composed from raw materials. Due to product's characteristics, a couple of key characteristic time changes should be stressed, regarding changes in surface which result from the “lifetime” of the material.

Changes in colour

Live surfaces of products with subtle cloud effects of changing game of colours correspond with the appearance of natural objects, showing their diversity compared to constructions built from synthetic materials. Elements crated throughout the production cycle may also show slight changes in colour. It is material-specific and natural feature. Temporary and permanent changes in colour may originate due to weather conditions (rain, solar radiation, climate).

Development of crystalline products on the surface

The natural feature of materials containing Portland cement is a possibility of origination of crystalline products on their surface, which can intensify visual properties and the perception of final product.

Air voids

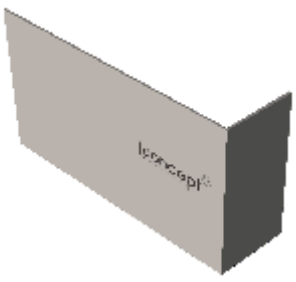
Should the Contractor want to create the effect of panel porosity, it must be noted that the occurrence of air voids on the surfaces of products is a natural effect, which means that the Manufacturer cannot affect their size, number, and placing.

Surface roughness

Some of utilized production technologies ensure product surface smoothness (without the effect of exposed aggregate). This however does not preclude the possibility of the origination of few roughenings, found only when touching the surface of the material,and some unpolished products can naturally show the effect of slight light reflection (light shine).

Pasaż 13
Krakow, Poland

Bar - panels, top
colour: natural concrete
texture: smooth panel
finish: KROE water-repellent impregnation



Bar - L-shaped element
colour: natural concrete
texture: smooth with convex inscription
finish: KROE water-repellent impregnation

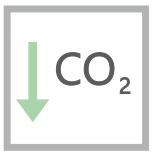
The impact of concrete on the environment

GRC Ecology

In matters of ecology, KROE raises the bar high, giving great care to the protection of natural environment and the ecological responsibility. Application of innovative technologies largely limits noise, dust, and CO2 emission into the environment.
Products made of GRC are completely harmless to the environment, and thus for the health of human beings, which is confirmed by the certificate from the National Institute of Hygiene.

The material in 100% consists of natural raw materials, and is fully suitable for reprocessing which ensures significant reduction of natural resources consumption.

100 % recycling



reduction in
CO2 emission

decrease in
noise emission

natural
components

Hygiene
Certificate

TioCem - Self-cleaning concrete

Photocatalytically active surfaces of concrete developed with use of TioCem cement show reductive action in case of harmful nitrogen oxides NOx, present in the exhaust gases emitted by vehicle engines. Reduction of NOx oxides contained in the air is an important issue because intensive car traffic, by increasing the concentration of nitrogen oxides, intensifies the creation of ozone which, as the main component of urban smog, negatively affects human health. Application of TioCem cement allows the reduction of harmful nitrogen oxides NOx through photochemical and oxidation processes, into harmless nitrate ions. Application of TioCem cement gives concrete surfaces self-cleaning properties because through the occurring processes not only harmful agents present in the air are oxidized, but also dirt covering construction objects with time. In result, almost all organic substances which may appear on concrete surface are subject to degradation, e.g. aerosols, fats, oils, dusts, bird droppings etc.

Self-cleaning of concrete surfaces containing TioCem cement occurs also due to superhydophilic properties of nanocrystalline titanium dioxide. Under UV radiation, moistening angle of TiO2 is reduced almost to zero. This results in water not creating drops on the surface of titanium dioxide, and concrete surface is evenly covered with thin water film which creates slip surface for the removal of impurities.

Service building
Krakow, Poland

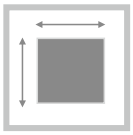
Facade panels
colour: white
texture: Reckli 2/84 MISSOURI pattern
finish: KROE water-repellent impregnation

KROE GRC CONCRETE TECHNICAL SPECIFICATIONS

Cladding elements

Flat panel

Technical specyfications



DIMENSIONS

AxBxC mm - custom order
A- slab length
B- slab width
C- slab thickness

SPECIFIC WEIGHT

1900-2100 kg/m.^{3}

BENDING STRENGTH

5-20 MPa

COMPRESSIVE STRENGTH

40-90 MPa

WATER RESISTANCE

W-1

FIRE RESISTANCE

A1

FROST RESISTANCE

>F50

Visual possibilities

COLOUR
Basic achromatic
Colours on request

TEXTURE
Smooth panel
Air voids

RELIEF
Development of convex or concave
inscriptions/marks/logos
in accordance with design

MOLD
Development of custom designs
in accordance with design
cooperation with RECKLI company

CUTTING THROUGH
Precise cut in the panel
with waterjet technology

SURFACE FINISH
Shine effects/ sandblasting/
corrosion etc.

KROE SPACILIZED IMPREGNATION
Special/water-repellent/colouring/
antigraffiti/

DUMENSIONS TOLERANCE*

Small cladding element	Value	Referred Standard
Dimensions tolerance (class A)	± 2mm	PN-EN 14992:2010
Flatness tolerance (class A)	± 2mm	
Facade cladding	**Value**	**Referred Standard**
Dimensions tolerance (class A: 1,5 – 3,0 m.)	± 5mm	PN-EN 14992:2010
Dimensions tolerance (class A: 3,0 – 6,0 m.)	± 6mm	
Flatness tolerance (class A: 0,2 m between points)	± 2mm	
Flatness tolerance (class A: 3,0 m between points)	± 5mm	

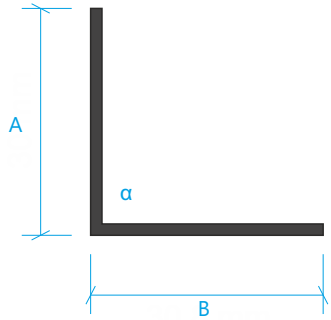
- * Dimensions and their tolerance are agreed upon with the contractor at design stage based on production capabilities and factually necessary dimensions deviations. Should it prove economically reasonable, B class tolerance can be applied, as well as non-standardized tolerances developed in collaboration with the Contractor.

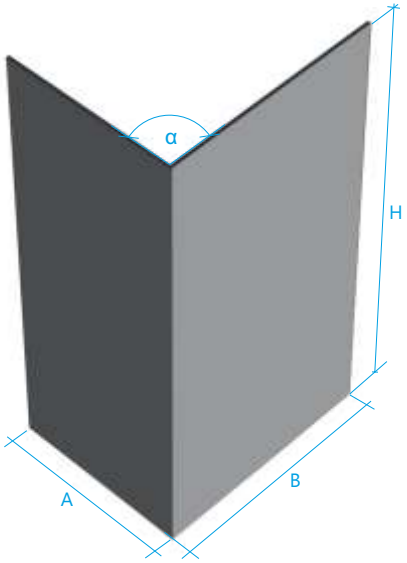
KROE cladding elements

GRC KROE technology provides virtually unlimited capabilities of forming thin-walled cladding elements. These are L and U-shaped elements, corner and arch panels, and custom panels.

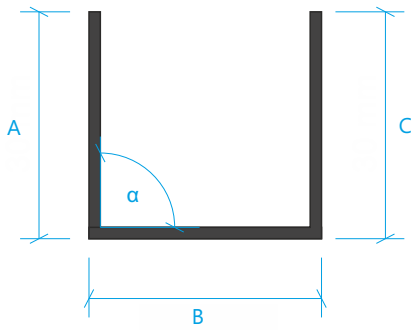
Dimensions of elements must be consulted with KROE at design stage. Below are listed exemplary shapes of cladding elements, possible for manufacture.

