

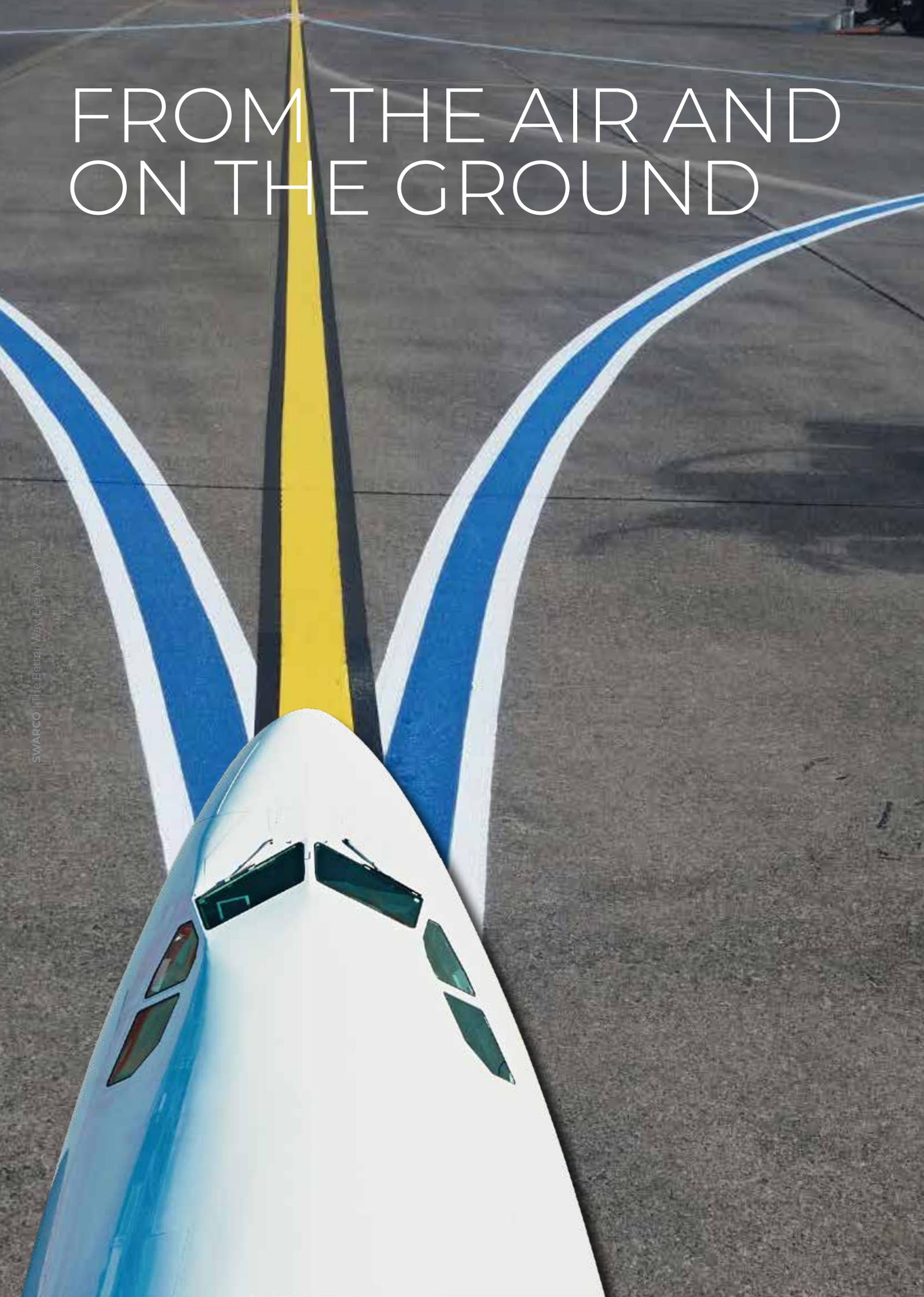
SAFETY AND ORIENTATION AT AIRPORTS



SWARCO | The Better Way. Every Day.

