Dow Coating Materials presents: FASTRACK™ binder for water-borne paints

A highly durable, cost effective and ecological road-marking solution increasing road safety



Advancing performance. Accelerating change

Water-borne. VOC limits and enhanced performance driving change from solvent-borne to water-borne paints.

Water-borne.

Environmentally friendly without compromising on performance.

Why does durable road-marking matter?

Source: Dow 2016

5 Main Properties

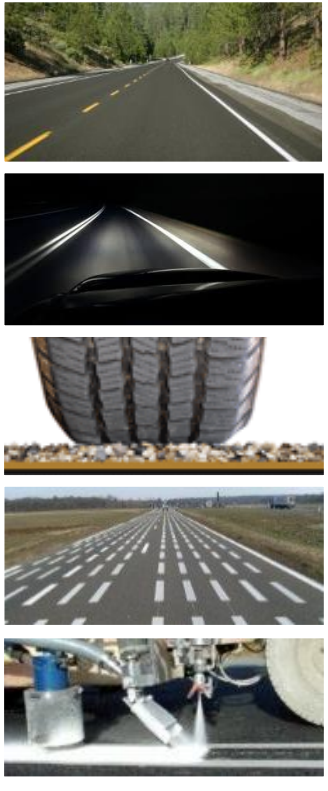
1 – Daylight
visibility – luminance QD.

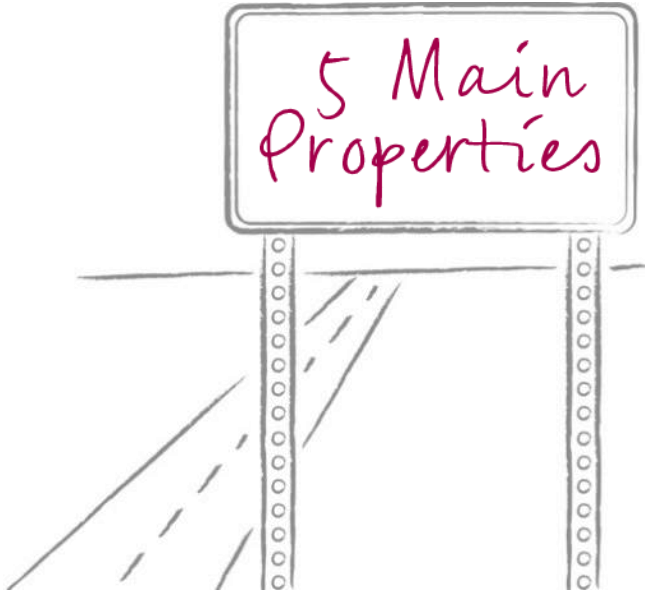
2 – Nighttime
visibility – Retroreflection RL – under all weather climates.

3 – Antislip
SRT: Skid Resistance Test.

4 – Durable
traffic and weather resistance.

5 – Easy to lay down
application.

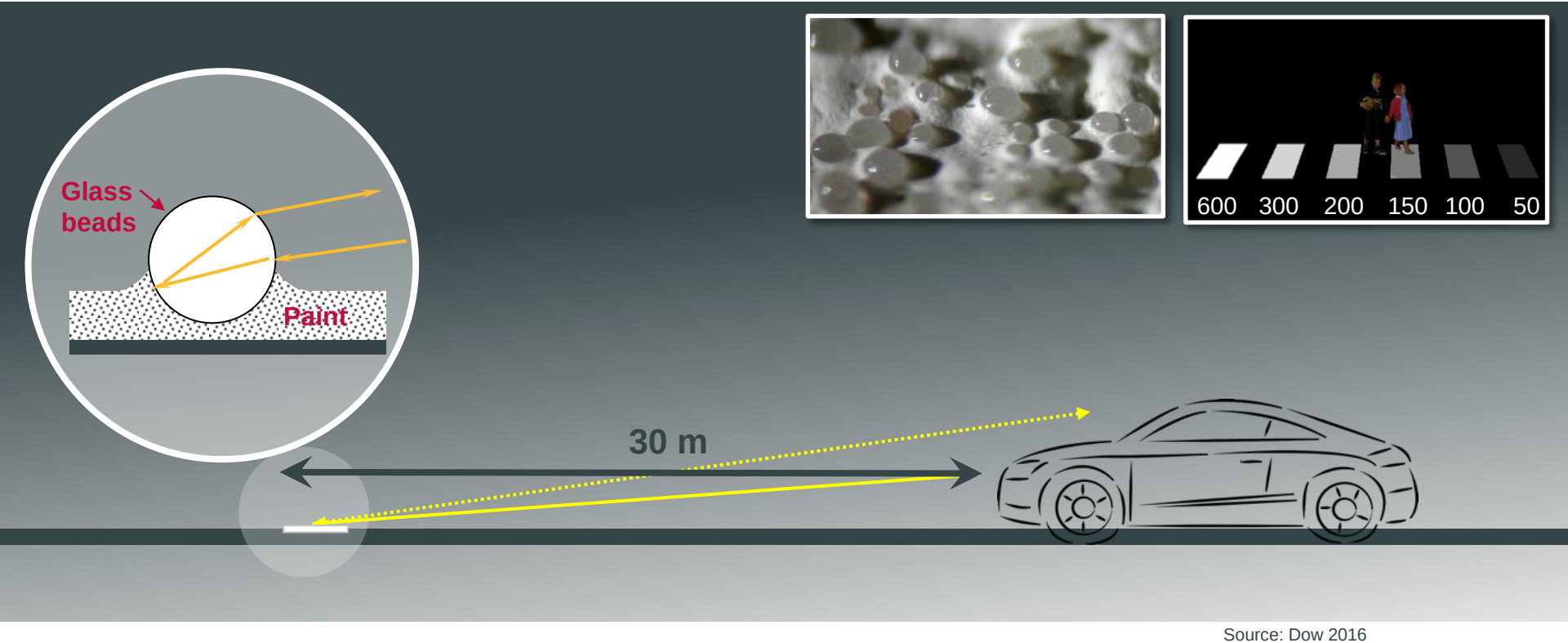




Source: Dow 2016

Nighttime Visibility (Retroflexion – RL)

The **true quality** of a road marking is revealed under **less favorable** light and weather conditions (i.e. at night, foggy, rainy).



Source: Dow 2016

Road Fatalities are real!

