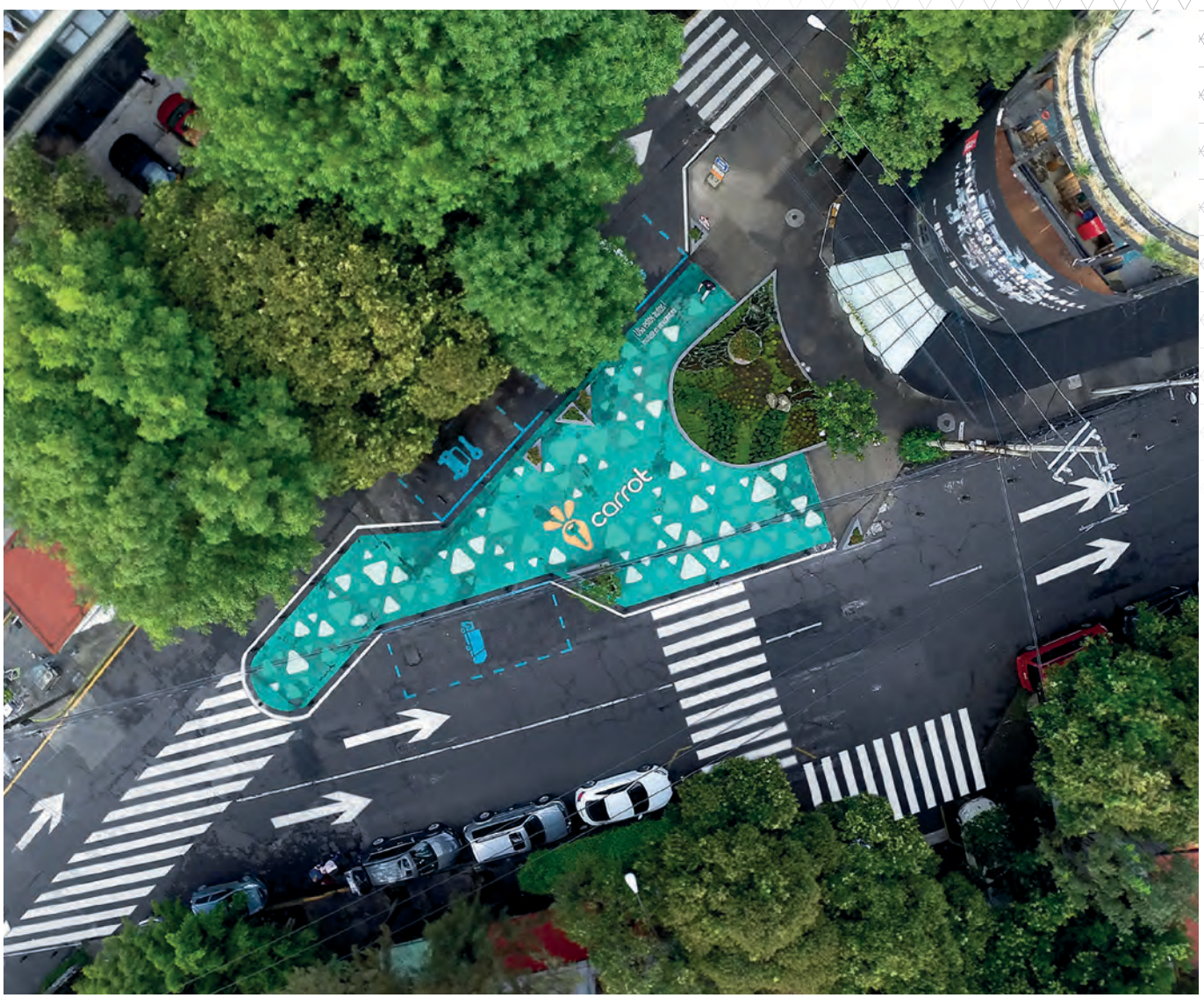
DEGAROUTE®

DEGAROUTE®
CREATIVE AND FUNCTIONAL ROAD MARKINGS



RÖHM

TRADITIONALLY **INNOVATIVE**

CONTENTS

DEGAROUTE®
A PIONEER IN EXPERTISE AND TECHNICAL SERVICE

ABOUT DEGAROUTE®
DEGAROUTE® is the trademark of Röhm for the world´s most renowned MMA (methyl methacrylate) resins which are used as binders in the production of durable cold plastic road markings. Being the pioneer of MMA road marking resins since 1960, the production has become seamlessly back-integrated into Röhm's MMA network, to ensure the long term supply of raw materials and sustainable quality for our customers.

Röhm's long-lasting DEGAROUTE® solutions are available on all five continents, reaching every corner of the Earth. Furthermore, the DEGAROUTE® team supports its customers and associates worldwide with technical assistance and expertise, as well as with training courses and further marketing services.

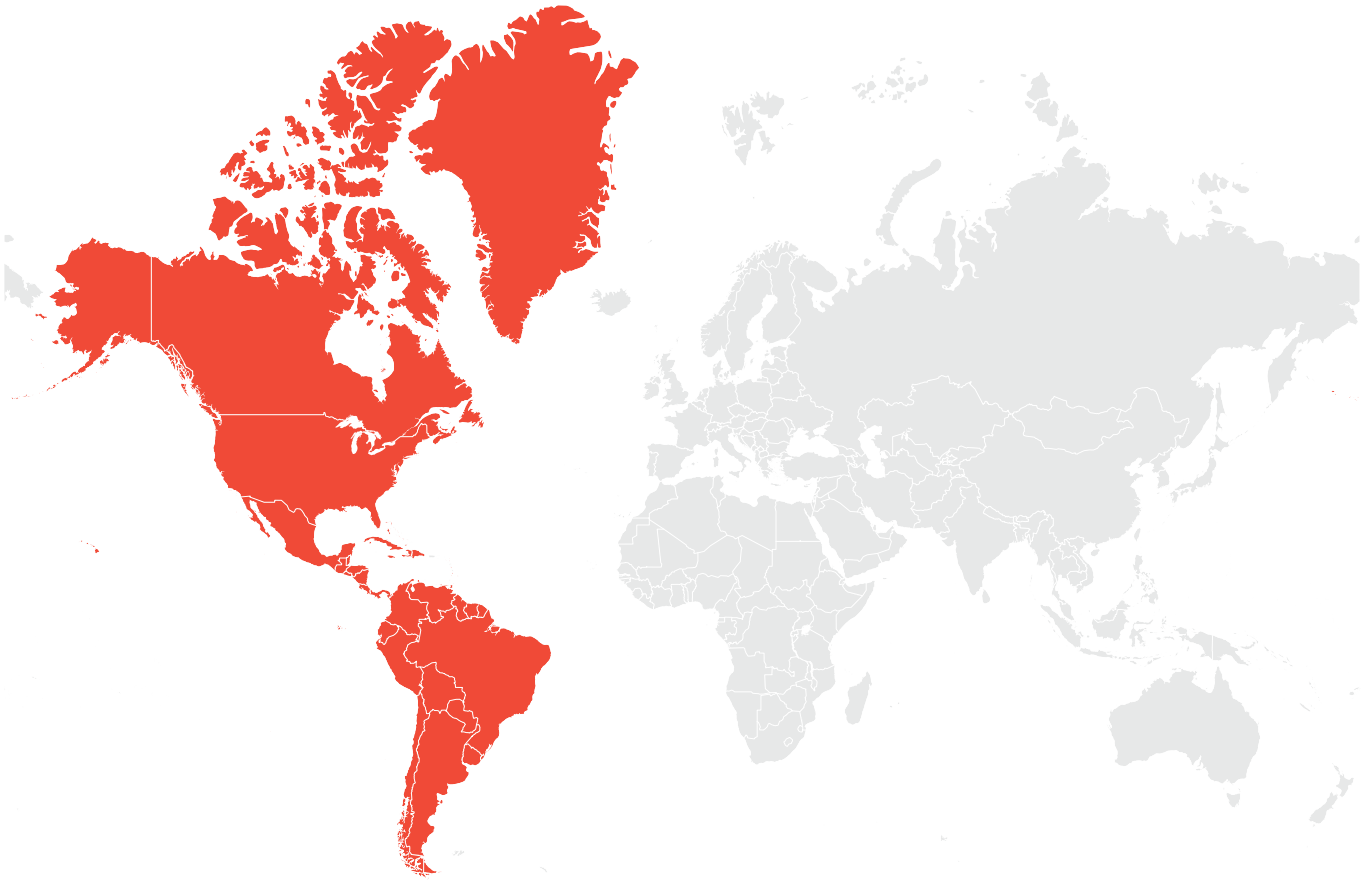
All of this has one goal: to make safe road markings available in all parts of the world.