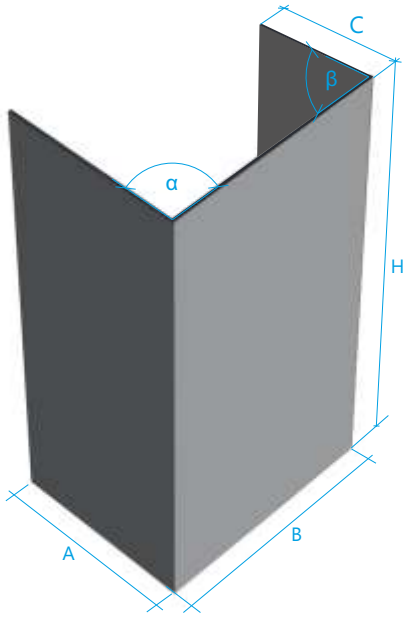
L-shaped element



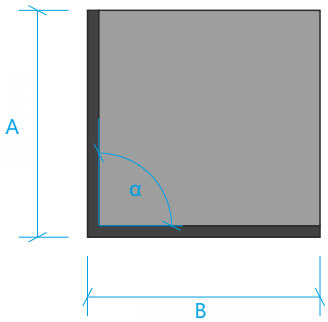


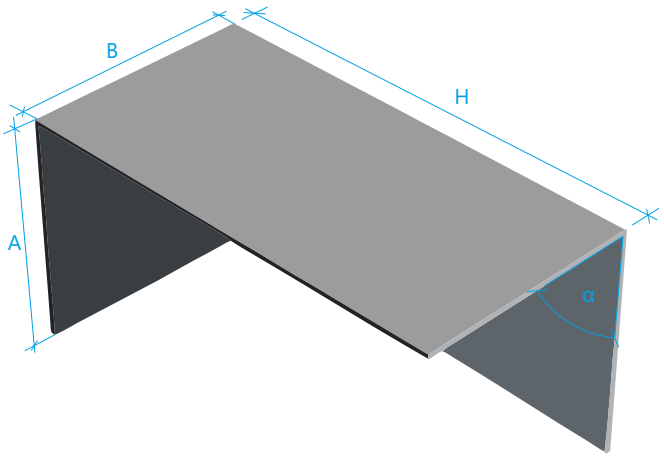
U-shaped element



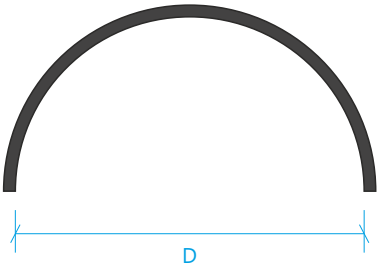


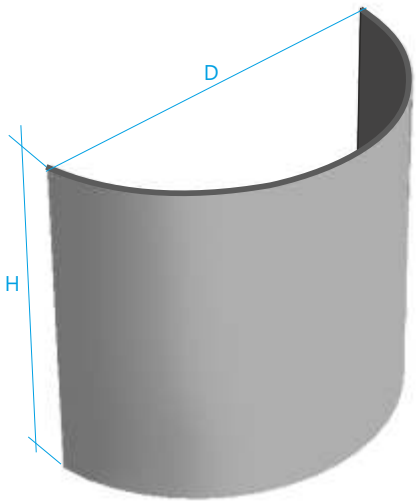
Corner element- 3D



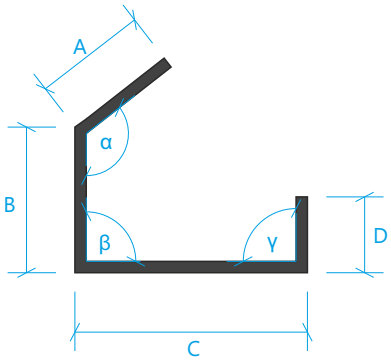


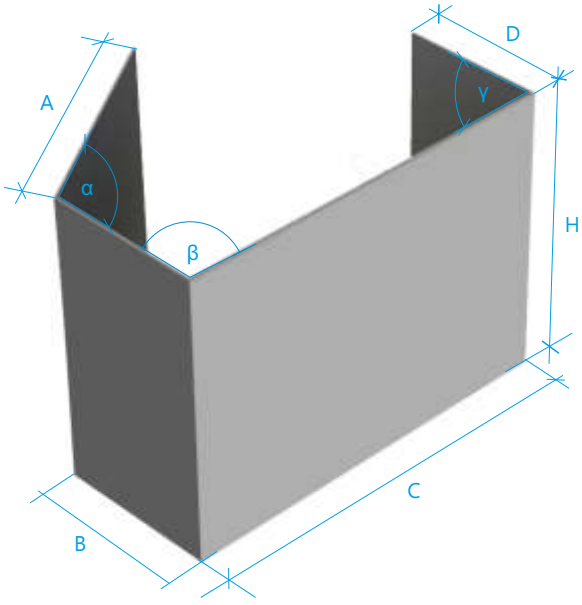
Arch shaped element



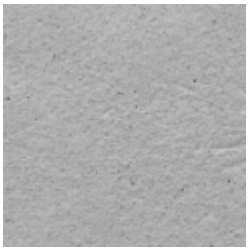


Non-standard element



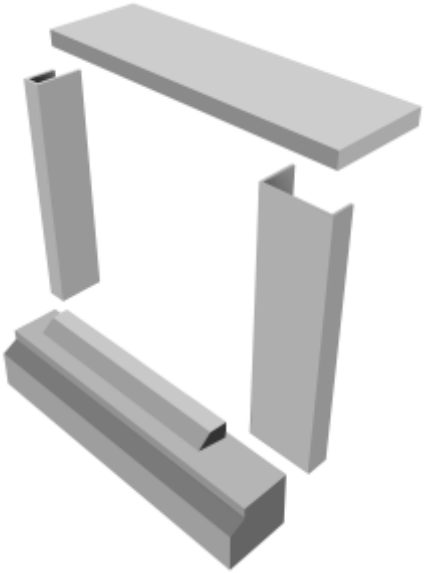


MOXY London Excel Hotel
London, Great Britain

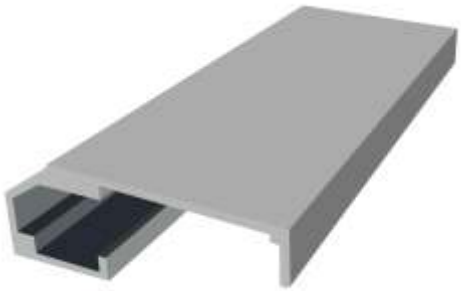


Window frame element
colour: natural concrete
texture: strong sandblasting
finish: KROE water-repellent impregnation

Components of window frame



Concrete elements 3D - roof finish

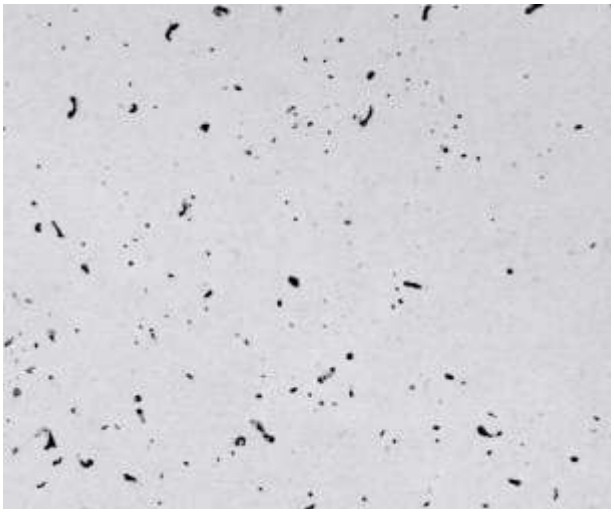


Individualism in creation - surface finish

Texture

Panel texture gives it a unique character. Primary, and naturally obtained two concrete panels textures are smooth panel and irregularly, chaotically situated air voids.

Smooth panel

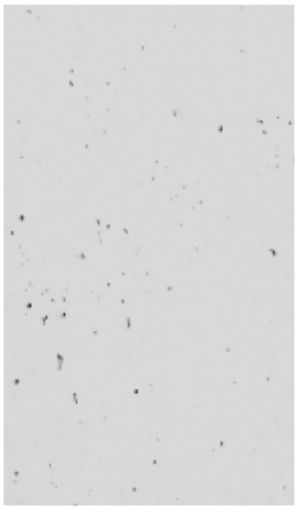


Air voids

Colouring

In their offer, KROE provides enormous palette of achromatic colour shades. From pure titanium white to dark anthracite. The company does not provide set colour pallet. It is possible to obtain virtually any colour of any shade. Colour panels are coloured in their mass using only natural pigments.

White



Natural concrete

Anthracite

Colour

Relief

KROE holds modern devices that allow developing any relief - logo, inscription, drawing - on concrete surface. Relief serves decorating both flat panels, as well as 3D elements. The technology allows to obtain unique visual effects.

Convex letters

Convace letters

Cutting through / cutting out shape

Cutting through / cutting out shape - cutting out in the panels inscriptions, marks, patters is performed with precise, computer-controlled water cutter. WaterJet is also used for cutting the panels to any form.

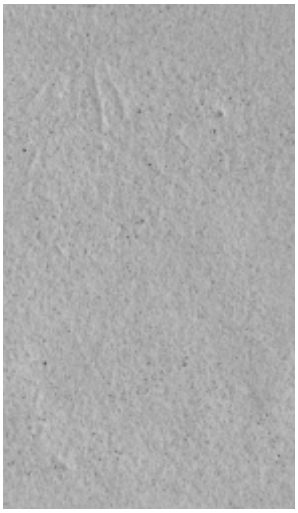
Cutting out letters/shapes

Individualism in creation - surface finish

Surface finish - mechanical

Mechanical surface finish is among others sandblasting, polishing, and corrosion effects.
Each of these treatments can be performed with different intensity - from light to very strong effect.

Light sandblasting



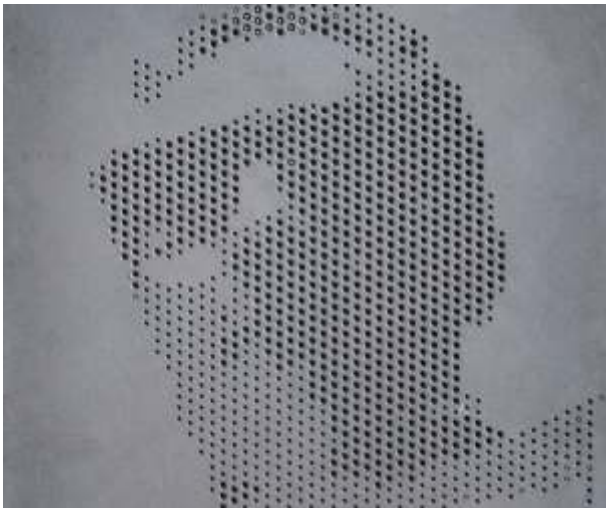
Strong sandblasting

Polishing

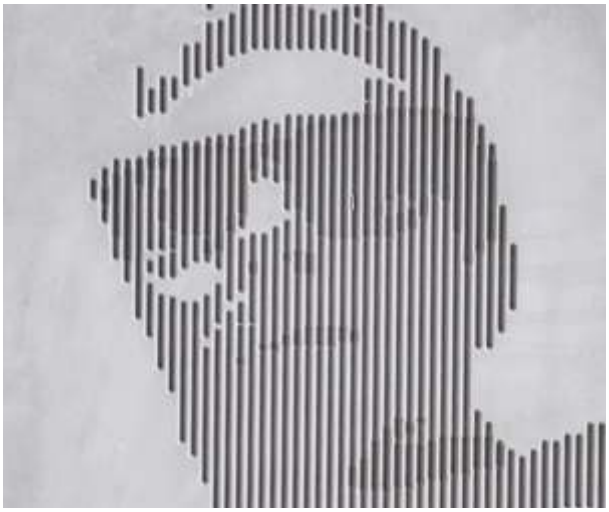
Corrosion

Photo concrete

Technique consisting of transferring two-dimensional image on concrete panel in 3d form. Any image (a person/landscape) is individually developed based on customer's photograph. The structure in a mold of vertical lines can be freely scaled and adjusted to ordered mold.



Cones



Lines

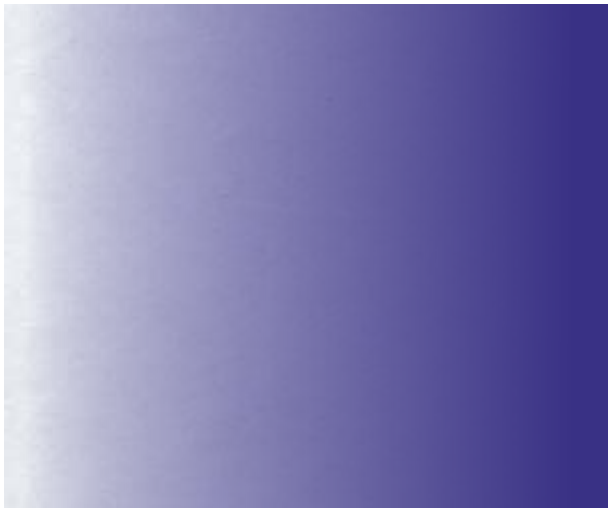
KROE specialized impregnation

In order to preserve colour durability and surface protection, we recommend the impregnation of our GRC concrete products with cutting-edge impregnation agents based on nano and micro particles that penetrate deeply inside the product. Types of applied impregnation: standard hydrophobization, antigraffiti, translusent impregnation (transparent), dirt-protection surfaces, siliceous sealing impregnation.