80 People die every day on European roads

Town of **27000** inhabitants disappearing every year

Billion € **51** Road Fatalities per year

Billion € **300** Road accidents per year

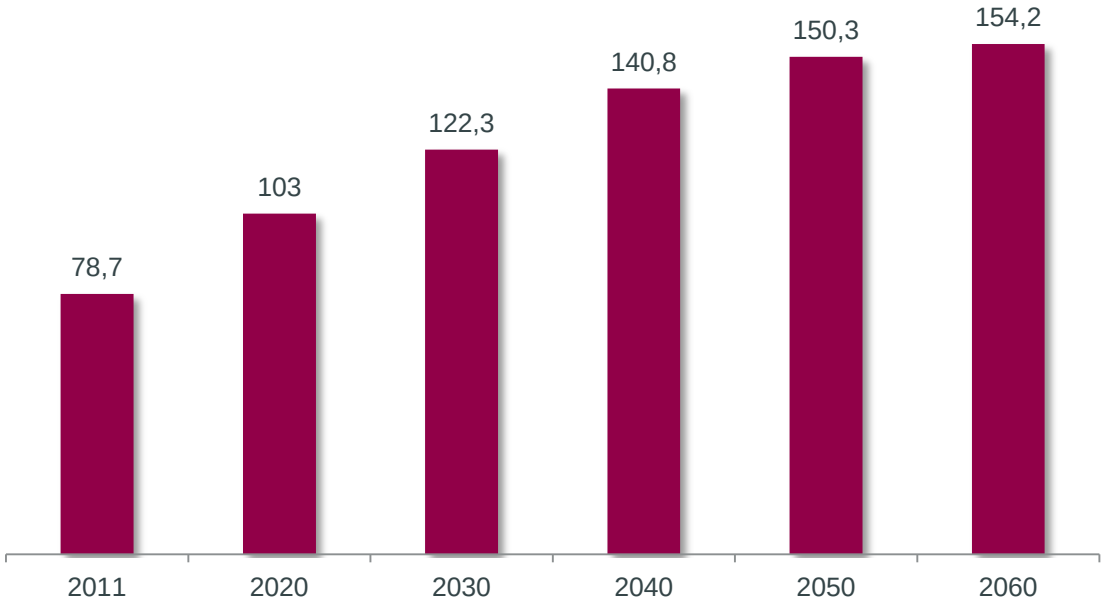
« Marking the way towards a safer future » - ERF position paper – 2014

Population ageing

Day & night visibility becoming more important

Demographic projection 65+ years

in Europe (Million)



Source: Dow 2016

Improved Road Safety

Resulting into min 20% less accidents

Traffic marking	Sideway	Axial roads	Turn arrows
Accidents reduction	-20%	-36%	-20%

Source: agent & Al (1996)

-32 to -34% Accidents when implementing high performance road markings.
Source: RSMA (2006) and ROSPCA (2000)

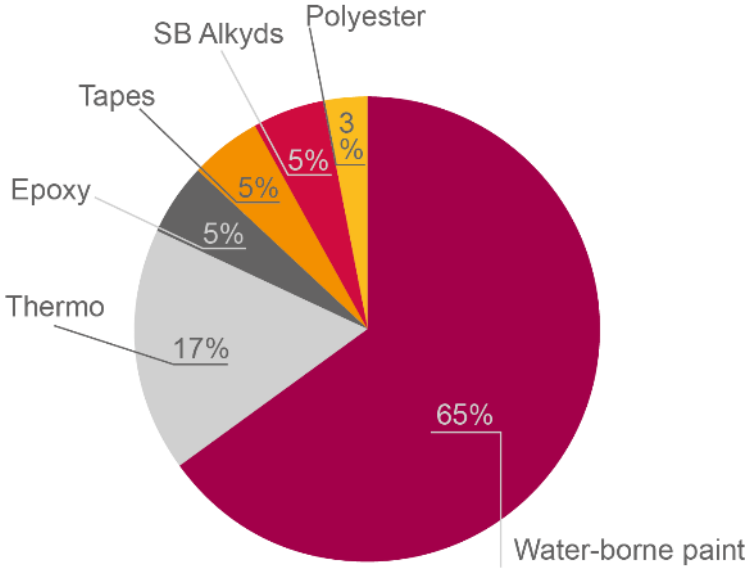
40% Crash reduction in nighttime fatal & injury.
29% Crash reduction in daytime fatal & injury.
Source: Michigan (2006)

Source: Dow 2016

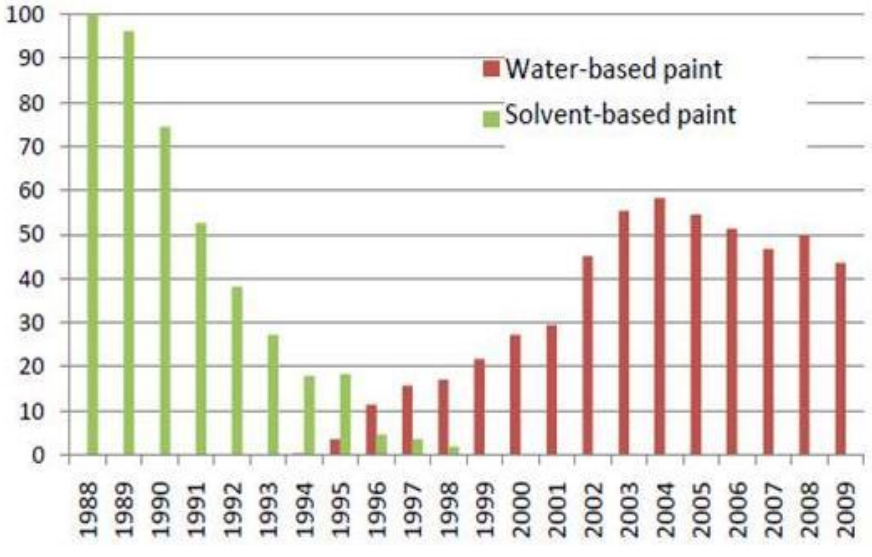
Where is water-borne paint being used?

Source: Dow 2016

Successful transition to water-borne paint in the US



In North America, 2/3 of linear markings applied every year are water-borne paints.



Source: Dow 2016

Driven by VOC limit.