ROAD MARKINGS
INFORMATION, GUIDANCE AND PROTECTION FOR MILLIONS OF ROAD USERS WORLDWIDE.

ABOUT MMA COLD PLASTICS BASED ON DEGAROUTE®
Cold plastics were originally invented by the company Degussa – now Röhm – in the 1960s as a high quality alternative to paints and thermoplastics in order to withstand winter service e.g. studded tire traffic on the German highway system. Thanks to excellent wear resistance and high form stability even at high traffic load from subzero to high temperatures, cold plastic road markings today provide long lasting functionality in all climate zones including cold Alaska to hot Middle East.
DEGAROUTE® resins are used as binders for the production of two-component cold plastic materials that are chemically cured upon addition of a hardener component to form a cold plastic road marking.

KEY FEATURES:
- Durability
- Form stable and clearly visible at high temperatures and traffic load
- CO_2 reduction due to longer service life
- Any form, any shape, any color
- Excellent wet-night visibility
- Low VOC and low microplastic emissions
- Longlasting safety functionality thanks to high wear resistance and excellent glass bead and aggregate retention

AMERICAS



RED BUS LANE
NEW YORK CITY, USA

PROJECT OBJECTIVE
Traffic jams are part of the daily routine for many New Yorkers. To smoothen the public traffic flow, the city has introduced colored bus lanes to help this mode of transportation get past queues of traffic and pull away first when the traffic light changes. These priority lanes for busses have contributed to a significant improvment of traffic flow.

New York City was looking for a material that could both be installed in cold weather and stand up to snow plows. Another requirement was that the material could be applied on concrete surfaces. Their current specification for thermoplastic road markings was not fulfilling this criteria, so the city turned to MMA for area marking applications. DEGAROUTE® based cold plastic MMA road markings can be applied in temperatures below 45 °F (7 °C), hold up well under snow plowing and can be applied on both existing and new concrete and asphalt surfaces.

Unlike thermoplastic, DEGAROUTE® based cold plastic MMA road markings show excellent adhesion to concrete, have double the life cycle, are UV stable and can adhere to itself for refreshing if necessary. Another attribute of the MMA resin is the high dimensional stability of the formulations which means no softening in heat and remains flexible in harsh winters.

SITE		APPLICATION	
COUNTRY	USA	SYSTEM	Area marking
LOCATION	New York City, NY	SURFACE	Asphalt
ROAD	125th Street	PREPARATION	Water blast
APPLICATION DATE	July 2016	EQUIPMENT	Manual mix application

GREEN BIKE LANE
SYRACUSE, USA

PROJECT OBJECTIVE
The "Connective Corridor" is a showcase for green infrastructure, incorporating a number of multidisciplinary projects that reshape the City of Syracuse and provide multiple environmental benefits. As part of this "Connective Corridor", the city of Syracuse has applied green bike lanes, or "greenways", using DEGAROUTE® based MMA cold plastic area markings to provide a safer biking network for students and residents navigating through the city.

This new green bike network in Syracuse was one of the first in the country to implement new MUTCD interim standards for green as a universal bike lane color. Not only was the city interested in the durability and extended color retention of the area markings, but the eco-friendliness achieved through the application process fulfilled the sustainability vision of the "Connective Corridor".

According to the city, the new "greenway" MMA bike lanes also represent a novel approach to emerging technologies. This new generation resin provides exceptional durability on asphalt and concrete, skid-resistance, and the highest reflective values for safety.

The bike lane in the Syracuse was a two phase project with a total of 28,000 ft² (2,600 m²) of green bike lane. These were the first of many green DEGAROUTE® based MMA cold plastic bikeways across the country.

SITE		APPLICATION	
COUNTRY	USA	SYSTEM	One-layer area marking
LOCATION	Syracuse, NY	SURFACE	Asphalt
ROAD	University of Syracuse/City of Syracuse	PREPARATION	Swept, scraped and blew debris off the surface
APPLICATION DATE	August – September 2012	EQUIPMENT	Manual mix application

PERFORMANCE

- The bike lane was completely cured and ready for use within 45 minutes
- Since the application, both the City and Syracuse University have been very satisfied with the project results
- Still looks great after many years

Bike lane in 2018 after 6 years in service

HIGH VISIBILITY CROSSWALKS
DENVER, USA

PROJECT OBJECTIVE
The Colorado Department of Transportation aimed at decreasing the number of vehicle-pedestrian crashes by redesigning crosswalks at three high-traffic intersections in the Denver metro area (Colorado Boulevard & East Colfax Avenue, East 14th Avenue, and East Montview Boulevard).

DEGAROUTE® based area markings were installed to define red crosswalks with white accent stripes in order to increase pedestrian safety. The red color draws attention to the crosswalk and catches the attention of both pedestrians and drivers. The high-friction surface ensures grip and retro-reflectivity allows pedestrians to safely cross the street, also at night and during rainfall.

The largest of the crosswalks in Denver is spanning 16 lanes of traffic. The marking material covered a 4,750 ft^2 (441 m^2) area and reflective beads were added to the surface of the accent stripe.

SITE		APPLICATION	
COUNTRY	USA	SYSTEM	One-layer area marking
LOCATION	Denver, CO	EQUIPMENT	Manual
ROAD	Intersections of Colorado Blvd and East Colfax Ave, East 14th Ave, and East Montview Blvd	AGGREGATE	#1 Silica sand
APPLICATION DATE	August – September 2012	MARKING	100 mils (2 – 3 mm)

PERFORMANCE

Colorado Department of Transportation (CDOT) Testimonial:

- Prior to installing contrast area markings to the crosswalks at the intersection of Colorado Boulevard and Louisiana Avenue, an average of two people were being struck each year by oncoming vehicles.
- Since installing the area markings, there has only been 1 person hit within the past 3 years.
- CDOT foresees that the newly applied crosswalks based on cold plastic (MMA, methacrylate resin) will have the same effect as seen at the intersection of Colorado Boulevard and Louisiana Avenue.
- Since this project, Denver has continued to apply more red crosswalks using DEGAROUTE® based material.

COLORFUL SAFE SPACES
MEXICO CITY, MEXICO

PROJECT OBJECTIVE
The implementation of "public pocket parks" throughout Mexico City exemplify how authorities are transforming underutilized areas into flexible public spaces that provide pedestrians with a designated area to enjoy recreation and relaxation, while also enhancing the community with unique designs created by local companies and institutions.

One of these "public pocket parks" was transformed to designate an area where car rentals by the hour could be parked, thus sparking a decrease in the use of alternate means of transport and creating colorful spaces for coexistence using MMA based DEGAROUTE® resins.

Covering an area of 800 m^2 (8,611 ft^2), the area markings were applied to the asphalt substrate at a thickness of 0.6 mm (25 mils), using automated spray equipment and templates to ensure a precise design. Due to the rapid application process and curing capabilities of the system based on DEGAROUTE®, each pedestrian area was completely passable within 45 minutes. The UV resistance and excellent adhesion of the newly applied area markings will ensure optimal color stability and durability for years to come.