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Road Marking Systems

FROM THE AIR AND ON THE GROUND



On the safe side - worldwide

The use of glass beads for airport markings is recommended by several institutions. This increases the visibility of runways, taxiways and aprons significantly. These glass beads are designed to direct the light back to its source. This is a considerable safety improvement as it enables faster orientation, especially in poor lighting or adverse weather conditions.

Studies by the USACE (US Army Corps of Engineers), the FAA's (Federal Aviation Administration) Airport Safety Technology Research and Development team and the IPRF (Innovative Pavement Research Foundation) analyzed the retroreflective performance of markings with different glass beads.* These analyses revealed that type III glass beads have higher retroreflective values than type I glass beads. They have a higher refractive index than low-index beads, reflect more light, thus making markings more visible.

As per US Federal Specification TT-B-1325, there are three types of glass beads suitable for airports. These three types differ in glass composition, size, refractive index and retroreflection.

Specification TT-B-1325



The only difference between type I and IV beads is their size, which also influences their retroreflective values. Type I beads reach up to 400 mcd/m²·lx. Type IV glass beads are larger than type I beads, with retroreflective values reaching up to 600 mcd/m²·lx. Type III glass beads are high-index beads. These have better optical properties and significantly higher retroreflective values of up to 1500 mcd/m²·lx because they are made from special high-grade glass.

* Sources: ERDC/GSL TR-07-20, A Comparative Field Study of PermaStripe™ Polymer Concrete and Waterborne Airfield Pavement Markings, June 2007, John K. Newman, Ph.D. DOT/FAA/AR-TN-05/43, Adsil Glass Coating Study, September 2005, Holly M. Cyrus

PLUS9 BEADS

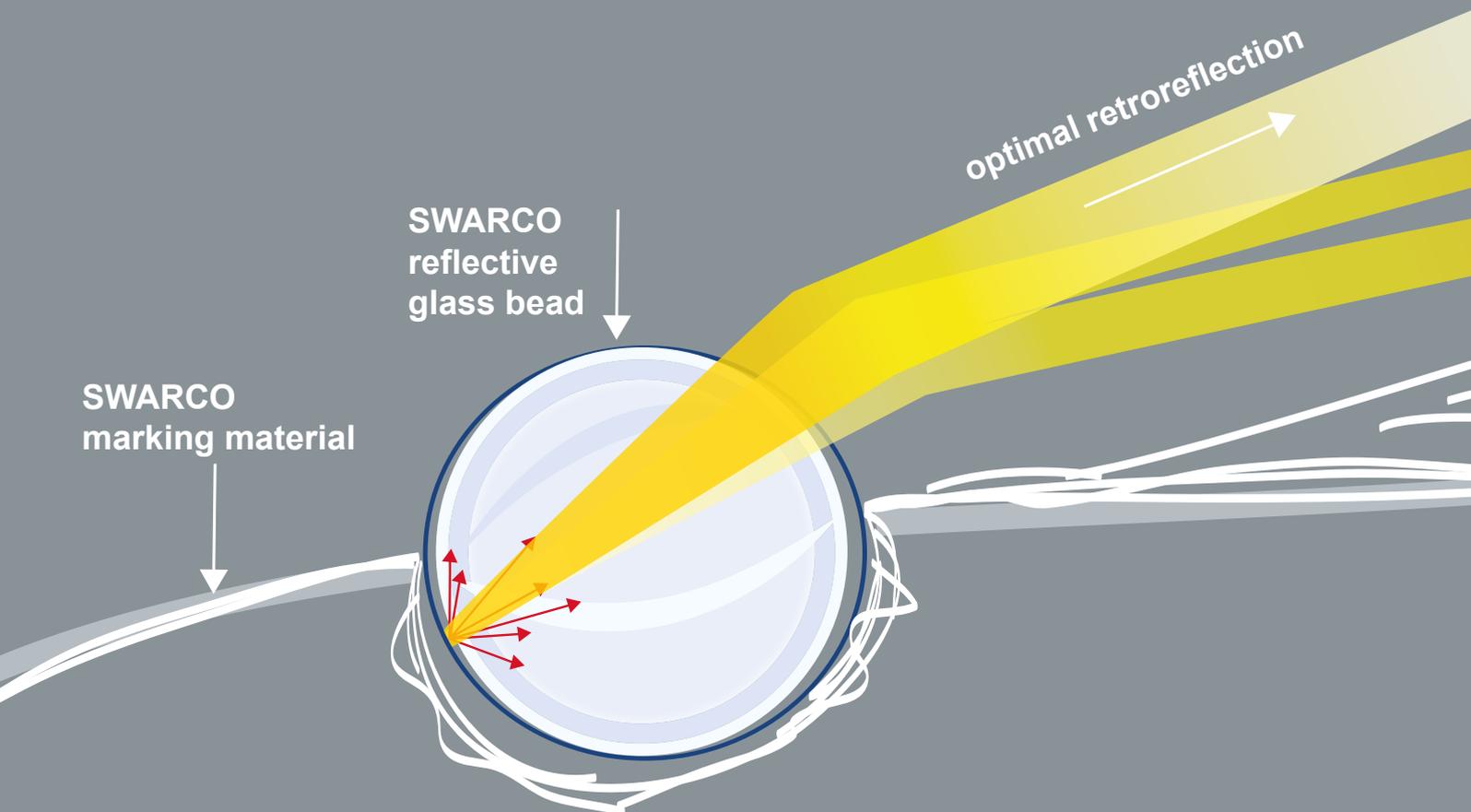
High-index PLUS9 BEADS by SWARCO Road Marking Systems are type III beads with a refractive index of at least 1.9 and retroreflective values of up to $1500 \text{ mcd/m}^2 \cdot \text{x}$. They are designed for the most challenging marking requirements. Because of its physical properties, the specially developed glass composition of high-grade raw materials is suitable exclusively for airports. PLUS9 BEADS deliver up to five times better visibility compared to conventional glass beads and respond to the landing lights of aircraft.