FASTRACK™ binder for water-borne paints

A demonsrated road-marking paint solution across Europe

85%

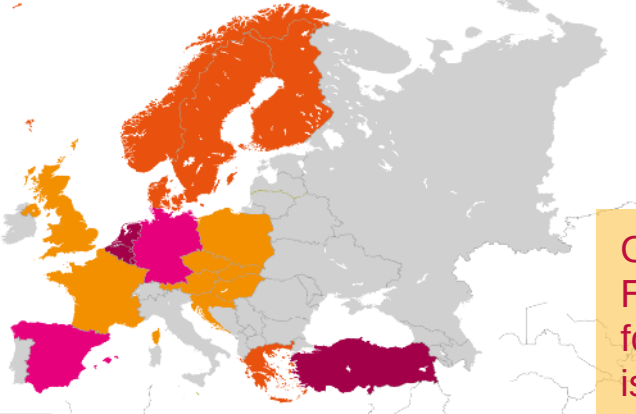
of the road-marking paint market in **Norway, Sweden, Finland, Denmark** is water-borne paint

Driven by **VOC-limit and durable performance**

35%

of the road-marking paint market in **France** is water-borne paint

Driven by **eco-label** and **better performance** than solvent-borne



30%

of the paint market in **Spain** is waterborne paint

Driven by **ecological profile, best solution to repaint old markings**

Other markets where FASTRACK™ binder for water-borne paint is used and introduced:

- Italy
- Belgium
- Austria
- Poland
- Hungary …

Source: Dow 2016

VOC limitations driving change towards water-borne

In Finland, in public tenders, a factual ban of solvent-based road marking paints is in force since 2007 due to a **VOC limit of 2 wt-%**

In Sweden, in 1986, the Swedish Road Marking Administration decided to restrict **the solvent content of road markings in public tenders with a limit value of 2 wt-%**

In the USA, the Clean Air Act Amendment (CAAA) of 1990 restricted **the VOC solvent content** in “architectural coatings”, also covering “traffic marking coatings” with limits of **150 g/l**, equivalent to 3 - 8 wt-%.

In Canada, the regulation determines a **maximum VOC solvent content of 150 g/l for the use road markings from 1 May to 15 September, and 450 g/l in the rest of the year**

~40 kMT Potential VOC reduction impact in EU by 2020 by limiting VOC level to 60 g/L

Source: *Review Options for Directive 2004/42/EC Impact Assessment on Road Markings (ökopol, May 2011)*

Shift from solvent-based to water-based road markings in Sweden by sales index (1988 = 100)

FASTRACK™ references

– 600 000 km of water-borne traffic paint with FASTRACK™ binder already applied on European roads.

– Global references in demanding applications (Airports, Formula1, etc.).

Punishing laps at 200 MPH put the most durable line marking to the test. Brazil‘s Interlagos Racetrack adopted FASTRACK™ technology to withstand grueling Formula I™ tire heat and friction.

Sighting the runway for returning Space Shuttles is greatly assisted with proper markings.

Nighttime shot at Bahrain International Airport taken – 1 year after application of high durability (Type III) water-borne paint based on FASTRACK™ HD-21A and high index glass beads (Type III).

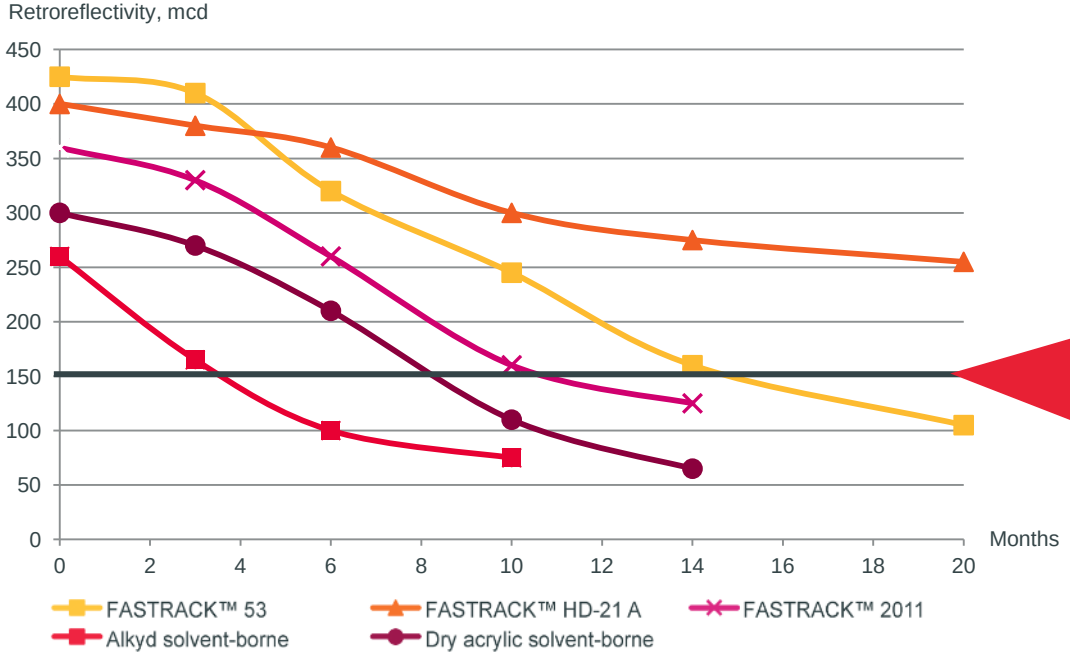
Source: Dow 2016

Why FASTRACK™ binder for water-borne paint?

Source: Dow 2016

FASTRACK™ water-borne paint delivers …

Durable road safety



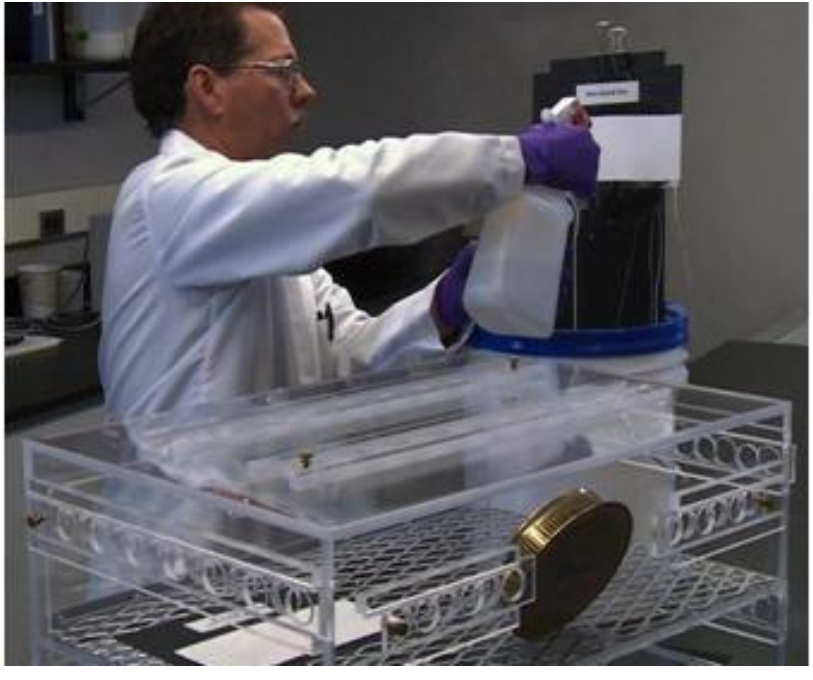
150 milicandela =
minimum for night visibility

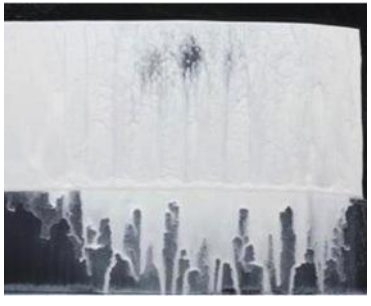
Water-borne paints with FASTRACK™ offer more durable day and night visibility than solvent-borne paints.