SITE		APPLICATION	
COUNTRY	Mexico	SYSTEM	Area marking
LOCATION	Mexico City	SURFACE	Asphalt
APPLICATION DATE	2014	EQUIPMENT	Manual application
		THICKNESS	25 mils (0.6 mm)

PERFORMANCE

- Excellent UV resistance and color stability
- High durability and weather resistance
- Very good skid resistance and adhesion to both concrete and asphalt
- High versatility and easy to apply in any shape, color, area size
- Quick application with short curing time
- Resource efficient and environmentally friendly with zero solvent emissions

Photos © Victor Benitez

ROAD SAFETY
MEDELLIN, COLOMBIA

PROJECT OBJECTIVE
Medellin has shown a strong commitment to the implementation of a sustainable mobility system by enhancing their transport infrastructure and applying targeted urban interventions to "reclaim the city." As part of the Municipal Development Plan, the city has integrated a network of preferential bus lanes, dedicated bike lanes for cyclists, restricted parking areas and colorful walkways and zebra crossings for pedestrians. These interventions have all proven to have a positive effect on reducing the number of conflicts among road users and are also receiving positive feedback from citizens.

As part of Medellin's Municipal Development Plan, the intersection of La Consolata was identified as an area in need of a road marking intervention project. Based on a study conducted by the Secretary of Mobility, this particular intersection has incurred 63 points of road conflict due to the multiple maneuvers that were allowed from the all roads converging at this point. Prior to the intervention, from January 2013 and August 2017, 45 accidents had been recorded, which is an average of 9.5 per year.

This staggering number of accidents at the La Consolata intersection prompted the city of Medellin to completely redesign the flow of traffic in order to bring greater safety to drivers, cyclists and pedestrians. The city incorporated a number of pedestrian plazas, medians and crosswalks by using DEGAROUTE® based two-component MMA area markings.

SITE		APPLICATION	
COUNTRY	Colombia	SYSTEM	Area marking
LOCATION	Medellin City	SURFACE	Asphalt
INTERSECTION	Intersection of La Consolata	EQUIPMENT	Manual
APPLICATION DATE	2018	THICKNESS	> 1.5 mm (> 59 mils)

FURTHER PROJECT DETAILS

- A total of 223 gallons of brightly colored DEGAROUTE® based area markings were used to hand apply 501 m^2 (5,392 ft^2) of vibrant markings, including a newly installed median along Avenida Nutibara which now restricts the number of vehicles moving across multiple lanes of traffic.
- Through the installation of crosswalks and pedestrian plazas, the local residents now have a safer way to cross the once dangerous intersection.
- The city of Medellin has been using DEGAROUTE® based road markings for the majority of applications throughout the city due to their long service life and excellent durability under high traffic.

FORM STABLE PROFILE MARKINGS
SAO PAULO, BRAZIL

PROJECT OBJECTIVE
The profile marking application was performed on the state highway 284 between the city of Rancharia and the state highway SP425. Sao Paulo Department of Transportation (DOT) decided for this application as a measure to reduce the number of accidents due to lane departure. Profile markings based on thermo-plastic material deformed under high temperature and heavy traffic load within 1 year of application.

Sao Paulo DOT decided to switch from thermoplastic to MMA based cold plastic profile markings due to superior form stability under such conditions with impressive results.

Form stable profile marking based on DEGAROUTE® based cold plastic MMA

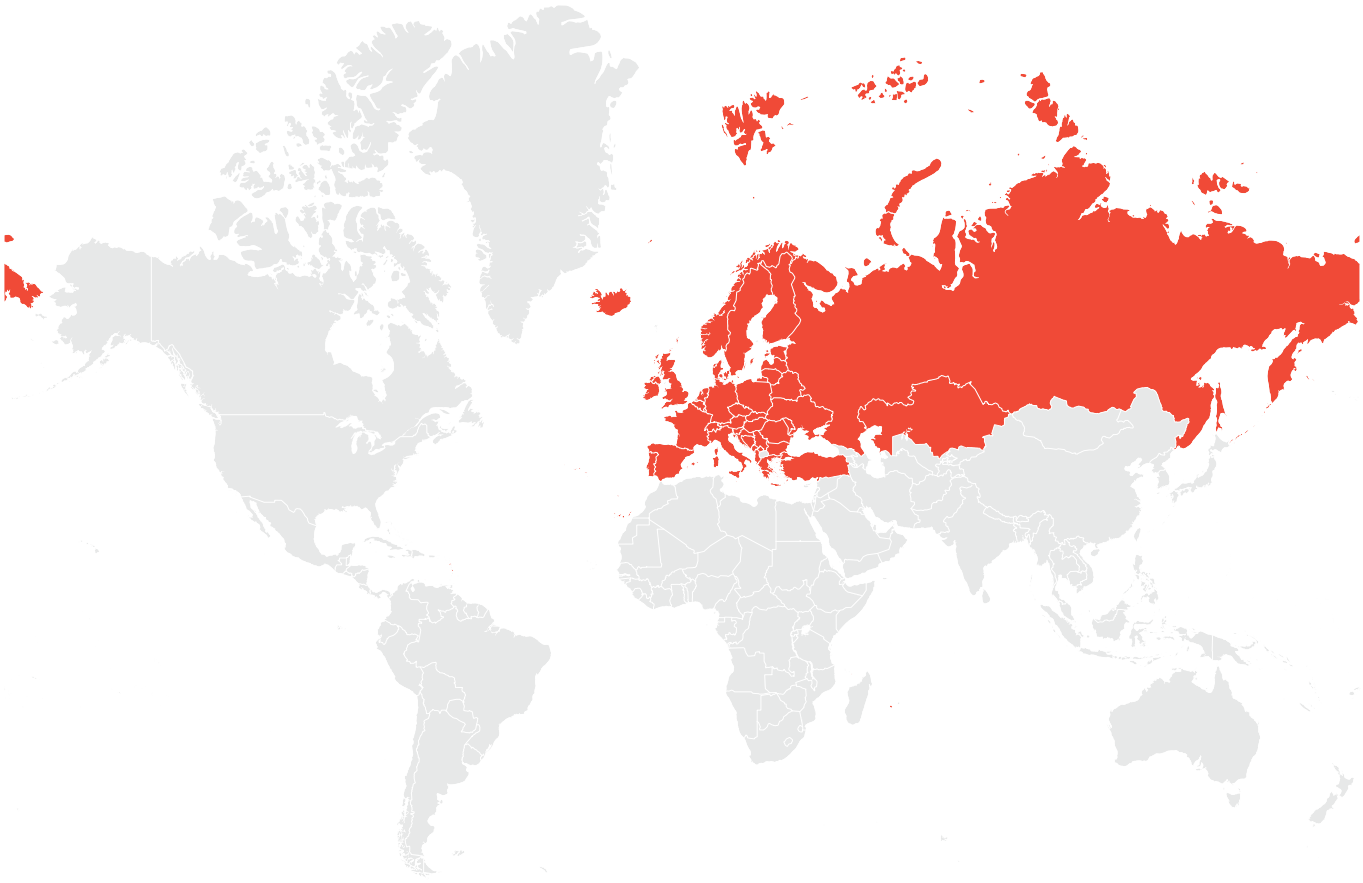
Profile marking based on thermoplastic road marking deformed within 1 year.

SITE		APPLICATION	
COUNTRY	Brazil	SYSTEM	Profile marking
LOCATION	Rancharia City – Sao Paulo	SURFACE	Asphalt
ROAD	State Highway SP284	TYPE	98:2
APPLICATION DATE	January 2014		

PERFORMANCE

- DEGAROUTE® based cold plastic MMA provided a long lasting form of the profile structure contributing to improved traffic safety.