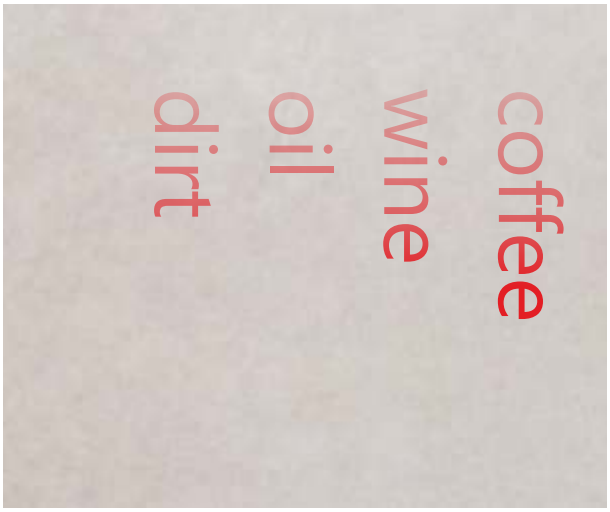
KROE water -reppalent impregnation

Antigraffiti

Thanks to many years of work of our laboratory engineers, we were able to develop impregnation technology that allows protection of our products against dirt and moisture absorption.
Special acrylic coatings, epoxy, polyurethane and ceramic, applied in proper order and set number of layers provide resistance to coffee stains, wine, oil, sauces, etc., while not affecting the appearance and nature of concrete element. All that is needed to remove the dirt is cloth and water. Elements impregnated this way can be used in kitchen as tops and tables, integrated sinks, shower cabinets, etc.



KROE colouring impregnation

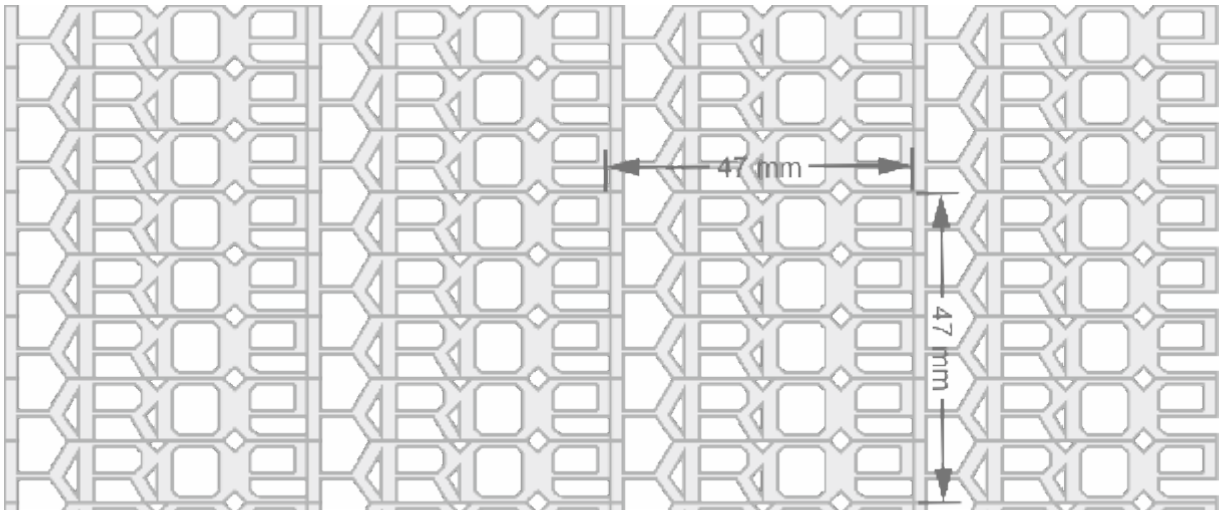


KROE specialized impregnation

Individualism in creation - surface finish

Custom-made molds in accordance with individual design

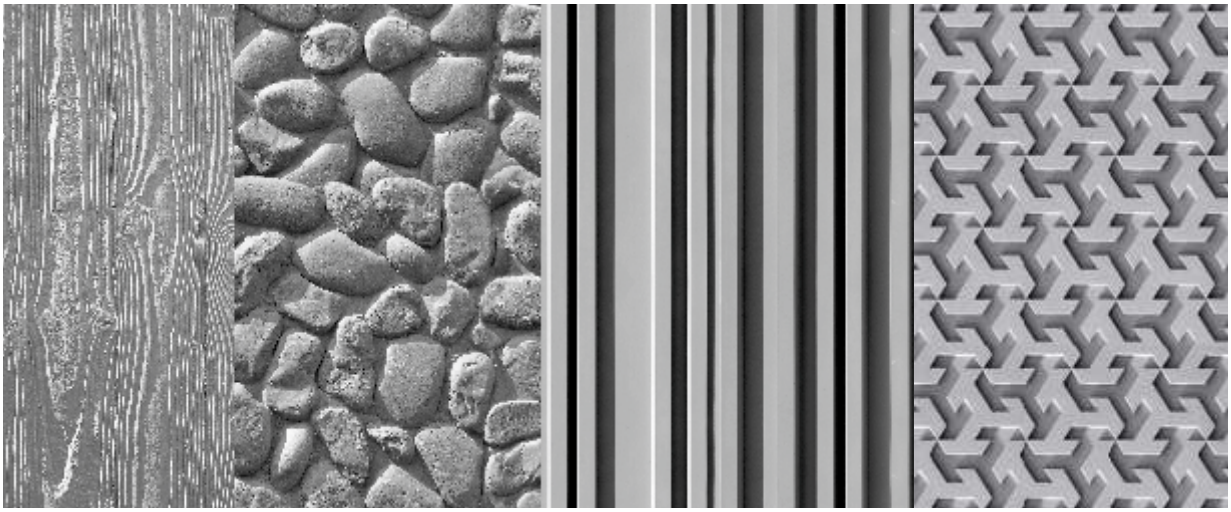
3D matrices are custom-made based on design consisting of technical drawings. KROE - manufactured molds are made of elastic, reusable material.



Custom mold design

Reckli - molds manufacturer

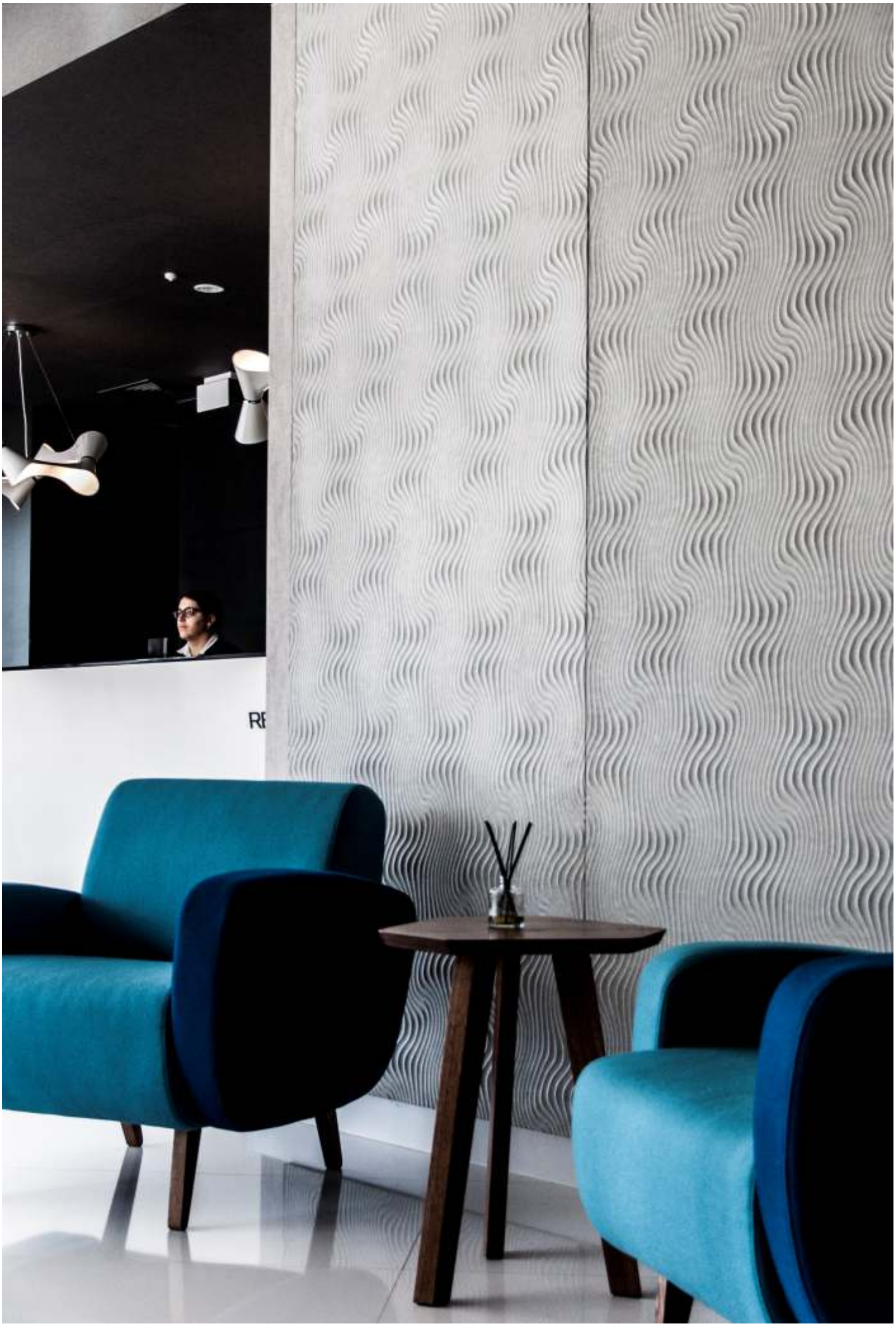
KROE cooperates with RECKLI company that offers a wide selection of ready-to-use molds for shaping concrete surfaces.



Exemplary patterns

Hotel Harnaś
Bukowina Tatrzańska, Poland

GRC KROE panels
colour: natural concrete
texture: Reckli 2/602 SAÔNE pattern
finish: KROE water-repellent impregnation



ASTORIA office building
Warsaw, Poland

Facade panels
colour: dark anthracite
texture: Reckli 1/173 THUR pattern
air voids

finish: KROE colouring impregnation
antigraffiti

FIXING

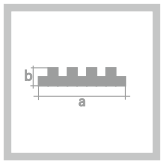
Fixing general rules for designing ventilated facade

During the design of ventilated facade made of GRC KROE concrete, a couple of particularly important issues should be considered that may affect the production process (time, accuracy, economics)

Read the material characteristics chart.