Source: Dow 2016

FASTRACK™ water-borne paint delivers …

Fast drying & Low Traffic Disturbance





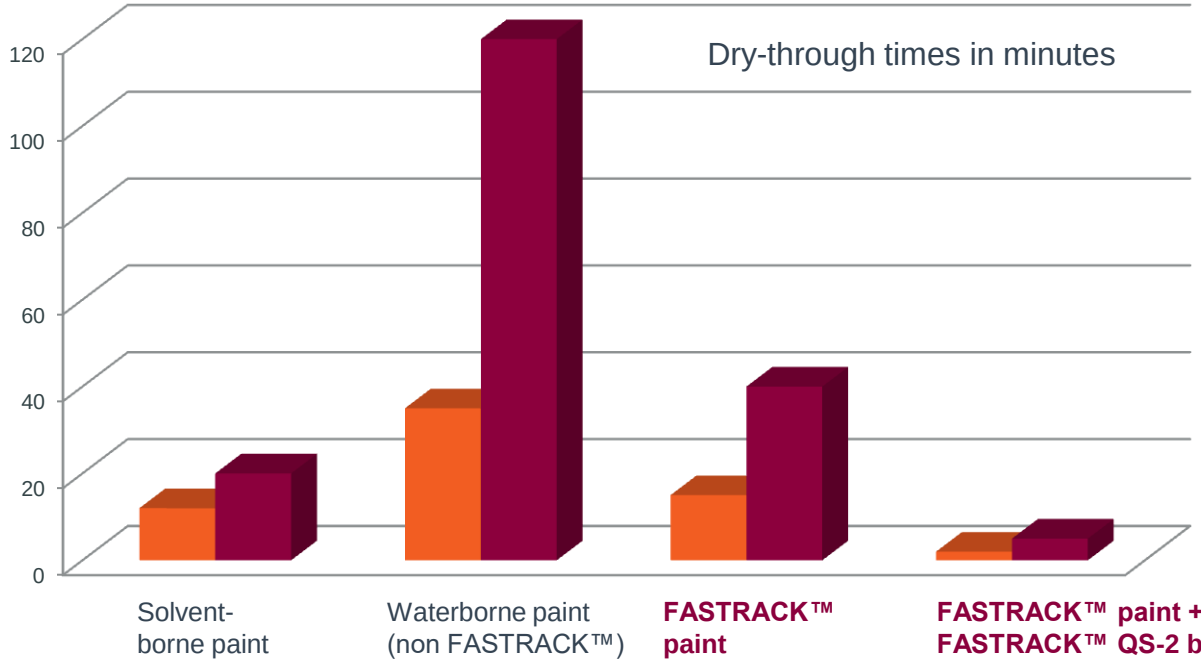
Paint withouth FASTRACK™ after 60 min drying @ 90% humidity.

FASTRACK™ 53 based paint after 20 min drying @ 90% humidity.

Source: Dow 2016

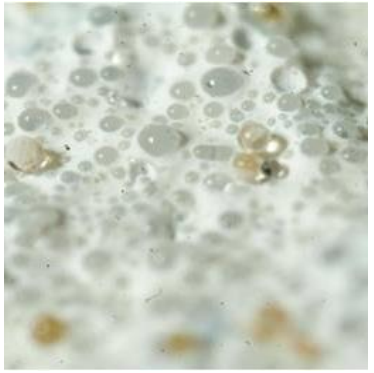
FASTRACK™ water-borne paint delivers …

Fast drying & Low Traffic Disturbance



50% humidity

90% humidity



FASTRACK™ QS-2 is suggested at low temperature/high humidity (80 – 90%). This product is available from glass bead manufacturers who mix this drying aid with their glass beads.

Source: Dow 2016

FASTRACK™ water-borne paint delivers …
An ideal solution to restripe old markings in cities

Why does my marking crack?

- Poor flexible markings: Marking cannot absorb « stress energy » from tire hits/ temperature variations
- Poor adhesion on old marking
- Too high thickness: old markings show different expansion than new markings → delamination

↓

	Adhesion	Flexibility	Thickness
Waterborne paint			
Solventborne paint			
Thermoplastics			

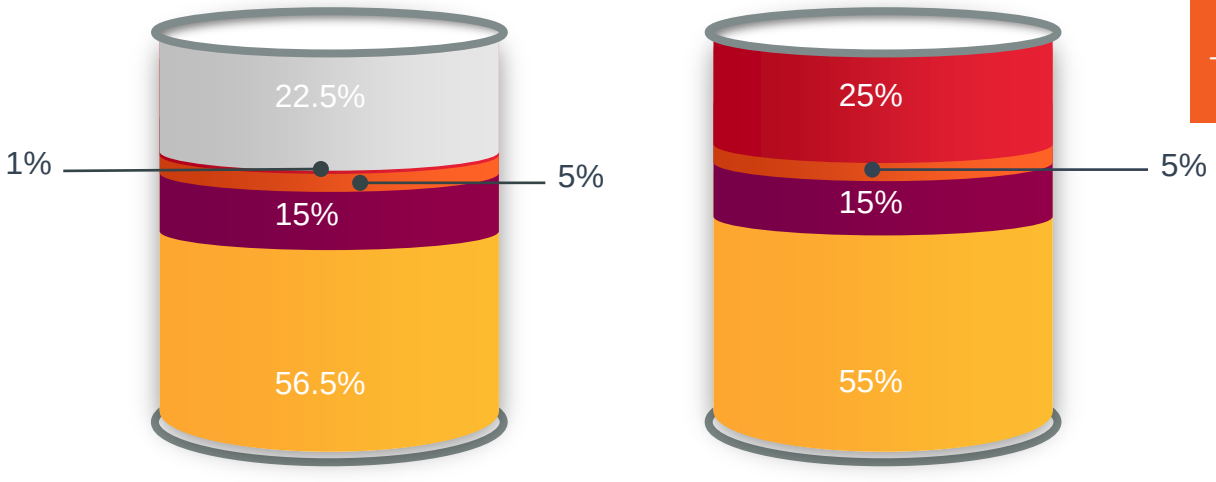
Water-borne paint has a better adhesion on thermoplastics and is more flexible than solvent-based paint which results in **no/less cracking**.