EUROPE

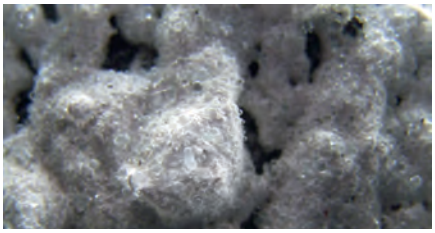


FIELD TRIAL
UPPER HARZ MOUNTAINS, GERMANY

PROJECT OBJECTIVE
Highly visible road markings are crucial to road safety. Motorists need to be able to clearly see the line markings that guide them – especially during nighttime driving or in weather conditions that restrict visibility (fog, rain or snow).

Testing has repeatedly, and undeniably, shown that cold plastics based on methyl methacrylate (MMA) resins achieve the best longlasting retro-reflectivity for road markings. A field trial in the Upper Harz Mountains in Germany has proven just how extremely durable and resilient this material is even when subjected to the extreme impact of regular road clearing by snow plows during the winter.

Featuring a range of different road marking materials, this testing field was exposed to several years of winter road clearance, with an independent group of experts regularly monitoring material performance, focusing on how it was performing under frequent snow plowing. The results achieved by the DEGAROUTE® based MMA cold plastic markings speak for themselves!



Even after 5 years on the road, the DEGAROUTE® based markings still fulfill the requirements of a Type 2 marking.

SITE		APPLICATION	
COUNTRY	Germany	SYSTEM	Cold plastic agglomerate markings
LOCATION	Upper Harz Mountains	APPLICATION TECHNIQUE	Spike bar
ROAD	National Highway 4	SURFACE	Asphalt
APPLICATION DATE	August 2006	SURFACE PREPARATION	Existing asphalt

PERFORMANCE

- After the first three winter seasons, some of the sample markings already showed clear signs of deterioration as caused by the snowplows
- 70 sample markings in total required either elimination or at least replacement during the period of 2009 to 2012
- Even after 5 years on the road, the DEGAROUTE® based markings still fulfill the requirements of a Type 2 marking

AREA MARKING ON CONCRETE
GERMANY

After application in 2010

2019 after 9 years in service

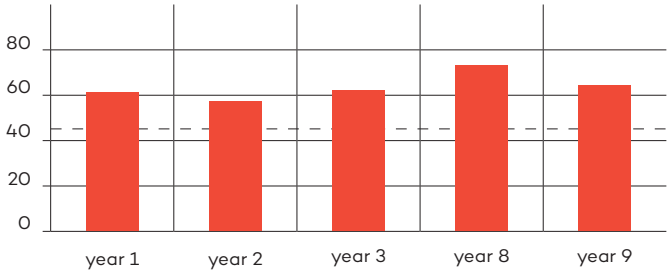
PROJECT OBJECTIVE
The red roundabout on a high traffic crossing area in Bad Vilbel had caused the city much undue stress. Large buses and trucks could not circumvent the radius of the round-about without driving on the edge of the area marking. Therefore, it was important for the city to find a road marking material that could withstand the traffic exposure on the concrete surface. In 2010, after various trials with other materials that eroded within a short period of time, the city of Bad Vilbel opted for cold plastic MMA, which is known for its long durability and adhesion to concrete substrates. Thanks to the outstanding durability of the cold plastic material, this led to increased safety and an elimination of constant maintenance repairs. Even after nine years in service, the red area marking based on DEGAROUTE® is still as visible as the first day it was installed and fulfills all requirements regarding grip.

SITE		APPLICATION	
COUNTRY	Germany	SYSTEM	Two layer area marking: Base and top coat
LOCATION	Bad Vilbel	SURFACE	Concrete
APPLICATION DATE	October 2010	TYPE	98:2
		PREPARATION	Primer DEGADUR® B71
		EQUIPMENT	Manual application
		AGGREGATE TYPE	Bauxite 1 – 3 mm (40 – 120 mils)
		AREA	10 m (33 ft) diameter; 80 m² (860 ft²)
		VOLUME	3.6 kg/m²

PERFORMANCE

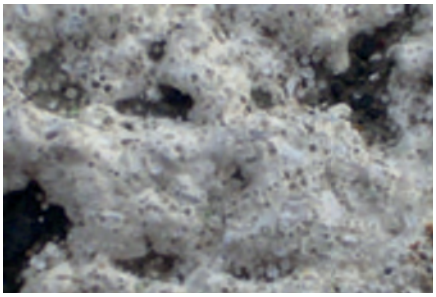
- High durability of cold plastic, where other markings failed
- High traffic density: DTV 16,600 cars/24h with extreme sheer forces
- Grip after 9 years still well above 45 SRT
- Excellent color stability

SKID RESISTANCE (SRT)



SAFETY MARKING AT FEDERAL ROAD GERMANY

Before: poor marking – accident hot spot



After: safety marking based on DEGAROUTE®

PROJECT OBJECTIVE
The federal road B521 between Höchst a.d. Nidder and Nidderau-Eichen was once an accident hot spot: In 2002 alone, 19 accidents occurred involving a car leaving the road at the narrow curve poorly marked with paint. The responsible authority, Hessen Mobil, improved the safety on this road by applying a structured marking based on DEGAROUTE® cold plastic.

SITE		APPLICATION	
COUNTRY	Germany	SYSTEM	Irregular structure (agglomerate)
LOCATION	Hessen	SURFACE	Existing asphalt
ROAD	B521	TYPE	98:2
APPLICATION DATE	October 2010	PREPARATION	Primer DEGADUR® B71
		EQUIPMENT	Plastomarker Junior (hand-guided)
		MARKING	12 cm (4.7 inch) edge line

PERFORMANCE

- Improved safety: three years since application, the road is no accident hot spot any more
- The structured edge line is not only highly visible (even under wet night conditions), it also prevents drivers from leaving the road by a warning rumble and sound
- Improved safety was achieved at relatively low cost, i.e. without construction work
- Besides the structured markings, the speed limit was reduced from 70 km/h to 50 km/h (43 mph to 31 mph) and vertical signs were exchanged to ones with higher reflectivity

RUMBLE STRIPES
ERZGEBIRGE, GERMANY

PROJECT OBJECTIVE
Many motorcycle accidents occurring at hazardous curves are typically a direct result of excessive speed, misjudgment of the driver and traffic related fundamentals or quick emergency braking maneuvers. To reduce the speed with which motorcyclists enter accident black spots and to alert other motorists of unexpected hazards on track of the road ahead, some countries have been installing rumble strips.

DEGAROUTE® based cold-plastic rumble stripes were installed at the approaches of hazardous bends on a section of road in Germany's Erzgebirge region, creating raised bands of thick-layer markings that have positively influenced driving behavior and improved road safety by reducing the number of accidents.

First, a 450 mm (15.7 inch) wide rumble strip was applied, colored with fluorescent pigments to a bright yellow shade for better visibility in daylight. This was followed by the application of four semicircular raised bands with a maximum height of 15 mm (590 mils) above the pavement. Subsequently, three raised white strips measuring 120 mm (4.7 inch) in width were applied to create an elevation of approximately 10 mm.

SITE		APPLICATION	
COUNTRY	Germany	SYSTEM	Profile marking
LOCATION	Hairpin bend on the K9107	SURFACE	Asphalt
APPLICATION DATE	2012	EQUIPMENT	Manual application, by using a draw box with integrated template
APPLICATOR	Rumble stripes	THICKNESS	Up to 15 mm (590 mils) above pavement

PERFORMANCE

- No damage to the road (unlike milled-in or rolled-in profiles)
- Shiny colors warn bikers of dangerous curves and reduce speed due to vibrations
- Audible and haptic signal to alert the driver
- Special profile makes stripes resistant against snow plow
- No accidents since application, Winner of German Traffic safety award 2013

ROUNDABOUT
AUSTRIA

Application in 2019 after 12 years in service

PROJECT OBJECTIVE
The roundabout is located at an entrance to motorway S31 with a DTV of 15,000/24h. Authorities were interested in testing the durability and SRT values of an inner circle area marking with DEGAROUTE® based cold plastic.