Used worldwide

PLUS9 BEADS are in line with Specification TT-B-1325. Their use has been authorized by all US federal authorities, the Federal Aviation Administration and the International Civil Aviation Organization.

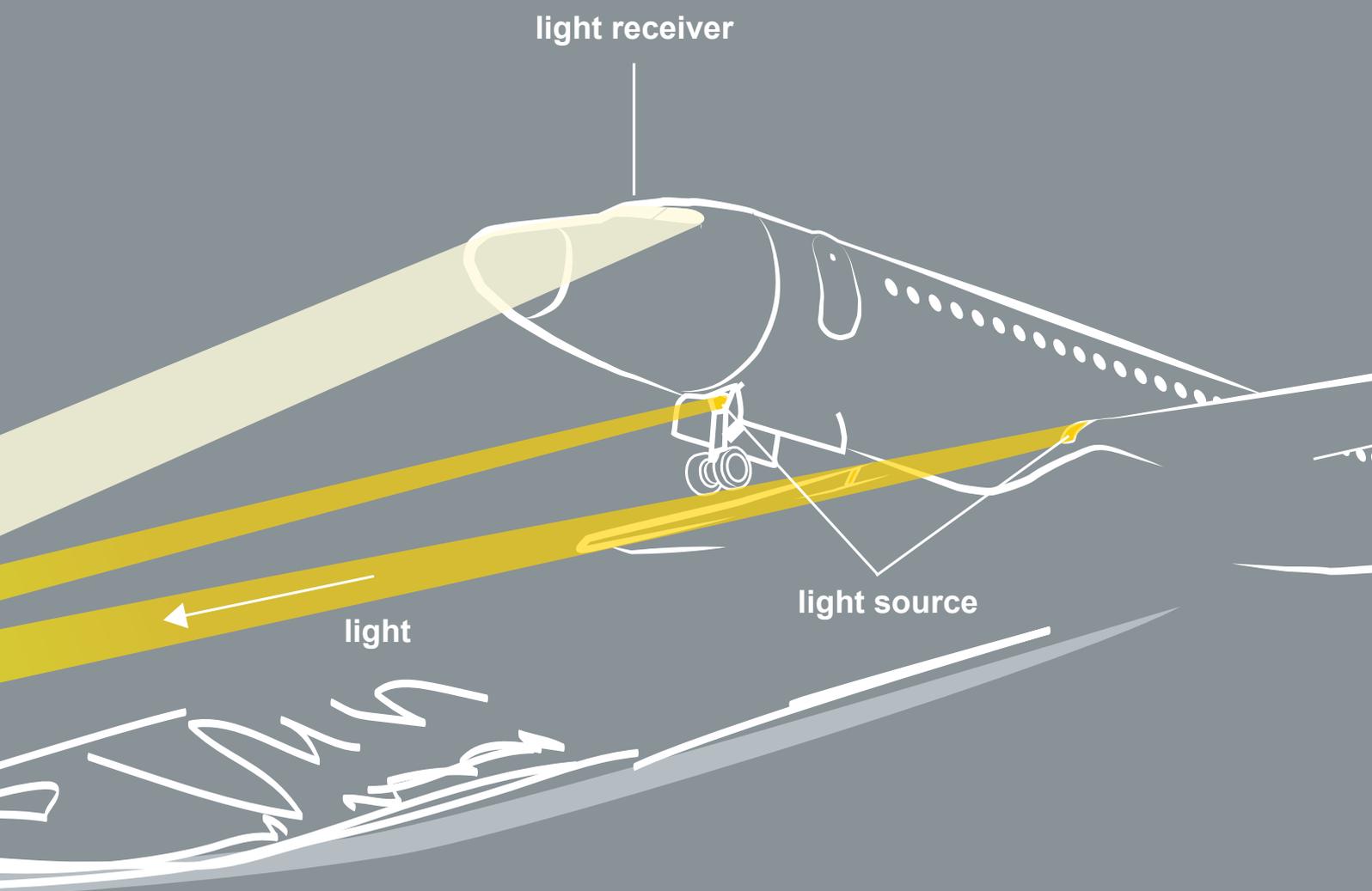
Strong in difficult lighting and weather conditions

Used in conjunction with high-grade marking materials, PLUS9 BEADS achieve optimal retroreflection even in difficult lighting and visibility. They show their strengths particularly at night or in rainy and foggy conditions. This makes our high-index glass beads the first choice for marking tasks on demanding sites like airstrips or helicopter landing pads.



How It Works

A light source (landing light) sends light rays towards the ground. There, the light rays strike the glass beads in the markings. The light gets concentrated in one spot and is reflected back. The light emitted by the aircraft gets retroreflected towards it. The markings can be perceived early on from the cockpit, from far away and in all lighting and weather conditions. Pilots have sufficient time to react, decreasing the risk of accidents.