FASTRACK™ water-borne paint delivers …

A sustainable and safe road marking solution

FASTRACK™ water based paints:

- are non-flammable.
- are non-hazardous.
- **VOC emissions can be reduced by up to 90%**
- **Carbon footprint can be reduced by up to 50%**



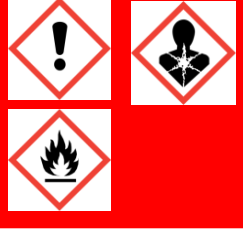
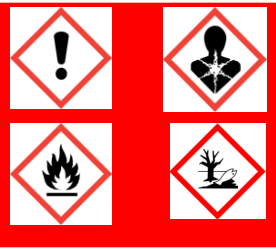
Water-borne traffic paint

Solvent-borne traffic paint

Source: Dow 2016

FASTRACK™ water-borne paint delivers …

The safest road marking material

	Water-borne	Solvent-borne	Thermoplastics	Cold plastics
Health risks	No risks	• Flammable • Irritant • Harmful	• Release of formaldehyde at high temperature • Burn risks	• Flammable • Irritant • Harmful
Cleaning	Water	Solvent	No cleaning	Solvent
Hazardous transport	No	Yes	Potential risk with powder	Yes
VOCs, carbon footprint	Low	High	High	High
Labels	No labels		No labels	
Approved by NF331 – French ecolabel	Yes	No	Yes	No

→ **Water-based paint most sustainable solution supporting Green cities ambitions**

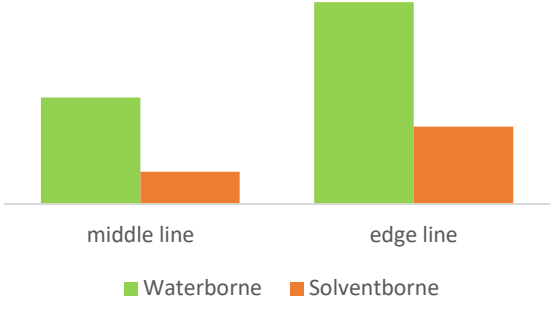
Case studies

Water-borne paint Aqualiner on the roads in Poland

1. National road 28 (between Kasina and Gruszowiec) – July 2016
2. National road no 25 – October 2014
3. Voivodo road no 913 – May 2014
4. City Wrocław – September 2013
5. South Poland Cieszyn – July 2013
6. South France – June 2013

Comparative application on the National road 28 made 5 July 2016

- Application with Road Authority;
- SB vs. WB comparision;
- Dry time to reopen to traffic: 3 min (27° C; humidity 30%)
- After 9 months, **waterborne** has **more than twice better retroreflectivity** compared to **solventborne** paint on middle and edge line



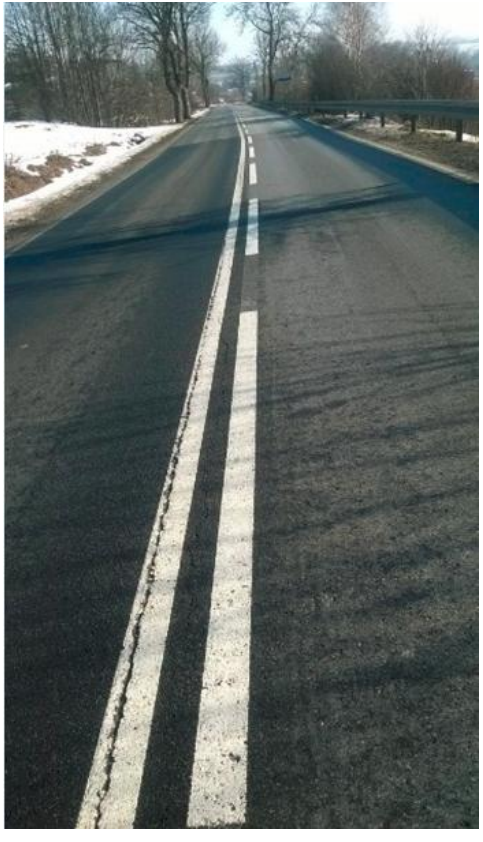
Road marking on the national road no 25 - 17.10.2014

- maintanance of chemo in 12 deg and 80% RH;

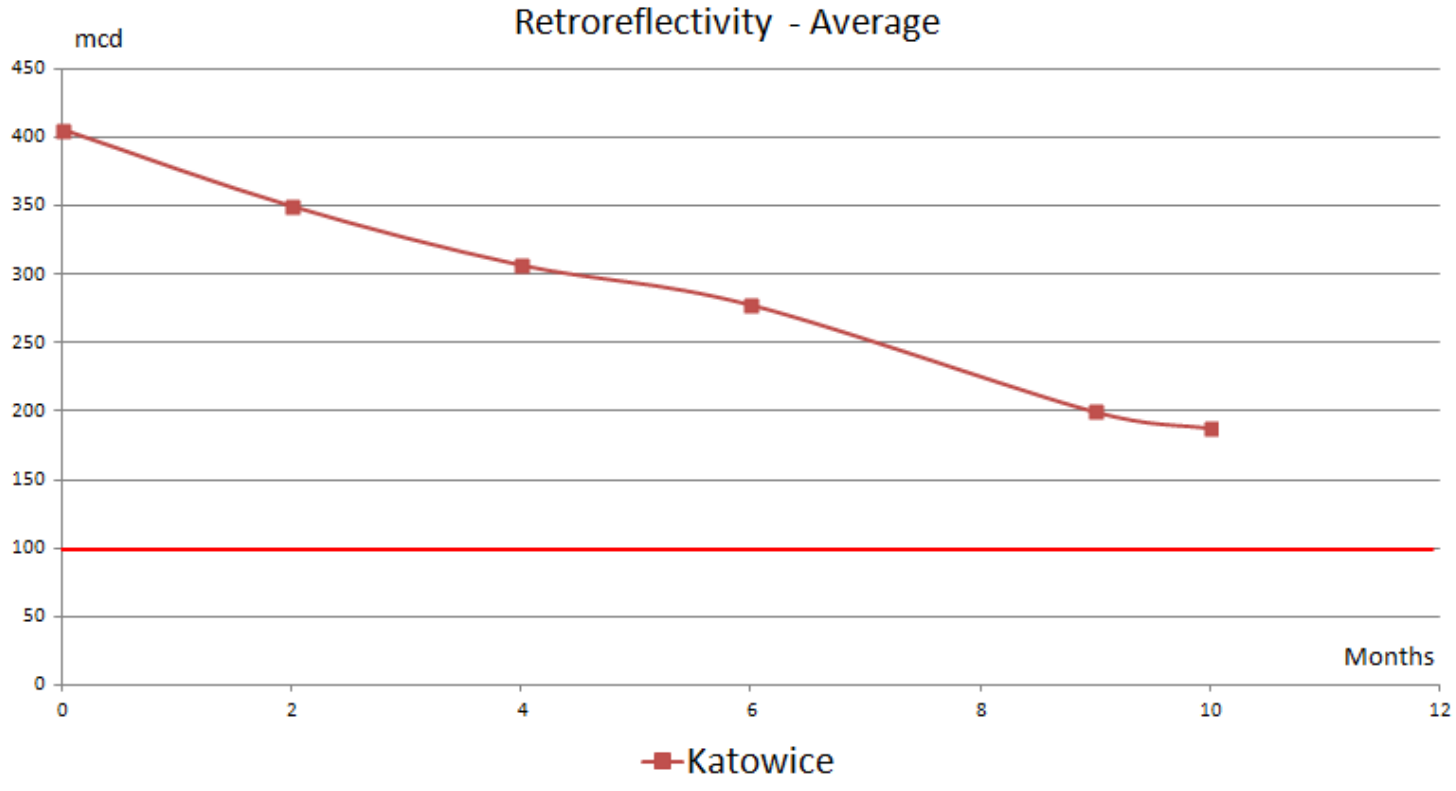
Comparative application on the provincial road No. 913 - 28 May 2014