Several applications of roundabouts in the same region with other materials did perform worse, because of low durability and SRT values.

After more than 12 years, the application provides the minimum SRT of 45 and is still in service.

SITE		APPLICATION	
COUNTRY	Austria	SYSTEM	Two layer area marking
LOCATION	Markt St. Martin	SURFACE	New asphalt (4 weeks)
ROAD	Federal Road B 50	TYPE	98:2
APPLICATION DATE	July 2007	EQUIPMENT	Manual application
		AGGREGATE	1 – 2 mm (40 – 120 mils) bauxite, 3.2 kg/sqm
		THICKNESS	4 – 5 mm (158 – 197 mils) including aggregate
		MARKING	1,75 m (5.7 ft) width, 80 m (262 ft) length, 140 m² (1.507 ft²) area marking

PERFORMANCE

Certificate September, 2015 – Research Center for Surface Engineering:

"For all the measurement points of the road markings the minimum skid resistance values of 45 PTV (SRT) units were exceeded, thus satisfying the requirements of the standards"

AREA MARKING IN THE LAND OF A THOUSAND FJORDS
LILLEHAMMER, NORWAY

PROJECT OBJECTIVE
In Norway, the small town Lillehammer lies on the northern shore of Lake Mjøsa, about 180 kilometers (111 miles) north of Oslo. Here the municipal council has banned cars from an old bridge, turning it into a pedestrian and bicycle zone that small tractors and mopeds may also use. The combined pedestrian and cycle path on the Vingnesbrua bridge reflects the municipality's concern for the environment and cleaner air.

With the redesign of the bridge, the pedestrian and bicycle infrastructure in Lillehammer has now developed further - as has the quality of life. In addition to the separator markings for pedestrian and cycle lanes, attention markings in colored stripes indicate areas at the side of the road that, in summer, will be reserved for benches, flower boxes, or areas for various social activities like small markets and exhibitions. DEGAROUTE® based cold plastic MMA area markings were chosen as they have outstanding durability and are ideally suited for pedestrian crossings, bus and cycle lanes, parking lots, and other areas where high skid resistance is necessary. To produce a permanently non-slip surface that significantly reduces the risk of skidding in rain, snow and on black ice, aluminum ore bauxite is mixed into the final DEGAROUTE® formulation. For visual highlights, various color pigments have been mixed into the DEGAROUTE® formulation, ensuring optimal color stability and allowing the bridge to glow in vibrant colors, even after many years.

SITE	
COUNTRY	Norway
LOCATION	Lillehammer
APPLICATION DATE	June 2017
APPLICATOR	Harald Mathisen
APPLICATION	
SYSTEM	Area marking, approx. 1.200 m^2 (12.917 ft^2)
SURFACE	Asphalt
EQUIPMENT	Smoothing trowel, draw box
THICKNESS	single-layer system with a total thickness of 2 to 2.5 mm (78-98 mils), time required for applying the markings on the 816 m (2.677 ft) bridge was 4 days

PERFORMANCE

- High skid resistance (confirmed by friction tests)
- Resistance to dirt and dust ensures high durability and color stability
- Quick application with short curing times
- Easy to apply in any shape, color and area size with a long service life
- Wide processing window from -10 °C/14 °F to 50 °C/122 °F
- Resource efficient and environmentally friendly with almost zero solvent emissions

Photos © Glis Studio
Photographer: Daniel Nordby

GREEN CAMPUS: BIKING TO LECTURES
ISTANBUL, TURKEY

PROJECT OBJECTIVE
Istanbul is Turkey's most populated city as well as the cultural and economic hub of the country. This metropolis of millions on the Bosporus is home to Istanbul Technical University, founded in 1773 and the third oldest university in the world. About 38,000 students from all over Europe are enrolled here and hurry every day from one lecture to the next. Navigating the vast size of the campus has so far only been possible by car.

However, a six-kilometer bike path through the campus now offers an ecofriendly alternative: The University's Green Campus project. This project, which includes barrier-free roads and sidewalks, rain-permeable concrete surfaces, eco-friendly building construction and the new bike path, is intended to make the extensive university campus more attractive to cyclists and pedestrians, while also increasing environmental awareness among students.

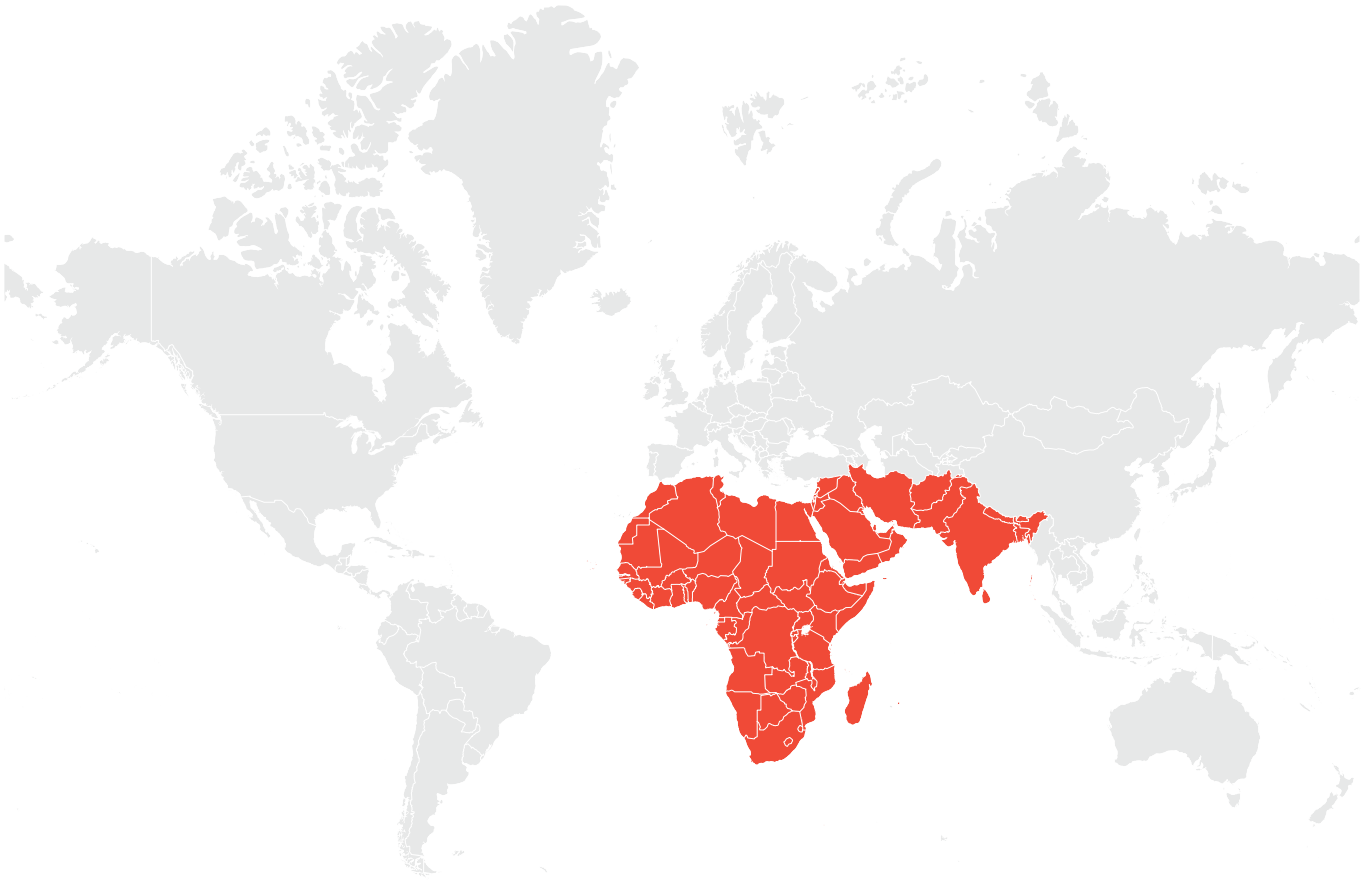
Röhm supported the project by sponsoring a part of the bike path and coating it with a durable MMA cold spray plastic. The rapidly processed two-component system is based on DEGAROUTE® reactive resin and can be used for a variety of applications including line and area markings.