Remember about the time required for: preparation of samples for acceptance, selection of reference sample, indication of method and fixing system, production, curing, packing, and transport.

In order to facilitate and speed up the production process, possibly repeatable elevation elements should be designed. It allows facilitating the production, fixing, and transport.

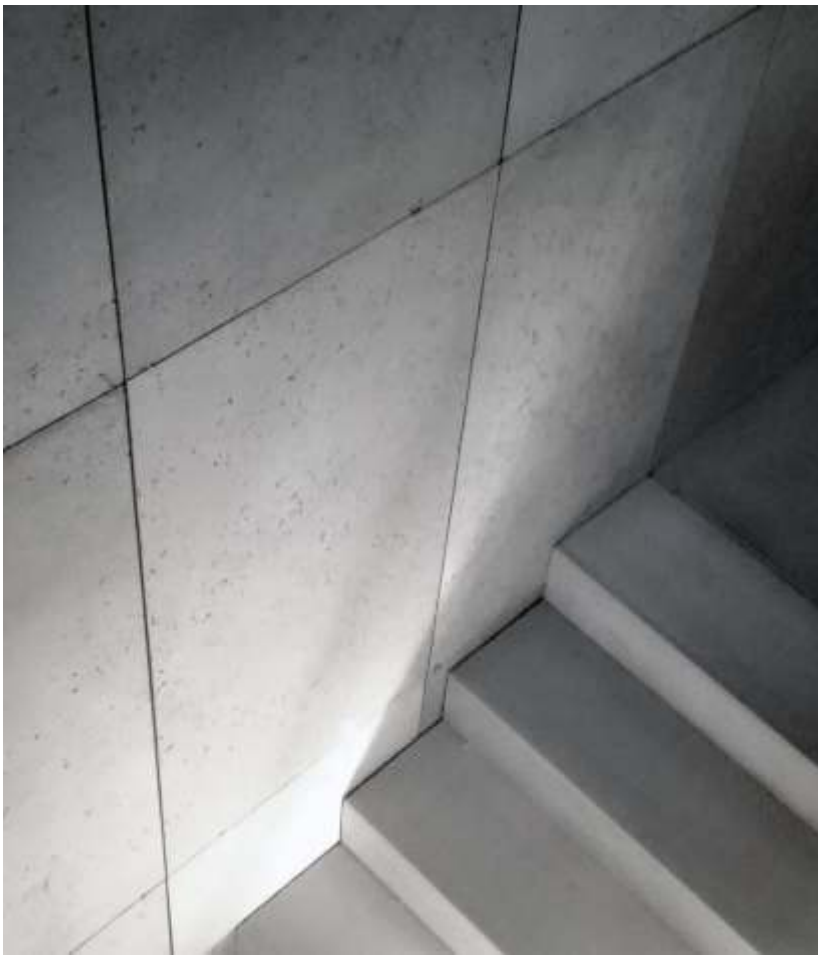


In case of designing panels with pattern reflection, molds dimensions should be considered, as well as the effect created from joining to neighbouring panles in regard to texture continuity.

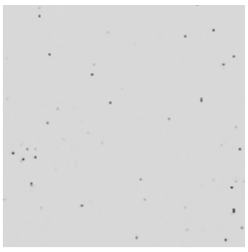
During the fixing, it is necessary to maintain dilatation voids between the panels. Depending on the design from 3 to 12 mm.

Each elevation must have individual fixing construction design, developed and signed by authorized persons.

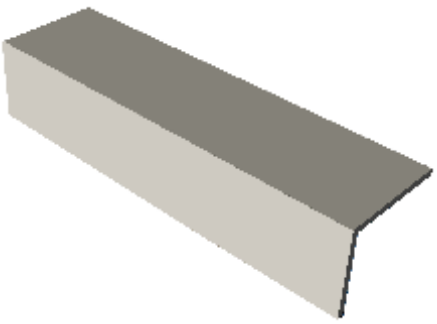
It is best to consult all technical aspects with KROE that will provide possible and best solutions: **info@kroe.eu**



Staircase
Krakow, Poland



KROE concrete panels
colour: natural concrete
texture: air voids
finish: KROE water-repellent impregnation



Concrete panels
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

Selection of fixing system

Selection of the type of fixing system should be defined by the elevation designer. In case of selection of mechanical fixing, the placing and number of mechanical connectors used for panel fixing with the substructure should be indicated in elevation technical designed, developed for specific construction object, depending on present loads and the condition and the type of surface on which the fixing elements are mounted. Each facade must have individual fixing construction design, developed and signed by authorized persons.

GRC KROE products, depending on their purpose, may be manufactured in such way as to obtain different material utility features. The following table compares characteristic parameters necessary for architects / construction engineers in selecting proper fixing systems.

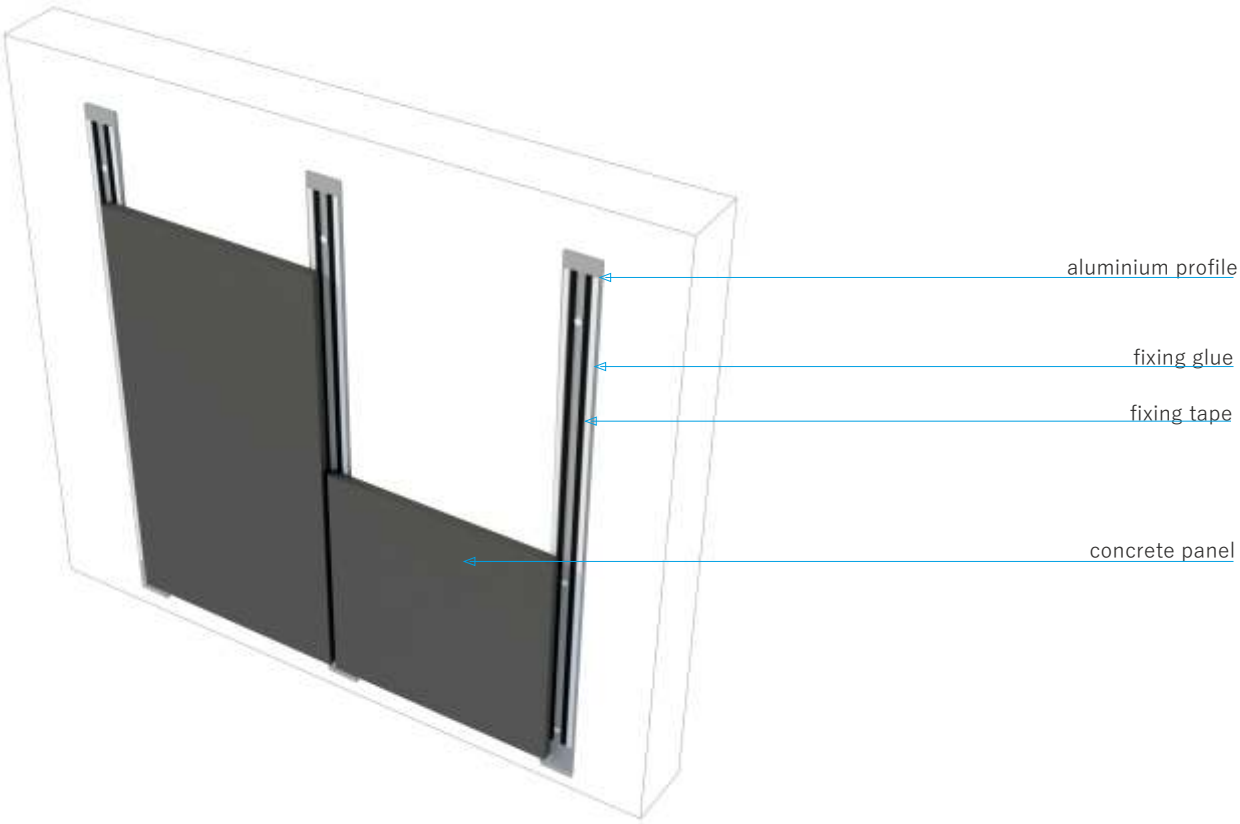
Production technology	Specific weight [kg/m3]	Limit of proportionality LOP [MPa]	Modulus of repture MOR [MPa]	Compressive strength [MPa]
Premix	1900-2100	> 3	> 5	> 40
Normal Spray		> 6	> 10	> 60
Superior Spray		> 7	> 18	> 50

Production technology	Water absorption [% m.]	Fire resistance	Water resistance	Frost resistance
Premix	7-13	class W-1	class A1	class > F50
Normal Spray				
Superior Spray				

Fixing system in interiors

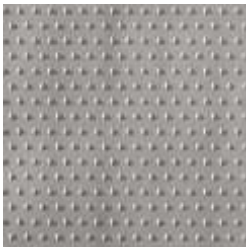
Adhesive system on aluminium substructure

KROE concrete panels are fixing on vertical substructure elements (aluminium profiles) with modern adhesive system, holding all necessary certifications. It is a more secure and the only interior system recommended by KROE, applied also outdoors, in case of no necessity of wall insulation.