- Application with Road Authority;
- SB vs. WB comparision;
- After 5 months 222 RI, which means 122 above requirements;
- after **10 months RI 150, Qd 180.**

Comparative application on the provincial road No. 913 - 28 May 2014



Comparative application on the provincial road No. 913: RL results after 10 months



Pedestrian crossings in Wroclaw - 28.09.2013

- The temperature of 18 degrees with 75% humidity;
- Asphalt and granite;
- After 4 months, the mean RL 176 which is 76 above requirement;
- Ecology and safety in cities becomes more important. Reduced smell to applicators and citizens.

Application trials at experimental road - 30.07.2013

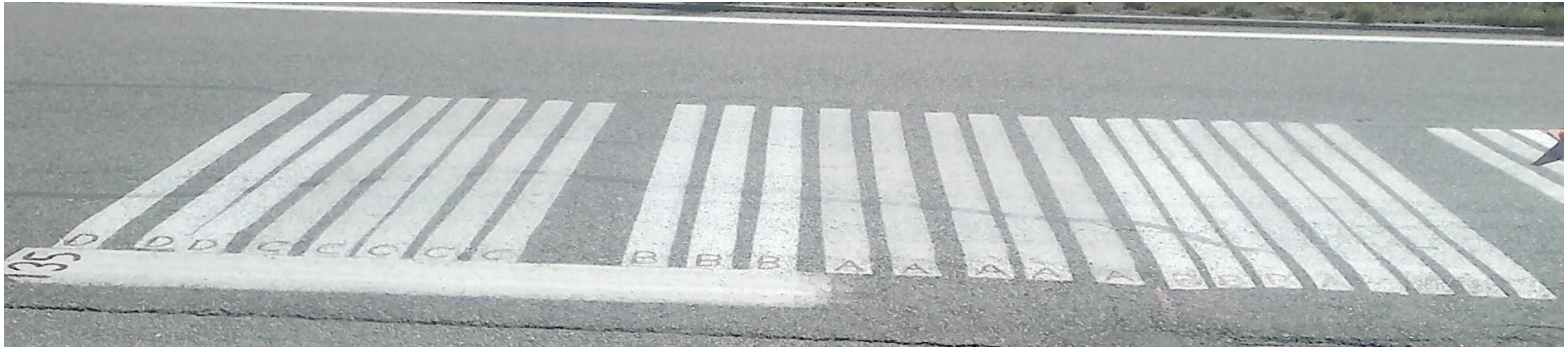
- Temperature 28 deg RH 55%;
- Comparision with two market SB paint;
- After 5 month WB paint is **TWICE** better in RI;
- Experimental road close to the PPG plant, high traffic by heavy trucks.

Application in South France 15.06.2013

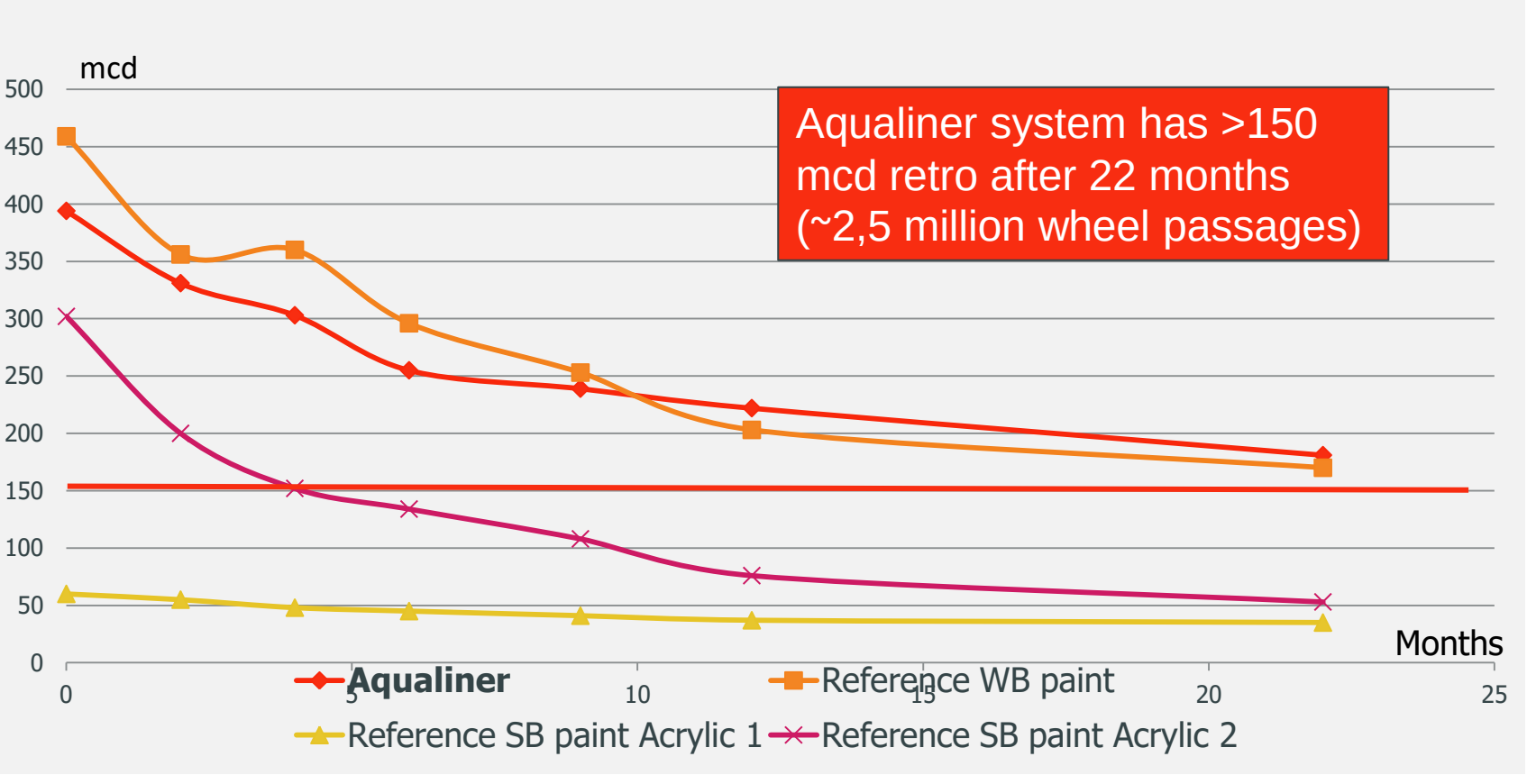
- Temperature 25 deg, RH 40%;
- Comparision with market SB paint;
- After **22 months** WB paint much better compare to the market SB paint (>150 Rl);
- 2,5 million wheel passagess.