SITE		APPLICATION	
COUNTRY	Turkey	SYSTEM	Anti-skid area marking (2,600 m^2/27,986 ft^2)
LOCATION	Istanbul Technical University	SURFACE	Asphalt
APPLICATION DATE	2017	EQUIPMENT	Spray application
		LAYER	Base layer sprayed containing anti-skid aggregate, followed by top coat

PERFORMANCE

- Anti-skid surface improving the safety of the bike path
- Strong adhesion to concrete and asphalt, even thin layers are highly durable
- Fast processing time and short curing time allows for a quick re-opening of roads
- Cost-efficient over the life cycle of the project

MIDDLE EAST, AFRICA, INDIA



500 KM OF ROAD MARKINGS
EGYPT

PROJECT OBJECTIVE

Tourism remains one of the most important sources of income for Egypt and is again flourishing after a few difficult years. To further boost the country's rediscovery as a tourist destination and to promote tourism in the southern Sinai Peninsula, the Egyptian government has launched extensive measures to improve the country's transport infrastructure.

The construction of a key project, a new six-lane highway connecting the capital city Cairo with the popular tourist resort of Sharm El Sheikh on the Red Sea, was recently completed. The road is already considered a major achievement because it not only facilitates the flow of tourists from Cairo to Sharm El Sheikh, but also makes the journey a lot safer. While vacationers had to travel for six hours on a one-lane country road between the two cities in the past, the new highway cuts the travel time down to four hours.

High-quality road safety technologies were a priority in the construction of the road. The MMA cold plastic markings based on DEGAROUTE® were not only applied to the highway from Cairo to Sharm El Sheikh, but also to the expanded highways from Ismailia to the northern city of Port Said and from Cairo to Sokhna on the Suez Canal.

The Egyptian government is planning to further support this development with major road construction projects to create better connections from the capital city Cairo to popular tourist centers.

SITE		APPLICATION	
COUNTRY	Egypt	SYSTEM	Extrusion and flat line marking
LOCATION	Roadway from Cairo to Sharm el Sheikh	SURFACE	Asphalt
APPLICATION DATE	2018 – 2019	EQUIPMENT	Line marking machine (spray, extrusion)
APPLICATOR	Balsam Trade	THICKNESS	2.5 mm (98 mils) thick interrupted centerline (extruded) and 600 µm thick sidelines (spray) over a distance of 500 km (311 miles)

PERFORMANCE

- Strong wear resistance under high-traffic loads, even in the most extreme climate conditions
- Resistance to dirt and dust ensures high durability in extremely dry and hot regions
- Form stability avoids subsequent cracks, road markings do not get torn up in traffic
- High visibility of road markings during the day and at night, so that drivers can safely reach their destinations

SPEED TRANSITION LIMIT
DUBAI, UAE

PROJECT OBJECTIVE
On Dubai – Al Ain Road, the change in speed limit from 100 km/h (60 mph) to 80 km/h (50 mph) and installation of speed cameras resulted in sudden braking, causing severe rear-end collisions.

Therefore, large-scale area markings, so called speed reduction zones, were applied in red color to create a highly vilisble indication, alarming the driver of the changing speed limit at a high traffic volume area.

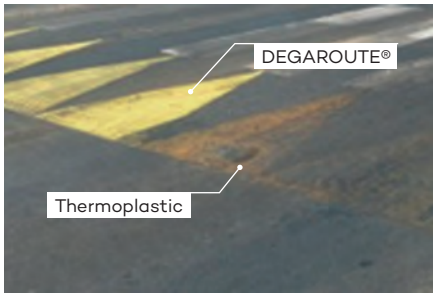
DEGAROUTE® based cold plastic area markings were chosen as they are characterized by an excellent visibility and slip resistance.

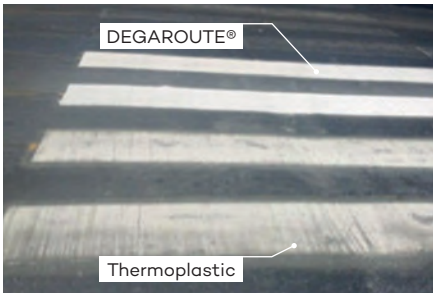
SITE		APPLICATION	
COUNTRY	United Arab Emirates	SYSTEM	Skid resistance
LOCATION	Dubai	APPLICATION TECHNIQUE	Area marking manual application
ROAD	Dubai – Al Ain Road	SURFACE	Asphalt
APPLICATION DATE	June 2017	SURFACE PREPARATION	Air pressure cleaning

PERFORMANCE

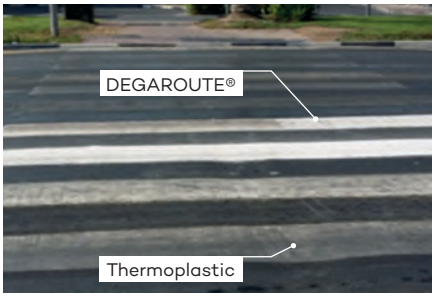
- Highly visible, red colored asphalt covering all three lanes attract the drivers attention

ANTI-BLACKENING ROAD MARKINGS
DUBAI, UAE





After 11 hours



After 90 days

PROJECT OBJECTIVE
Climate and environment are tough conditions for road markings in the Middle East. The sand, oil and hot temperatures typically cause road markings to blacken quickly.

The Roads & Transport Authority (RTA) in Dubai was looking for a solution to reduce the dirt pick-up of road markings aiming at providing clean, visible and safe markings. Therefore, the autority started a field test to compare the performance of anti-blackening cold plastic road markings with thermoplastic.

The yellow triangles are commonly applied in Dubai in front of cross-walks. Cold plastic with anti-dirt pick-up effect and thermoplastic were applied at the same time. Within a short period of time the thermoplastic turned black and after a few months cracked and partially worn, while the cold plastic remained completely intact and clearly visible. Therefore, the local autority chose DEGAROUTE® based cold plastic MMA markings with anti-blackening capabilities for the application of the yellow triangular humps on Cairo Street.