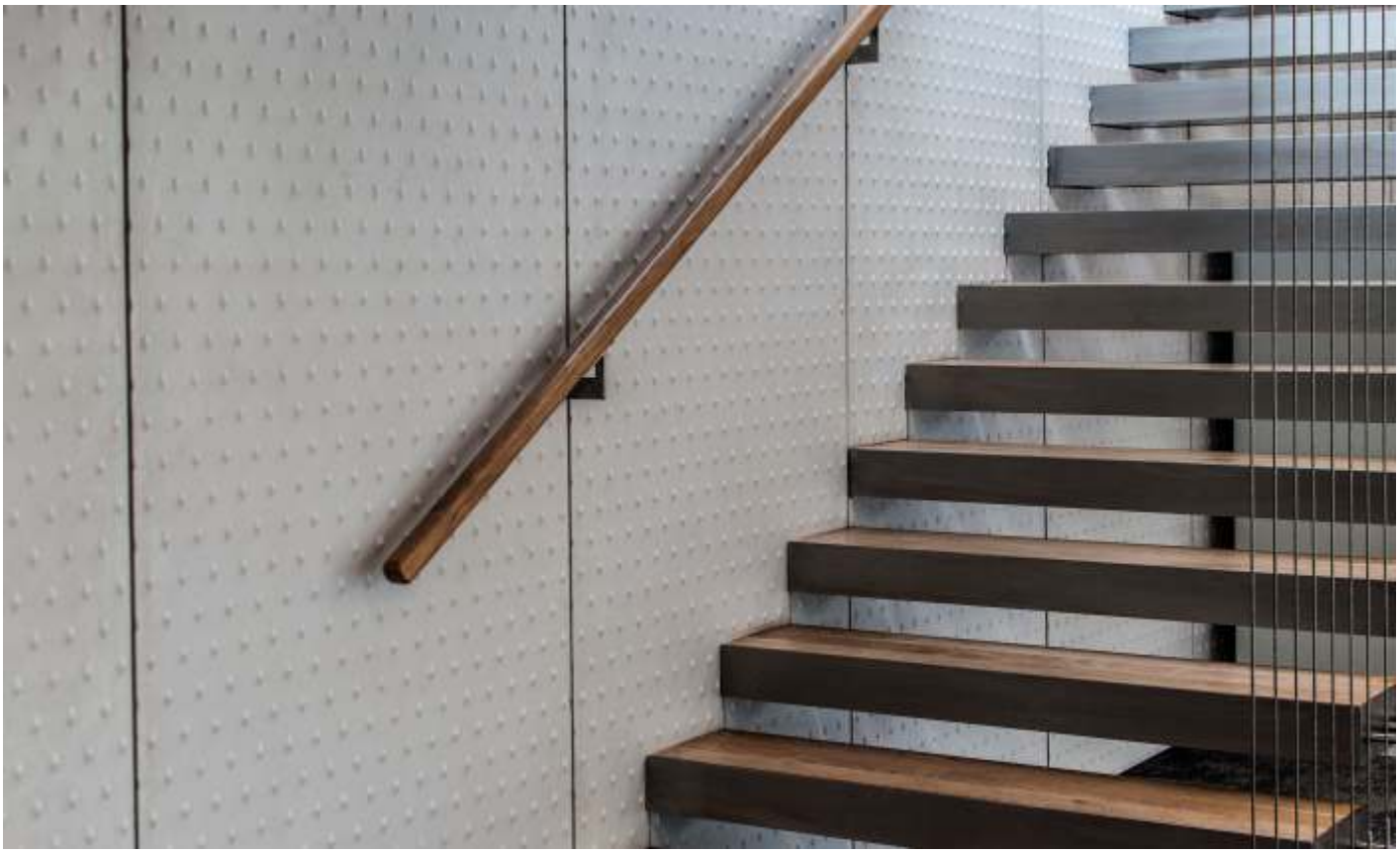


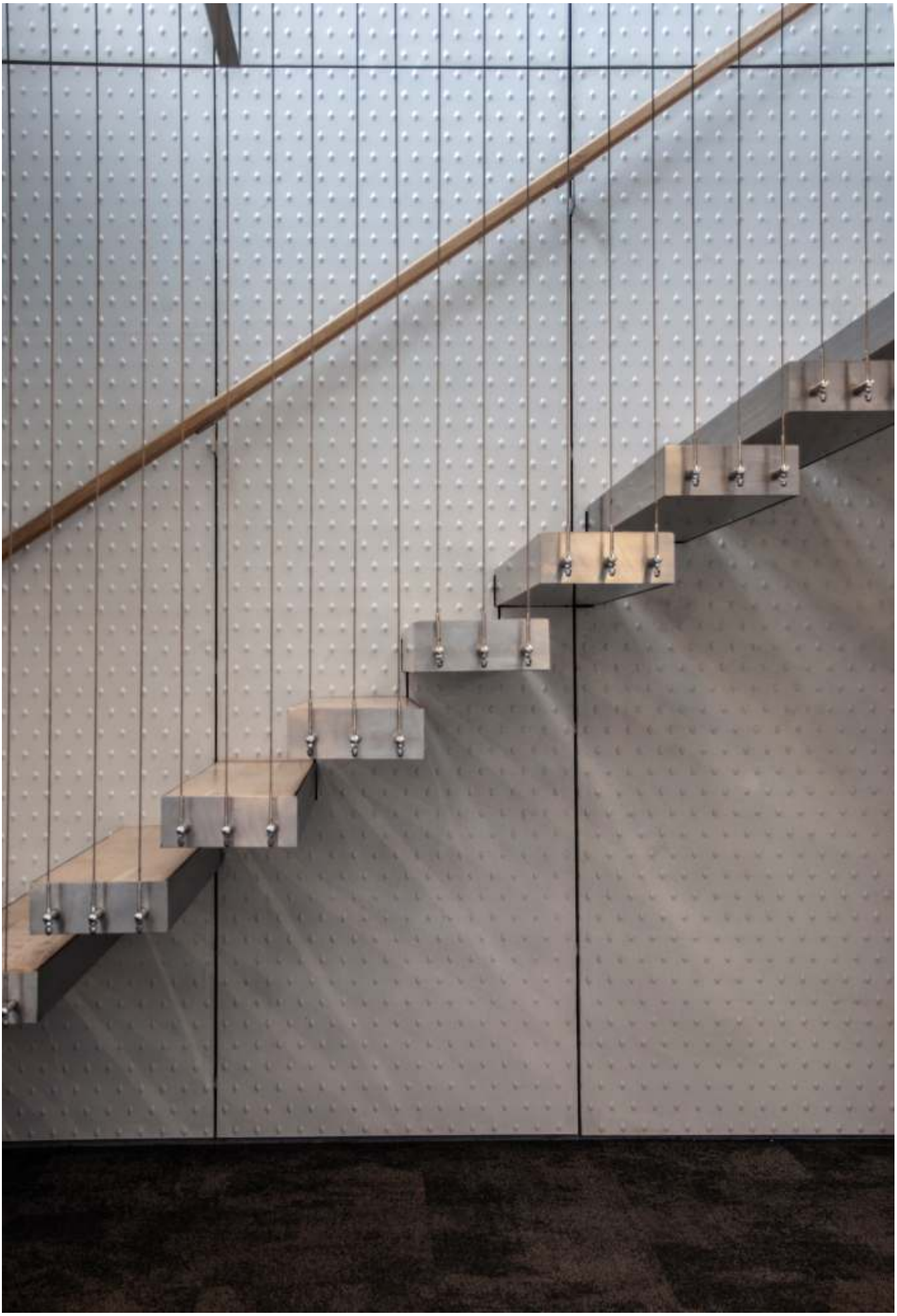
- KROE recommends simplified fixing system for indoor application.
- Panel is glued to a wall levelled with aluminium flat bar, with agents provided by KROE.
- Specific instructions are available together with KROE products when ordering adhesive system.

FUX Advertising Agency
Gliwice, Poland



GRC KROE panels
colour: natural concrete
texture: Reckli 2/174 BREISGAU pattern
finish: KROE water-repellent impregnation





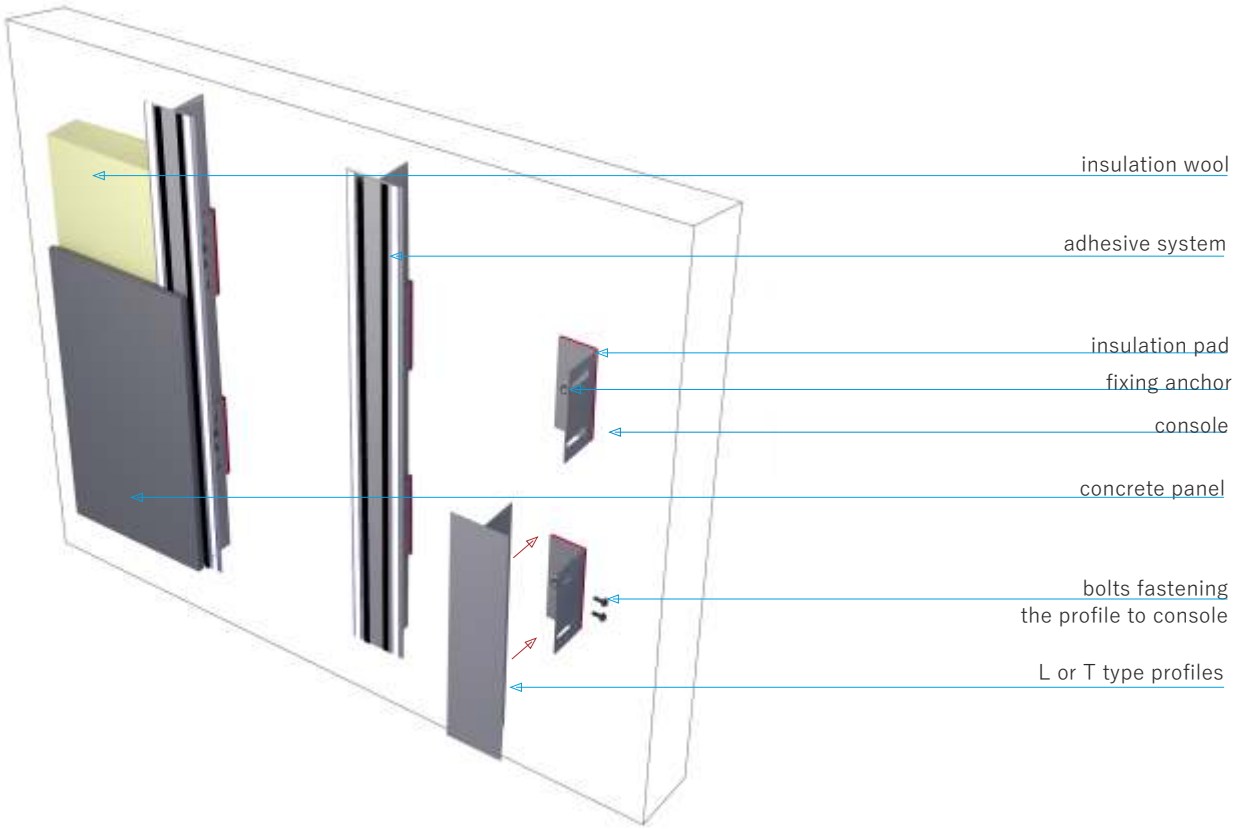
Panels fixing system on ventilated facades

The concept of facade ventilation consists of leaving an air void between elevation panels and building insulation elements.

The system consists of fittings and profiles - aluminium or stainless steel - which together create a rack that is mounted to the building wall, between which the insulation material is inserted.
Each investment should have an individual fixing system design. KROE can develop substructure fixing design, as well as provide complete fixing system.