Road tests Utelle (Southern France)

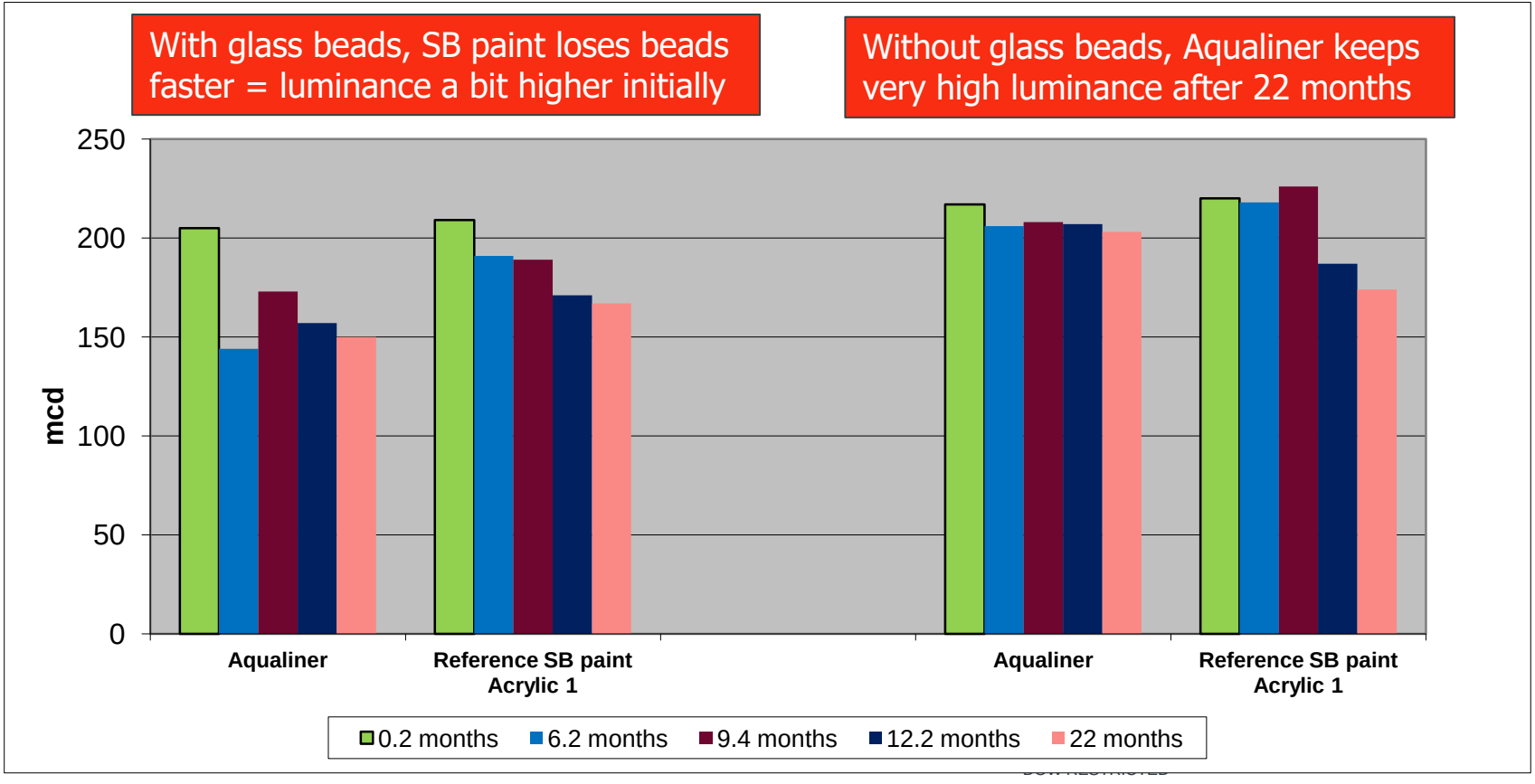
Name	g/m2	Glass beads	Temp/ humidity	Drying time
Aqualiner	**460**	**370g/m2 125-600**	**23 deg C/ 40% RH**	**<15 min**
Reference WB paint	480	360g/m2 125-600		<15 min
Commercial SB acrylic 1	510	310 g/m2 125-600	28 deg C/ 40% RH	40 min
Commercial SB acrylic 2	530	360 g/m2 125-600		38 min



22 months results - Retroreflectivity (Night visibility)



22 months results – Luminance (Day visibility)



22 months results- Appearance

Aqualiner

Reference SB Acrylic 1

Summary

- Fast drying water-borne acrylic traffic paints improve road safety as it offers up to twice better retro reflectivity compared to solvent-borne paint.
- By replacing solvent-borne by water-borne traffic paints, VOC emissions can be reduced by up to 90% and carbon footprint by up to 50%
- Water-borne paint is a cost-effective road marking solution as it combines excellent performance at low thickness resulting in cost-saving for authorities.