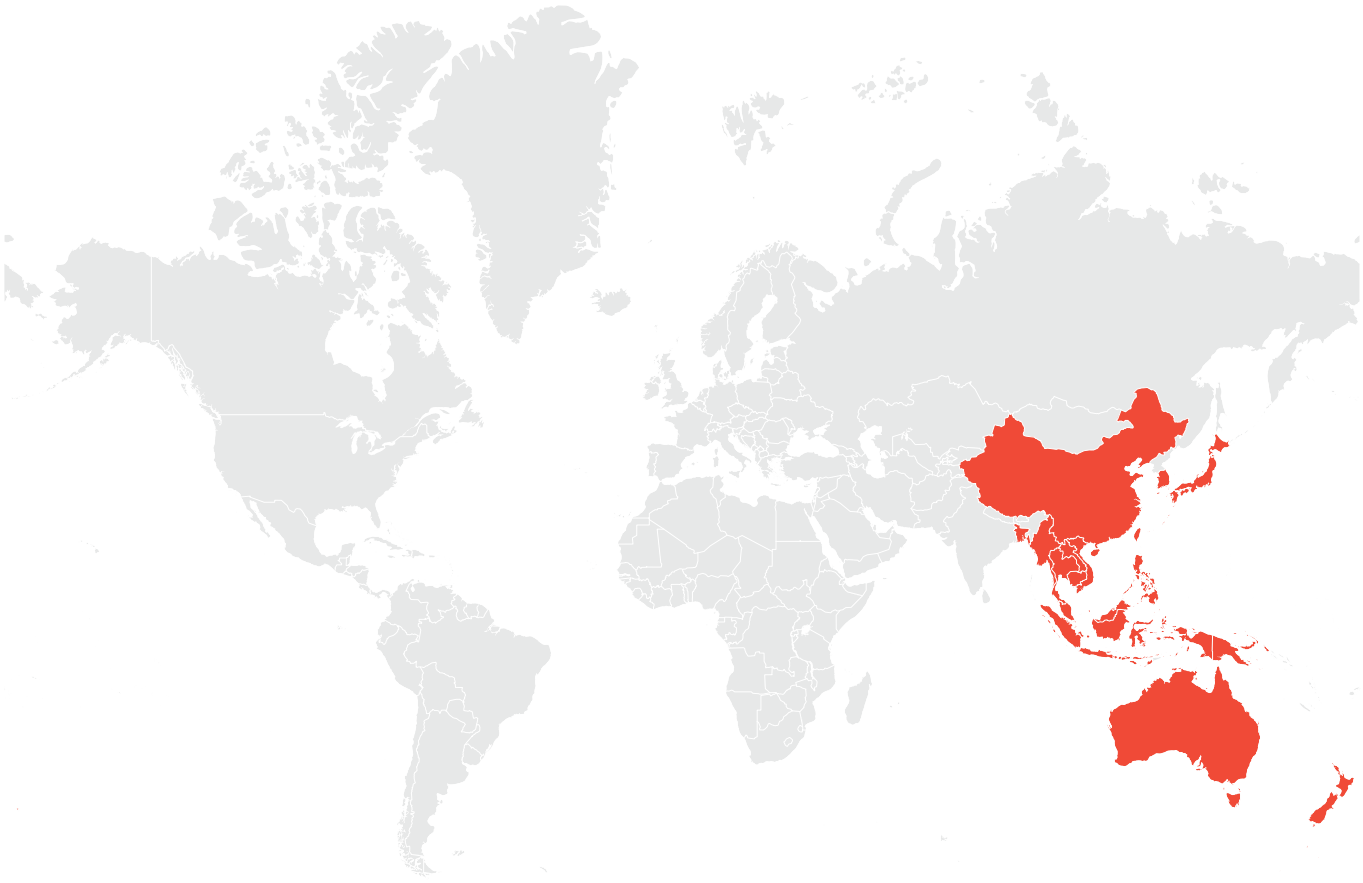
Anti-blackening technology can also be used for line markings, zebra crossings, legends and all other kind of area markings.

SITE		APPLICATION	
COUNTRY	United Arab Emirates	SYSTEM	Two layer system with anti-blackening
LOCATION	Dubai	SURFACE	Existing asphalt
ROAD	Cairo Street	PREPARATION	Shot-blasting to clean the surface
APPLICATION DATE	April 2014	EQUIPMENT	Manually: drawbox and roller

PERFORMANCE

- DEGAROUTE® based markings with anti-blackening remained more yellow, cleaner and more visible
- Thermoplastic markings picked-up dirt after a few hours

ASIA PACIFIC



TOLL LANE AREA MARKING
OSAKA, JAPAN

DEGAROUTE® based marking after 5 years

DEGAROUTE® based marking after 1 year

Epoxy markings after 1 year

PROJECT OBJECTIVE
Electronic toll collections (ETCs) must be well marked to slow down traffic and guide vehicles to the correct lanes. Moreover, these markings must maintain high durability as they are crossed by thousands of vehicles daily.

The toll gate at the Isumisano Interchange in Osaka was marked with a DEGAROUTE® based cold plastic MMA area marking. To demonstrate its superior durability compared to other systems, an epoxy based area marking was applied next to it.

SITE		APPLICATION	
COUNTRY	Japan	SYSTEM	Two-layer colored area marking
LOCATION	Osaka	SURFACE	Asphalt and concrete
ROAD	Isumisano Interchange	EQUIPMENT	Manual (rake)
APPLICATION DATE	September 2005	PRIMER	For concrete surface: DEGALAN®
		BASE-COAT	Based on DEGAROUTE®
		TOP-COAT	Based on DEGAROUTE®
		ANTI-SKID MATERIAL	Colored Ceramic
		THICKNESS	3 mm (118 mils)

PERFORMANCE

- Very good durability, skid resistance, color stability, as well as adhesion – both to asphalt and concrete
- Average daily traffic (ADT): 9,000 vehicles
- The DEGAROUTE® based marking is still in good shape after 5 ½ years
- Epoxy markings at the same toll gate show strong adhesion problems on concrete, they are already in bad shape after 1 year and have to be re-coated

STRUCTURE MARKINGS
KAYEMO EXPRESSWAY, CHINA

PROJECT OBJECTIVE
Kayemo expressway in Western China is connecting Kashgar and Hetian area. The length of the road is more than 185 miles (300 km) and it plays an important role for Southern Xinjiang region. The expressway improves traffic infrastructure and contributes to the economic development in the region. During construction, special efforts were taken to overcome extreme weather conditions, such as sandstorms or drought and to protect the local ecosystem.

With the expressway, the local road authority aimed at increasing road safety and reducing maintenance efforts for lane markings after construction of the roadway. Therefore, the authority chose the two-component MMA cold plastic road marking system based on DEGAROUTE® resins.

In case of tire contact, the dot structure produces a soft vibrating and subtle audible warning signal, alerting the driver when departing from the lane. The three-dimensional structure also allows for optimal water drainage, revealing glass beads that reflect the headlights of passing cars, resulting in better guidance of drivers at night and during rainfall.

Besides haptic and audible warning signals and excellent wet-night visibility, structure markings based on DEGAROUTE® resins are highly durable. These markings withstand extreme temperatures, heavy traffic loads and snow plows for years without losing their visibility and ensuring low maintenance efforts.

SITE		APPLICATION	
COUNTRY	China	SYSTEM	Cold plastic spray and structure markings
LOCATION	Expressway connecting Kashgar and Hetian area	SURFACE	Asphalt
APPLICATION DATE	May to July 2019	EQUIPMENT	2K road marking machine (spray and dot structure)
		THICKNESS	Cold spray plastic 0.7 mm (28 mils), dot structure 5 mm (197 mils)

PERFORMANCE

- Audible and haptic signal to alert the driver when crossing the lane
- High visibility of road markings during the day and at night, so that drivers can safely reach their destinations
- Resource efficient and environmentally friendly with zero solvent emissions
- Strong wear resistance under high-traffic loads, even in the most extreme climate conditions

STRUCTURE MARKINGS
LE'E ROAD, CHINA




PROJECT OBJECTIVE
Le'e road in Sichuan province in China is connecting the two famous tourist cities Leshan and E'meishan. The length of the road is approximately 12 miles (20 kilometers), from Tianqan Square in E'meishan city to Mianzu Town, Leshan city.

Particularly interesting in this context is the fact that the project represents the first structure line marking application in Sichuan province.

For the application, the local road authority chose the DEGAROUTE® based MMA cold plastic road markings as they offer best performance when road users need guidance the most. Center and edge lines were applied with DEGAROUTE® based cold plastic MMA extrusion markings in a thickness of up to 3 mm (118 mils).