Fixing methods can vary significantly or slightly. Selection of fixing system depends on constructor's and/or investor's decision.

Fixing with non-visible method - gluing

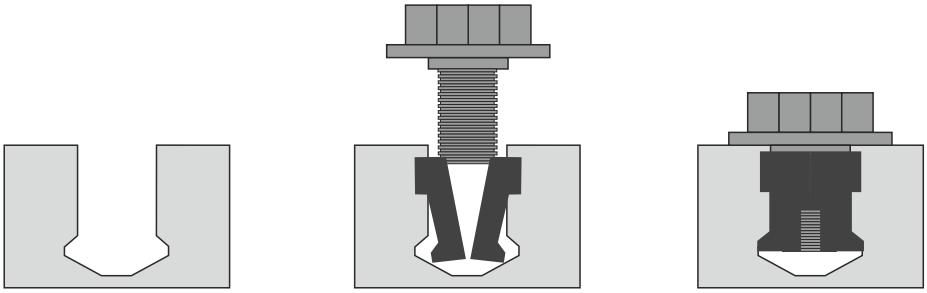


- It is one of the most often applied and KROE-recommended fixing system for GRC panels.
- Substructure consists of anchoring elements which are installed on building supporting wall - fixing consoles which ensure space for insulation, and vertically levelled T or L - shaped profiles consisting fixing space for elevation panels.
- The idea is the same as in case of gluing the panels on aluminium profiles indoors

.

- The facade fixing in this system should be carried out in temperature from +5 to +35° C and air humidity below 75%.

Fixing with non-visible method - mechanical system



drilling a hole on panel rear side

seating the fixing pin

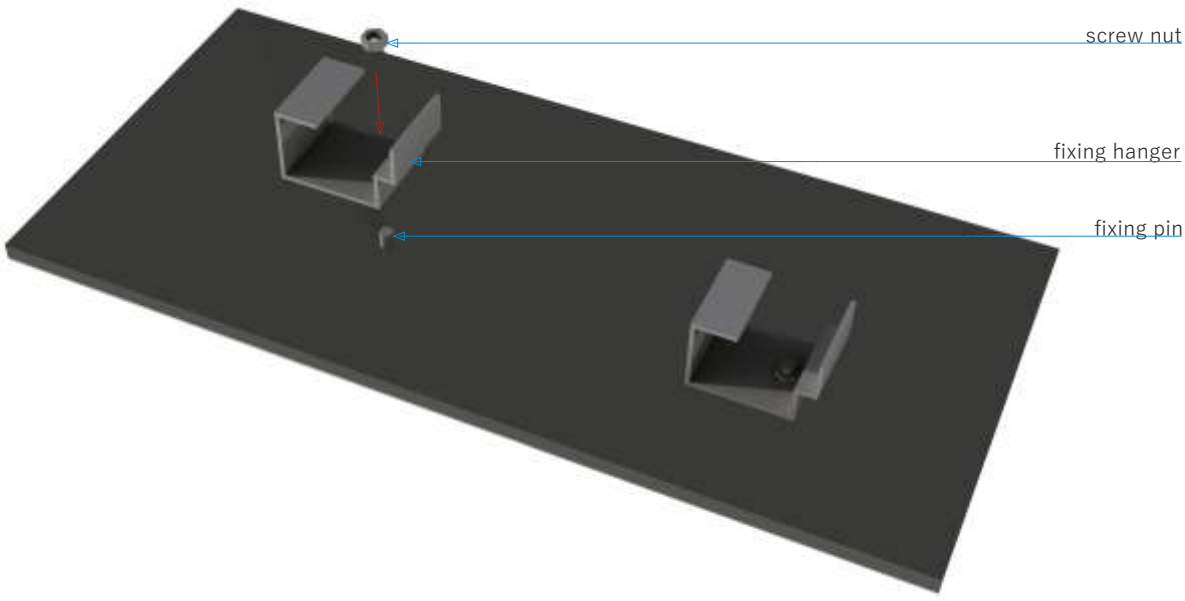
screwing the bolt

The idea of the mechanical system

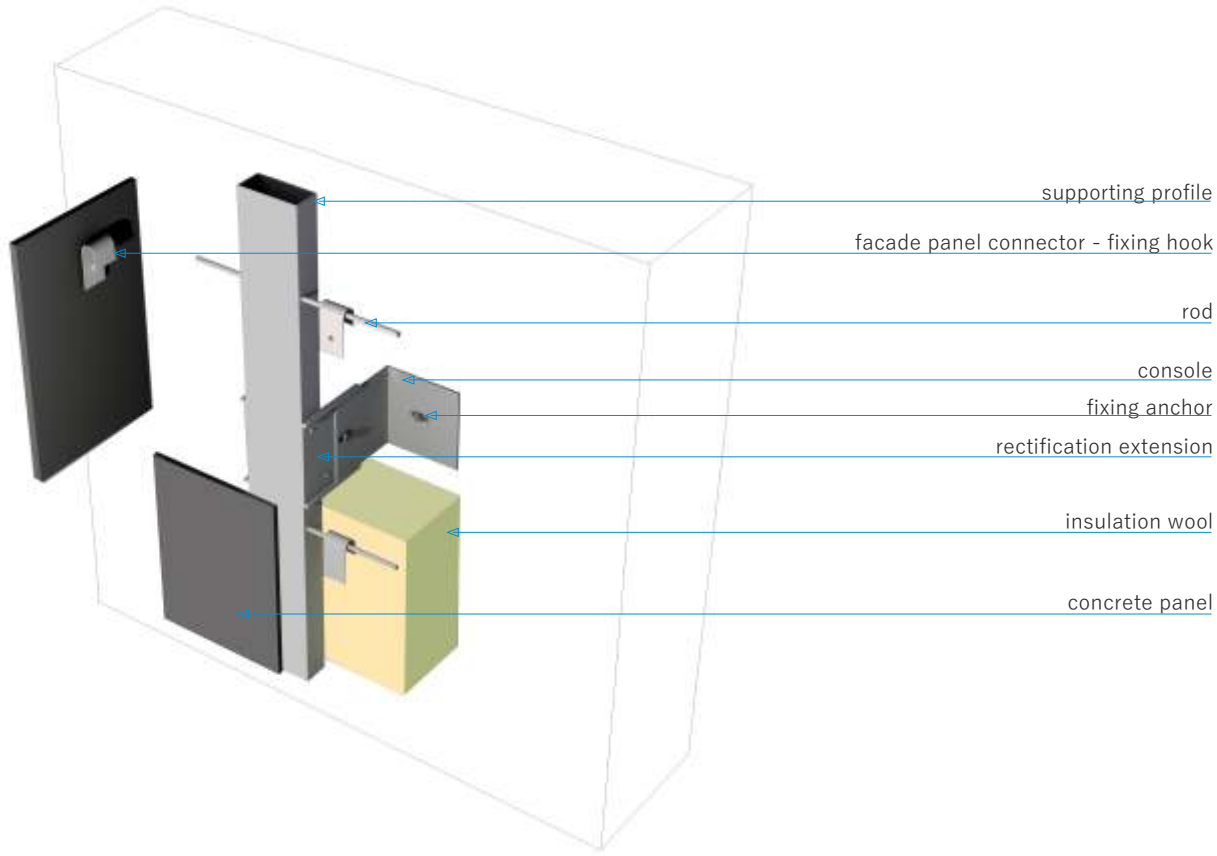
On the rear side of the slab holes are drilled with undercutting. Special fixing pins are inserted into the hole. The placing of pins on the panel must be calculated by constructor engineer and adjusted to selected fixing system and panel size and parameters.

Application of mechanical system

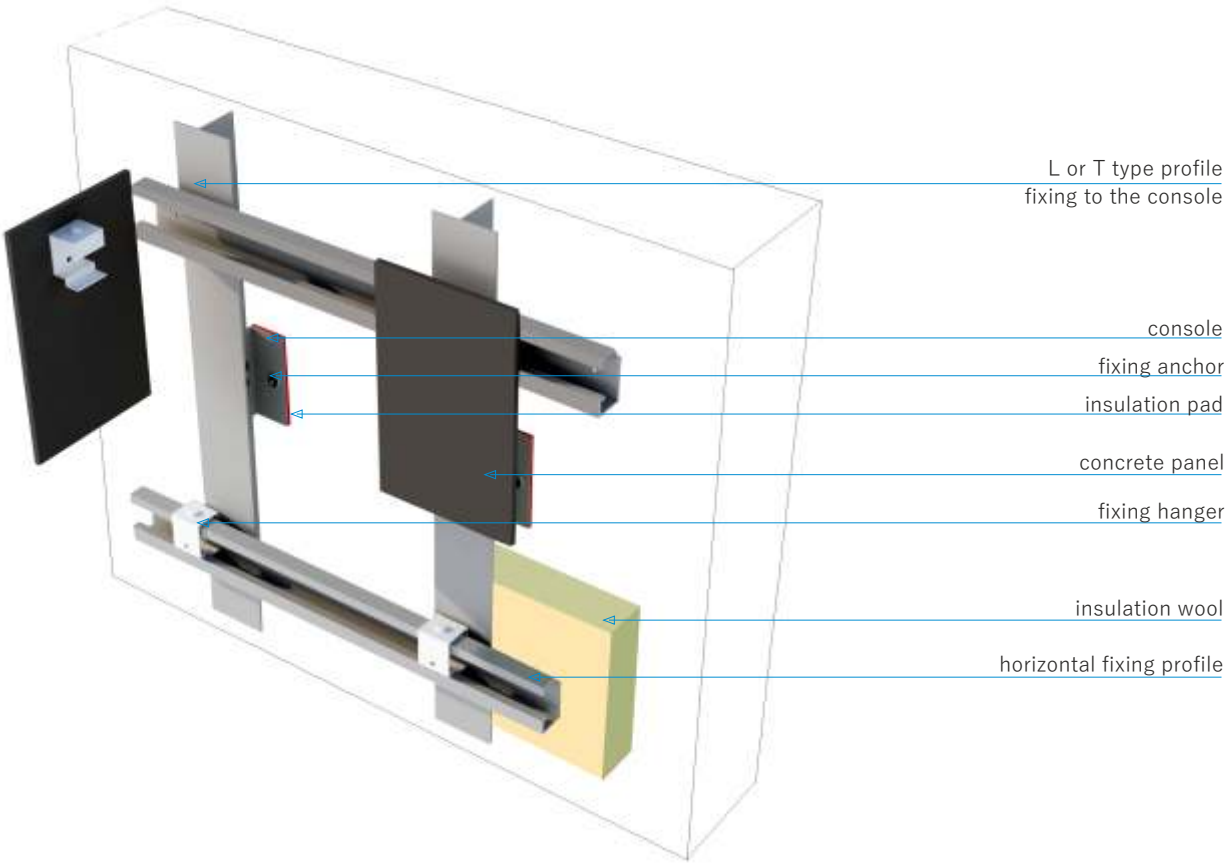
- Depending on the needs, partial fixing can be performed both at the construction site or at the production hall.
- Seating the fixing pin in concrete panel allows large flexibility in the selection of fixing system of world leading fixing system manufacturers (e.g. hooks, lanyards)
- The advantage of this system is easy fixing and disassembly that can be performed regardless of weather and temperature conditions (possibility of fixing during winter).