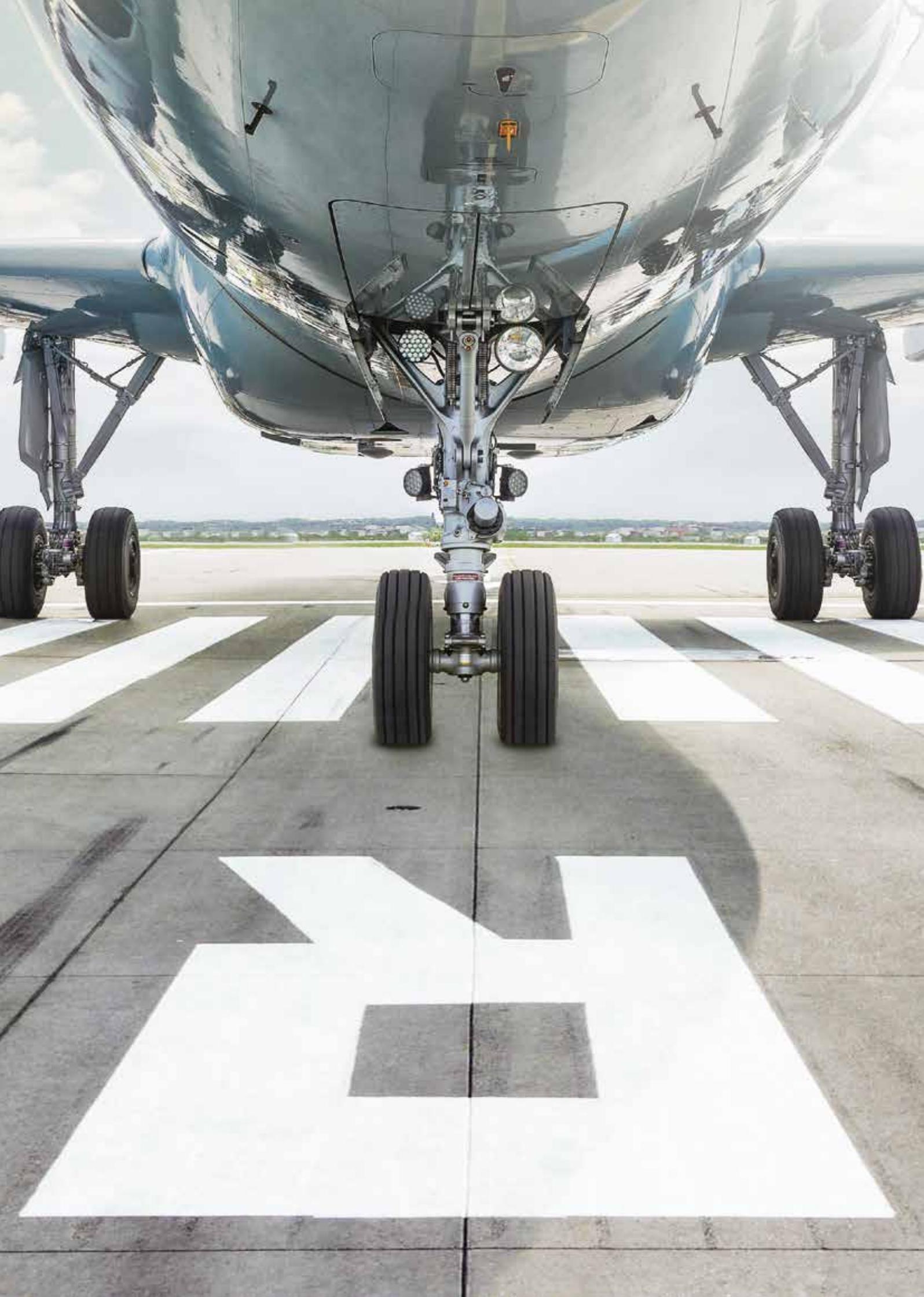
FOR OPTIMAL SAFETY

The marking materials comply with the latest European directives. All colour shades have passed the stringent EASA (European Aviation Safety Agency) tests. SWARCO Road Marking Systems' products ensure a perfect view over airports, enabling swift orientation.

In addition to its high-index glass PLUS⁹BEADS, SWARCO Road Marking Systems manufactures a complete range of marking materials.