Thank You

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Handling precautions

Before using any product mentioned herein, consult the product's Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

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Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

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Health & Safety Risks with road-markings

	Solvent-borne paint	2K cold plastic	Waterborne paint
Safety risks on MSDS	**Flam. Liquid 2**, H225, highly flammable liquid and vapor	**Flam. Liquid 2**, H225, highly flammable liquid and vapor	None
Health risks on MSDS	**Eye Irritant 2**: H319 – irritating to eyes **Repr 2**: H361d-suspected of damaging the unborn child EUH066- Repeated exposure may cause skin dryness or cracking	**Skin irritation 2**: H315, causes skin irritation. **Skin sensitisation 1**: H317, may cause an allergic skin reaction	None
labels			None

In addition the initiator for 2K cold plastic is environmentally damaging

2 lobbying priorities involving biz dev and country manager

Top down:

- Lobby at Ministry of Transport* to get environmental specifications in tenders

Bottom-up:

- Leverage success story and lobby at authorities for local roads

* Owner and timing: see slide 12

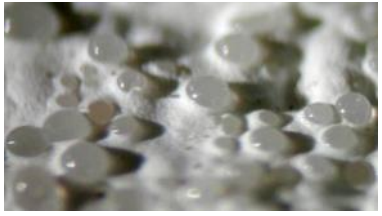
Homologation in Belgium 2016

Attestations d'aptitude à l'emploi des systèmes de marquages routiers appliqués sur le site de Baillonville N63 - le 21/10/2016									Classe de performances					
Homologations selon le guide G0025									Classe de Trafic	Rétroréflexion par temps sec	VNTP Rétroréflexion par temps humide	VNTP Rétroréflexion par temps de pluie	Luminance	Rugosité SRT
Année	Bloc	Type	Producteur	Produit de base du marquage	Dosage	Produit de saupoudrage	Dosage	Producteur						
2013	17	Peinture à l'eau	AXIMUM	TYPHON PREMIUM	525 g/m²	Echostar 5 WBP SRT 710-125 + SII 12 1000-150 (80/20)	350 g/m²	SOVITEC	P 1	R 4	-	-	Q 3	S 1
2013	18	Peinture à l'eau	AXIMUM	TYPHON VILLE ROUTE	475 g/m²	Echostar 5 WBP SRT 710-125 + SII 12 1000-150 (80/20)	350 g/m²	SOVITEC	P 5 P 3 P 1	R 3 R 3 R 5	- - -	- - -	Q 2 Q 3 Q 3	S 1 S 1 S 1
2007	10	Peinture à l'eau	GEVEKO MARKINGS - PLASTIROUTE	AQUAROUTE UWS AL-B	610 g/m²	Echolux SRT 850-212 + SII 12 75/25	220 g/m²	SOVITEC	P 1	R 3	-	-	Q 3	S 1
2013	23	Peinture à l'eau	VANDIPAINT NV	SASKIA	350 g/m²	500-180 + SILI 11 710-125 (80/20) WBP	300 g/m²	SOVITEC	P 6 P 5 P 3	R 3 R 4 R 4	- - -	- - -	Q 2 Q 2 Q 3	S 1 S 1 S 1
2013	44	Peinture à l'eau	VELUVINE bv	VELUQUA CLAIRE	625 g/m²	Echostar 5 SRT + SILI 12	400 g/m²	SOVITEC	P 5	R 3	-	-	Q 3	S 1
2013	65	Peinture à solvants	ACB	LIPAROAD ML	650 g/m²	Echostar 5 SBP ECO SRT	400 g/m²	SOVITEC	P 6 P 5 P 4 P 3	R 2 R 3 R 3 R 3	- - - -	- - - -	Q 3 Q 3 Q 3 Q 4	S 1 S 1 S 2 S 2
2013	66	Peinture à solvants	ACB	LIPAROAD ML	400 g/m²	Echostar 5 SBP ECO SRT	350 g/m²	SOVITEC	P 5 P 1	R 2 R 3	- -	- -	Q 3 Q 4	S 2 S 2
2013	67	Peinture à solvants	ACB	LIPAROAD ML	500 g/m²	600-125 + SII 12 75/25	450 g/m²	SOVITEC	P 5	R 2	-	-	Q 3	S 3
2007	11	Peinture à solvants	GEVEKO MARKINGS - PLASTIROUTE	H3ROUTE H3 - 9 PREMIX B	1 kg/m²	600-125 + SII 11 75/25	180 g/m²	SOVITEC	P 1	R 2	-	-	Q 4	S 3
2008	33	Peinture à solvants	ORE PEINTURE	KYOTO	400 g/m²	600-125 ACB0	550 g/m²	POTTER3	P 1	R 2	-	-	Q 4	S 1
2008	46	Peinture à solvants	VANDIPAINT NV	ISIS AF	575 g/m²	Injection 600-125 / Saupoudrage 600-125 + SII 11 75/25	145 g/m² / 550 g/m²	SOVITEC	P 1	R 2	-	-	Q 3	S 1
2008	47	Peinture à solvants	VANDIPAINT NV	ISIS AF	575 g/m²	600-125 + SII 11 75/25	500 g/m²	SOVITEC	P 1	R 4	-	-	Q 3	S 2
2013	22	Peinture à solvants	VANDIPAINT NV	SILANCE	425 g/m²	500-180 + SILI 11 710-125 (80/20) SPB ECO	300 g/m²	SOVITEC FRANCE	P 2	R 2	-	-	Q 4	S 1
2013	26	Peinture à solvants	VANDIPAINT NV	RESONANCE	725 g/m²	600-125 SBP ECO SRT (80/20)	325 g/m²	SOVITEC	P 1	R 2	-	-	Q 3	S 1
2007	16	Peinture à solvants	VELUVINE bv	VELUCRYL B	600 g/m²	600-125 + Alu 21 75/25	450 g/m²	SOVITEC	P 1	R 2	-	-	Q 4	S 2
2008	37	Peinture à solvants	VELUVINE bv	VELUCRYL B	650 g/m²	Velucryl NM B 3:1	500 g/m²	POTTER3	P 1	R 3	-	-	Q 4	S 3
2013	40	Peinture à solvants	VELUVINE bv	VELUCRYL B EXTRA	600 g/m²	Velucryl NM B 3:1	400 g/m²	POTTER3	P 5 P 1	R 2 R 4	- -	- -	Q 3 Q 4	S 2 S 2

- Supporting better durability of FASTRACK Waterborne paint at lower thickness than solventborne paint

Conclusion

- Improved road safety.
- Improved durability.
- Improved Health & Safety and reduced environmental impact.
- Cost-saving for contractor and road-authority.
- Fast-Drying & Low traffic disturbance.



Source: Dow 2016