Exemplary panels fixing in non-visible system - fixing hook

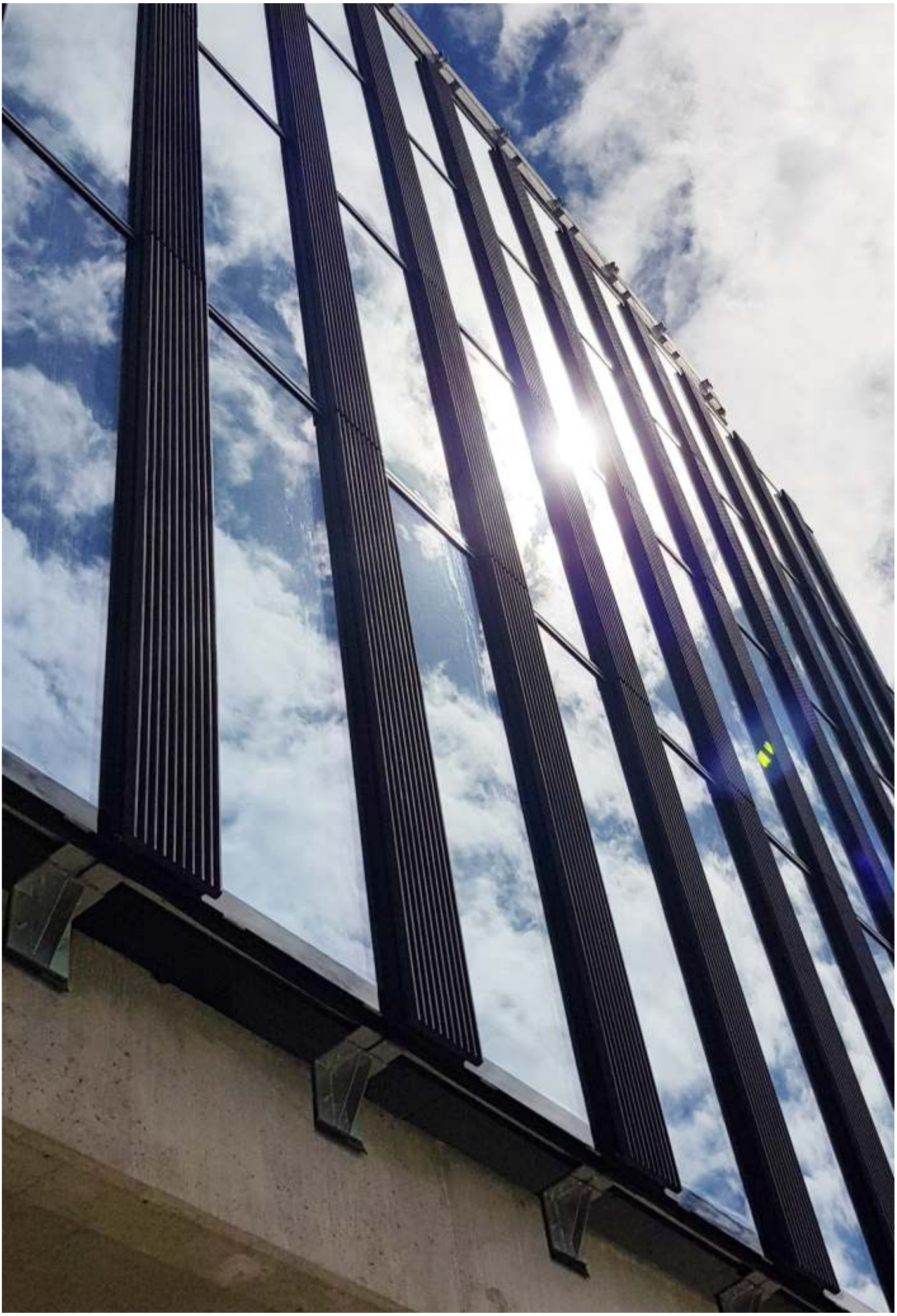


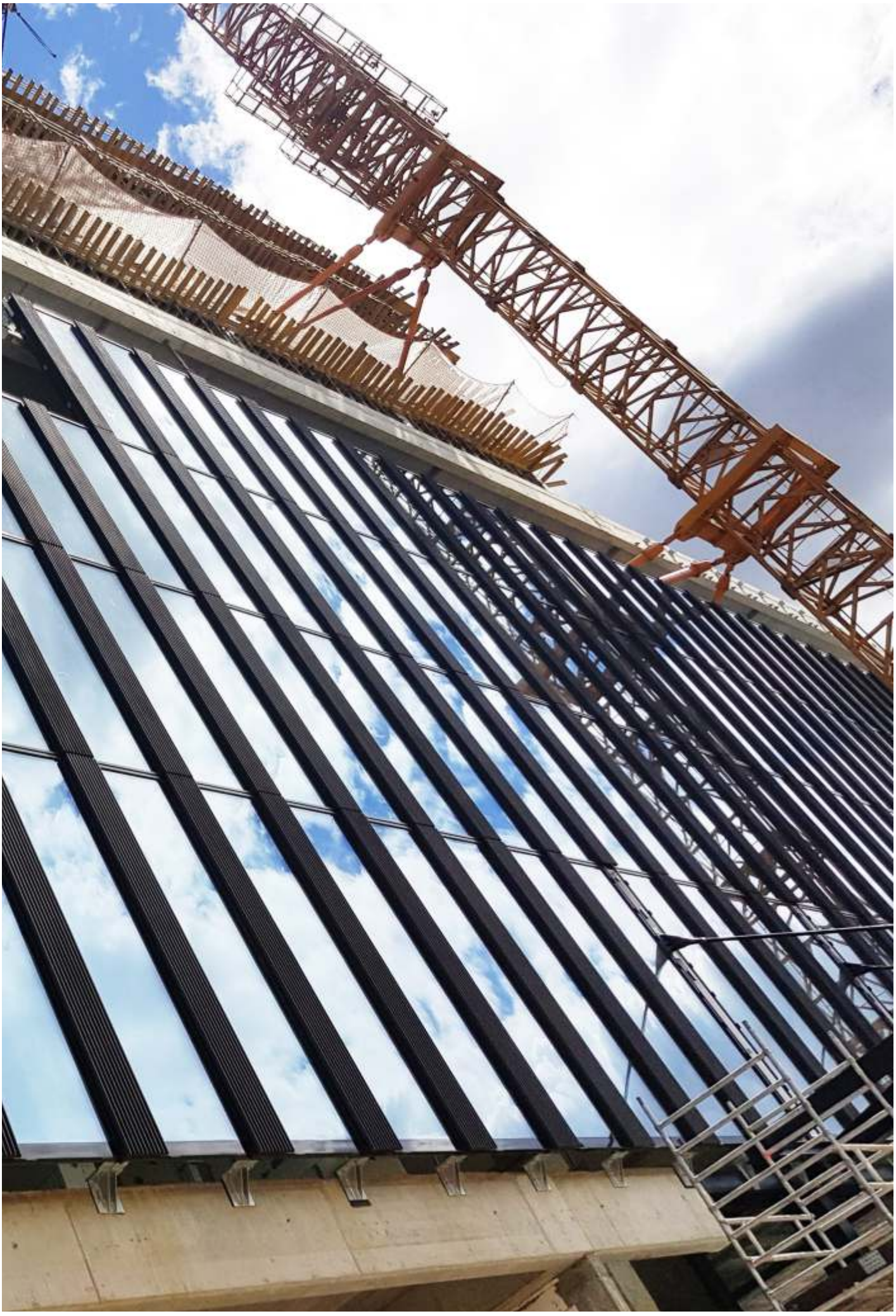
Exemplary panels fixing in non-visible system - hanger fixing on horizontal profile



KTW office building
Katowice, Poland

Facade panels
colour: dark anthracite
texture: individual pattern design - medusa group
finish: KROE specialist colouring impregnation





RULES OF CONDUCT AT CONSTRUCTION SITE

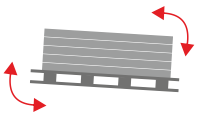
Transport

KROE concrete panels are properly secured and transported on special pallets.

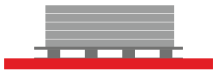
Panel edges are secured during transport, during unloading proper security of products must be assured.

Large panels must be transported with lift truck so the distribution of load is even. Excessive pallet bending may cause damage to elements.

Avoid vibrations during pallet manipulation. Pallets must be lifted one at a time and with proper care.



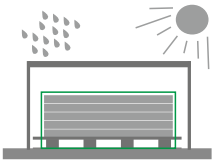
Storage and warehousing



Make sure that the pallets will be seated on even, levelled, and paved surface.

It is forbidden to stack the pallets vertically, leaning one against another.

At the construction site, proper location for panels storage should be provided, ensuring maximally dry storage conditions.



Manufacturer’s packaging does not provide 100% protection against weather conditions. Make sure to additionally secure the panels with construction foil. Manufacturer's packaging should be removed shortly before mounting the panels.

Treatments possible during and after fixing

KROE panels are impregnated. Do not independently apply any chemical cleaning agents nor any additional impregnating agents without manufacturer’s guidelines.

Periodical panels cleaning and maintenance after mounting is recommended within 2-5 years, unless the conditions and risk of panels getting dirty require different frequency.

Any independent treatments connected with processing - such as cutting, drilling, should be consulted with the manufacturer.

Repairing minor defects

Should despite all and any precautions, the panel will be damaged by tearing off its small fragment, contact the manufacturer and ask them to prepare and send repair primer together with instruction manual.