Structured road markings contribute to road safety since the three-dimensional structure allows for optimal water drainage when it rains, revealing glass beads that reflect the headlights of passing vehicles. The structure also produces a soft vibrating sound that warns the driver in case of tire contact.
Besides its visibility, structured road markings based on DEGAROUTE® cold plastic MMA are highly durable. These markings withstand extreme temperatures, heavy traffic loads and snow plows for years, without losing their visibility.

SITE		APPLICATION	
COUNTRY	China	SYSTEM	Structure markings
LOCATION	Expressway connecting Leshan and E'meishan	SURFACE	Asphalt
APPLICATION DATE	May to June 2018	EQUIPMENT	2K hand guided extrusion machine
		THICKNESS	Up to 3 mm (118 mils)

PERFORMANCE

- High visibility of road markings during the day and at night, so that drivers can safely reach their destinations
- Strong wear resistance under high-traffic loads, even in the most extreme climate conditions
- Form stability avoids subsequent cracks, road markings do not get torn up in traffic
- Haptic signal to alert the driver when crossing the lane

HONG KONG-ZHUHAI-MACAO BRIDGE
CHINA

PROJECT OBJECTIVE
Hong Kong-Zhuhai-Macao Bridge (HZMB) spans kilometers and is both the world's longest sea crossing and the longest fixed link on earth.

HZMB is situated at the waters of the Lingding-yang of Pearl River Estuary consisting of three main sections: The Main Bridge in the middle of the Pearl River Estuary, the Hong Kong Link Road in the east and the Zhuhai Link Road in the west of the Estuary.

Connecting the east and west area of the Pearl River Estuary with a direct road connection, HZMB is expected to boost the economic and sustainable development of this region.
In the past, traveling between Hong Kong and Zhuhai respectively Macao took up to three hours - the new bridge cuts this down to 45 minutes. Measuring 30 kilometers (19 miles), the Main Bridge is the largest part of the project, including a bridge-tunnel system consisting of an undersea tunnel and a viaduct.

With an expected number of 126,000 commuters per day by the year 2030, safety is a top priority. Flat line markings based on DEGAROUTE® resins were mainly applied on the Main Bridge, the largest part of the HZMB.

High performance as well as durability and visibility were claimed as key criteria for road markings. Therefore, DEGAROUTE® based cold plastic MMA road markings were chosen as the primary road marking system.

SITE		APPLICATION	
COUNTRY	Greater China	SYSTEM	Flat line marking
LOCATION	Hong Kong-Macau-Zhuhai Bridge	SURFACE	Asphalt
APPLICATION DATE	2017 – 2018	EQUIPMENT	Flat line marking machine
		THICKNESS	1.2 – 1.5 mm (47 – 59 mils)

PERFORMANCE

- High visibility of DEGAROUTE® based road markings contribute to the safety of commuters during the day and night under all weather conditions
- Good performance in durability and eco-friendliness of DEGAROUTE® based road markings guarantee a long life-time
- Initial retroreflective value of DEGAROUTE® based road markings was >350 mcd/lux/m^2, expected to provide >250 mcd/lux/m^2 after two years of service and >150 mcd/lux/m^2 after three years of service on the bridge

SCHOOL ZONES
THAILAND

PROJECT OBJECTIVE
The Department of Rural Roads (DRR), Thailand, began their road safety pilot project at Nonthaburi province in 2013 to improve the children's safety in school-zone areas. Colored anti-skid rumble stripes, edge lines and pedestrian crossings based on MMA cold plastic road markings have successfully raised awareness of traffic participants.

Since its implementation in 2013, DRR has been monitoring the accident rates, anti-skid performance and the conditions of their road safety materials.

Until mid of 2017, zero accidents have been counted and the cold plastic road markings remain durable and functional even after 4 years without any maintenance required.

With such a successful outcome of the project, this innovative, sustainable and environmentally-friendly solution has already been applied countrywide across more than 700 schools, and will be extended to 3,000 rural schools in the near future.

SITE		APPLICATION	
COUNTRY	Thailand	SYSTEM	Cold plastic agglomerate markings
LOCATION	School Zones	APPLICATION TECHNIQUE	Manual
APPLICATION DATE	2013 – today	SURFACE	Asphalt
		SURFACE PREPARATION	Existing asphalt
		AGGREGATE SIZE	1 – 2 mm (39 – 79 mils)
		AGGREGATES CONSUMPTION	3 to 4 kg/m²

PERFORMANCE

- Zero accidents since installation in 2013
- MMA based cold plastic road markings remain durable and functional even after 3 years, with no maintenance required

Photos © Department of Rural Roads, Thailand. Bureau of Traffic Safety

HIGH FRICTION SURFACE
SUVARNABHUMI AIRPORT, THAILAND

PROJECT OBJECTIVE
The entrance from motorway number 7 to the new Bangkok International Airport (Suvarnabhumi) is a curvy bridge. Especially in rainy weather, the curvy road was very slippery, resulting in roadway departure and wet weather crashes.

Therefore, the Department of Highways in Bangkok decided to increase the skid-resistance of the road by applying DEGAROUTE® based cold plastic MMA high friction surfaces.

High friction surfaces are a proven countermeasure to reduce roadway departure and wet weather crashes at dangerous sections on the road. With applications ranging from bridges and steep grades to ramps, intersections and tight curves, the opportunities for enhancing road safety are endless.

In this way, the Department of Highways was able to increase the safety of travelers without having to redesign the entrance road to the airport.

SITE		APPLICATION	
COUNTRY	Thailand	SYSTEM	High friction area marking (9,000 m^2)
LOCATION	Suvarnabhumi Airport Entrance	SURFACE	Asphalt
APPLICATION DATE	2012	EQUIPMENT	Manual application
APPLICATOR	Cleanozone Traffic (Thailand) Co., Ltd		

PERFORMANCE

- Fast curing allows for a quick re-opening of roads
- Strong adhesion on concrete and asphalt surfaces
- Highest wear resistance (heavy traffic loads, snow plows)
- Cost-efficient over the life cycle of the project

RED BOXES FOR MOTORCYCLES
BALI, INDONESIA

PROJECT OBJECTIVE
Motorcycles have become a popular and affordable means of transportation in low- and middle-income countries. With over 100 million units, Indonesia has the largest number of motorcycles in the world.

Since more than half of road users are motorcyclists, the Indonesian government started to focus on how to better organize them on the roads. To improve the performance, especially of intersections, the Institute of Road Engineering proposed a traffic engineering approach where red motorcycle boxes separate the traffic between motorcycles and other types of vehicles at red lights. Within these boxes, motorcyclists are able to stop in front of other types of vehicles, allowing them to proceed through the intersection first when the traffic light changes.

Due to its long-term performance, UV resistance and, most importantly, its excellent skid resistance properties, the Indonesian project used DEGAROUTE® based cold plastic MMA area markings to apply the red boxes. MMA has the unique ability to fuse to itself, creating a single layer which no other pavement markings can offer. This benefit eliminates the common failure of inter-coat adhesion and early delamination.

SITE		APPLICATION	
COUNTRY	Indonesia	SYSTEM	Anti-skid area marking
LOCATION	2 intersections in Badung (Laswi and Pasteur), 2 intersections in Balis (Ubung and Dewa Ruci)	SURFACE	Asphalt
APPLICATION DATE	2012	EQUIPMENT	Manual application
		THICKNESS	Approx. 3 mm (118 mils)

PERFORMANCE

- Traffic conflicts decreased by 40% after implementation of red motorcycle boxes
- Improvement of traffic flow after implementation of red motorcycle boxes of up to 13%
- Long-term performance: resistance against wear, color stability and UV-resistance
- Excellent skid resistance properties, also during rainfall

Photos © Institute of Road Engineering of Indonesia

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