PRODUCT OVERVIEW

	Layer thickness	Characteristics	Recommendation for use
1-C High-Solid Paint			
LIMBOROUTE K828F	Wet film thickness Type I markings 0.4 mm, 0.7 mm Type II markings 0.6 mm, 0.7 mm	<ul style="list-style-type: none"> • Good day and night visibility • Low wear resistance 	Well suited for runways and areas where tyre particles have to be removed and markings have to be frequently renewed.
Dispersion Paint			
LIMBOROUTE LW48F	Wet film thickness Type I markings 0.3 mm, 0.4 mm Type II markings 0.6 mm	<ul style="list-style-type: none"> • Environmentally friendly • Reduced emissions • Note the WOT • Low wear resistance 	Well suited for runways and areas where tyre particles have to be removed and markings have to be frequently renewed.
2-C High-Solid Paint			
LIMBOROUTE 2-K K809F	Wet film thickness Type I markings 0.3 mm, 0.4 mm Type II markings 0.6 mm	<ul style="list-style-type: none"> • Good wear resistance and night visibility • Good adhesion on damp, mineral substrates • Well suited for application on damp substrates • Longer drying time 	Well suited for taxiways and permanent markings on aprons Long application window until autumn on permanently damp substrates
Cold Spray Plastic			
LIMBOPLAST KSP 120F	Dry film thickness Type I markings 0.3 mm, 0.4 mm Type II markings 0.6 mm	<ul style="list-style-type: none"> • Cost-efficient marking • Good day and night visibility • Good wear resistance • Quickly trafficable 	Well suited for taxiways and permanent markings on aprons, and traffic load (aircraft and land-based vehicles)



AIRPORT MARKINGS



RETROREFLECTION

The systems by SWARCO Road Marking Systems offer excellent retroreflection and night visibility on dry and wet surfaces due to innovative glass bead blends (various particle sizes, low and high index).

INNOVATION – MORE CONTRAST

Coloured glass granulate can be added to the marking systems as needed to adjust the colour shade. The resulting marking symbols and lines appear much more vivid and rich in contrast.

DURABILITY

SWARCO Road Marking Systems' products have been successfully tested by independent bodies for resistance against fuels, deicers, engine oils and hydraulic fluids and excel in their resistance to kerosene.

High-quality airport markings by SWARCO Road Marking Systems improve safety and ensure optimal orientation at airports for aircraft and ground traffic vehicles.

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ABRASION RESISTANCE

By choosing the right solutions from SWARCO Road Marking Systems' wide range of products, complemented by various glass granulates as well as coloured glass granulates, excellent functionality and abrasion resistance of marking systems on airfields and runways, taxiways and aprons is guaranteed.

SURFACE BONDING

Apart from their stipulated product-specific characteristics, markings need to have sufficient adherence to the surface to avoid engine ingestion of loose marking material. The right choice of an optimal and cost-efficient marking system for the different areas depends on airport specifications and other prerequisites.

CERTIFIED

The marking systems by SWARCO Road Marking Systems have been successfully tested and approved by the German Federal Institute for Material Research and Testing in regard to colour standards according to DIN 5033, the assessment according to ICAO, Annex 14, Aerodromes and STANAG 3711.

REFERENCES

EUROPE

Aviano

Cologne

Ramstein

Berlin

Copenhagen

Riga

Düsseldorf

Lajes

Rome

Eelde

Lakenheath

Rotterdam

Fairford

Moscow

Seville

Frankfurt

Munich

USA

Chicago O'Hare

Dallas/Fort Worth

Detroit Metro

Jacksonville International

Los Angeles International

Nashville International

San Antonio, Texas



SWARCO Road Marking Systems used worldwide

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Ashgabat

Qatar

Baku

Kuwait

Bengaluru

Mumbai

Basra

Phnom Penh

Dili

Sihanoukville

Kaohsiung

Taschkent

ASIA

AFRICA

Accra

Algiers

Lagos

Tripoli



SWARCO | The Better Way. Every Day.

SHOWING THE WAY, WORLDWIDE

In 1969 we started out with the manufacture of tiny reflective glass beads. Today we have grown into the world's largest systems provider for road markings, making roads safer and saving lives on a daily basis. Our high quality products and services, safely direct traffic flow from A to B, every day and night. On all roads, in any weather, and all from SWARCO.

We prepare for the future by fusing knowledge with innovation at our Competence Center for Glass Technology and Marking Systems. So, even with smart and autonomous driving, we continue to blaze the trail of premium road markings to the world. Jump in and drive with us; we will be happy to help you find your ideal road marking solutions.

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