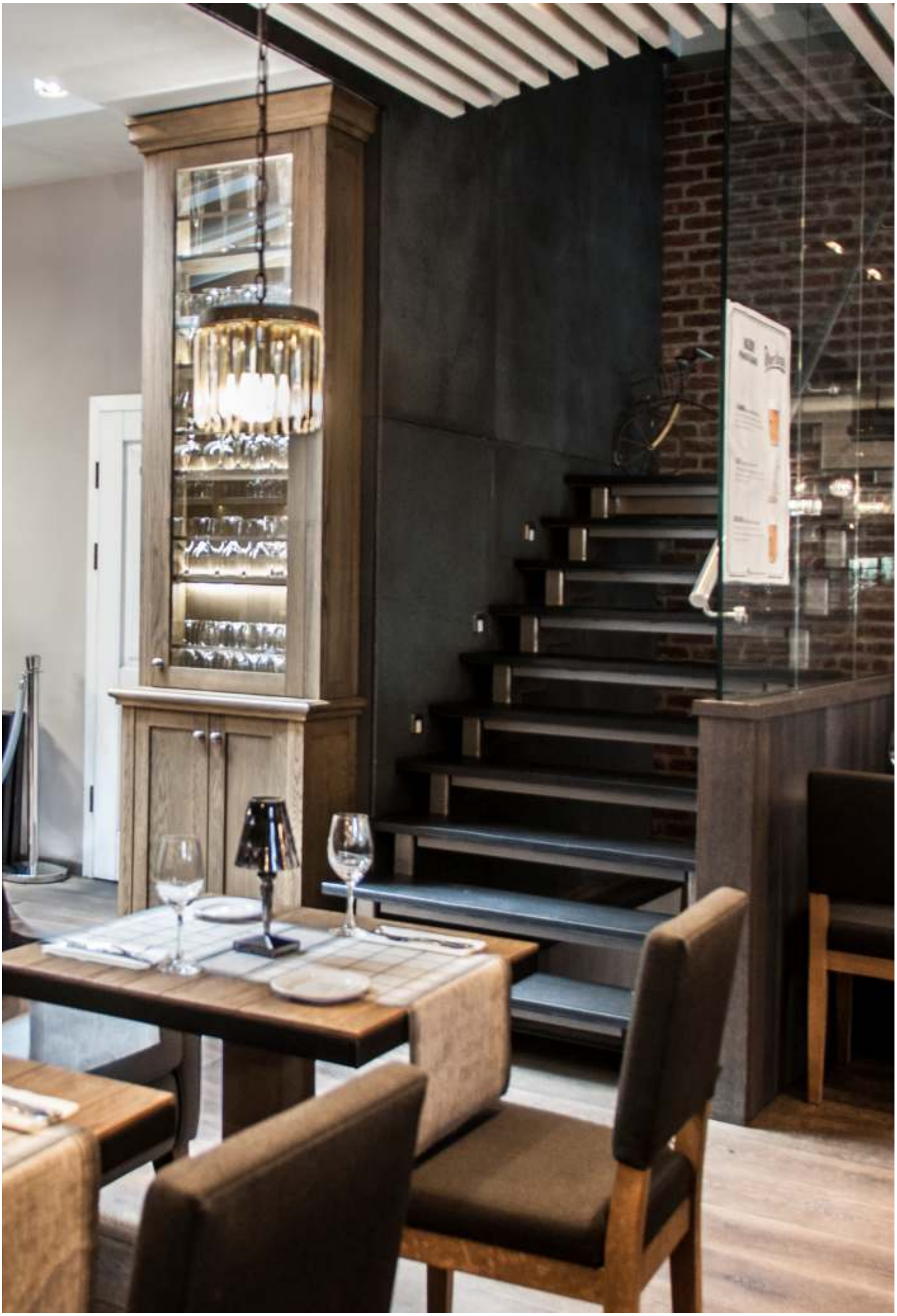
INTERIORS

KROE concrete products perfectly fit modern interior designs.
Each element is manufactured in accordance with individual design.

KROE manufactures wall panels with corner elements dedicated for interiors, waterproof and water-protective panels for bathrooms, monolithic stair treads, table tops and tables secured with specialist KROE impregnation which provides 100% protection against liquids, dirt, or oils that may penetrate material's structure.

MIODOVA Restaurant
Krakow, Poland

GRC KROE panels
colour: anthracite
texture: air voids
finish: KROE water-repellent impregnation



Private apartment
Krakow, Poland

Cabinet fronts
colour: anthracite
texture: smooth panel
finish: KROE water-repellent impregnation

Monolithic table top with openings for kitchen appliances
colour: anthracite
texture: smooth panel
finish: KROE specialist impregnation

Table top with integrated sink
colour: anthracite
texture: smooth panel
finish: KROE specialist impregnation

Stary Hotel
Krakow, Poland

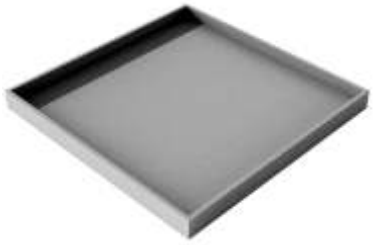
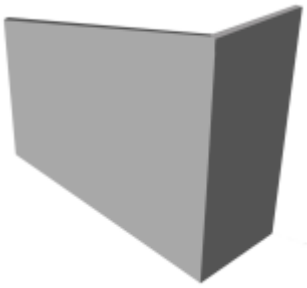


Table tops - element with thickened rants
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

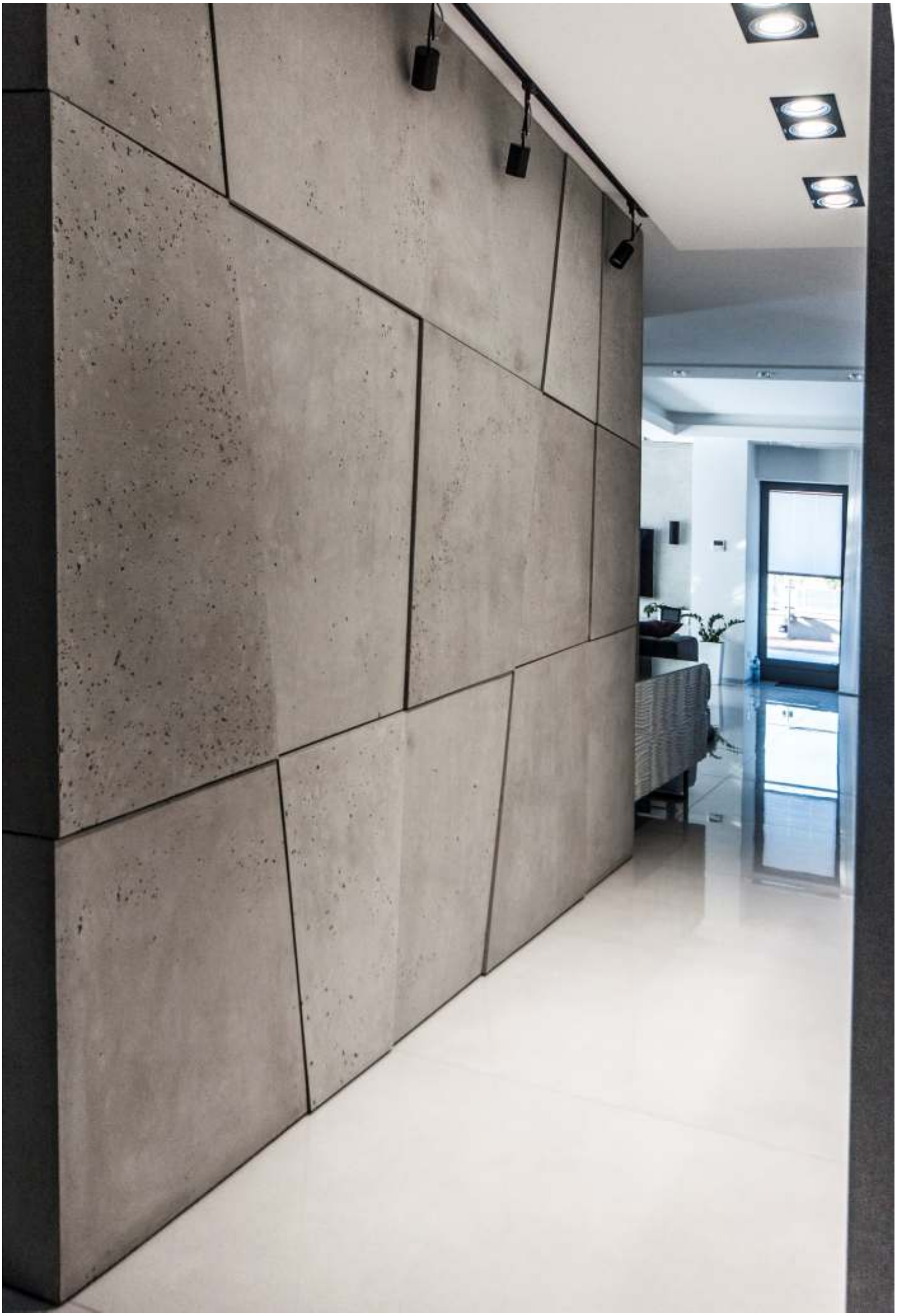
Semisphere lamp with tube
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

Private apartment
Krakow, Poland

GRC KROE panels
colour: natural concrete
texture: air voids
finish: KROE water-repellent impregnation



3D mosaic with corner elements
colour: natural concrete
texture: air voids
finish: KROE water-repellent impregnation



Private apartment
Krakow, Poland

GRC KROE panels
colour: anthracite
texture: polished
finish: KROE water-repellent impregnation

Semisphere lamp
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

Table top with integrated sink
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

GRC KROE bathroom panels
colour: natural concrete
texture: smooth panel
finish: KROE specialist impregnation

ORDER REALIZATION PROCESS

Request of offer to info@kroe.eu
Request of offer is best to be sent in written form and, provided such is possible, with drawing. Please remember about the contact data.

Selection of solutions - offer
After making ourselves familiar with the request we will check the possibility of order realization. We propose the best method of realization - we select the mold, concrete mixture, and the technology. We make our best efforts for the offer to reach you not alter than within 7 days.

Order
If the offer proves to meet your requirements, we officially accept the order by e-mail and send you back the confirmation of your order. In case of large investments, a meeting is necessary in order to accept samples.

Realization
Realization period depends on element's degree of complexity and the size of the order. Please also note the period necessary for the preparation of molds, production, curing, final processing, packing, and transport.

Quality Control
Manufactured elements are subject to additional FPC quality control. Each element ready for transport is marked numerically and is registered in our database.

Packaging and transport
Manufactured elements will be packed on prepared and marked pallets, and then transported to the construction site.

Contact

KROE Sp z o.o.
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POLAND

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