Improving Drying rates of Waterborne Pavement Markings

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Rohm and Haas is a fully owned subsidiary of The Dow Chemical Company
Market demands new ideas

- Increasing WFT specs >500um
- Desire for increased durability
- Limited use of cones for line protection
- Preferences for conducting night work

Need to improve DRYING
Drying Additives

• An externally provided “booster” to aid the drying and film formation needed for glass bead adhesion and speed of dry

• Types of systems available
  – Rapid pH drop through post addition of acid- limited to 400um- licensed and patented
  – Use of Superabsorbants- eg Used in nappies and Sanatory liners- difficult to operationalise- patented
  – Controlled flocculation- forced phase separation of solids and liquid component of the paint- poor overall durability.

• Combining the need to reduce pH quickly and then remove the excess water led to a number of patents around this approach.

• First generation drying additives tested on Desert Road New Zealand in 2000 and Canberra 2001. Extended trials completed in Canberra 2002-04

• Second generation (current) tabled early 2007 as drying criteria become more difficult to meet through increased WFT and less work protection.
Drying Additives
WATER ABSORBING, ACIDIFIED SPHERICAL BEADS

Increased surface area allows for increased moisture absorption
Dark colored and approx 0.3-0.8 mm diameter
**Wet State at high pH**: Fastrack™ Quick Set agent (in blue) ionic charge is neutralized. Fastrack™ polymer (negative charged particles) and paint are stable.
FASTRACK™ Quick Set Technology - Dry Paint
No Drying Additive
Set State (dry through and water resistant)

Ammonia begins to flash off, pH drops and Fastrack™ Quick Set agent becomes charged. As water evaporates, Fastrack™ agent forms bridges between polymer particles to achieve a “set state” before all of the water is evaporated.
FASTRACK™ Quick Set Polymers with a Drying Additive

Drying Additive accelerates the Fastrack™ drying mechanism to achieve even faster “set” in two ways:

1) Drying Additive particles are acidified to neutralize ammonia and reduce the pH faster, which accelerates positive charge generation of Fastrack™ agent.

2) Drying Additive particles absorb water (absorbs 1/3 to 1/2 of the water in the paint) so that the paint reaches the “set state” faster, without relying completely on the evaporation of water.
# Drying Additive- effect on Dry Through Performance

Tested at 23°C, Zero airflow

<table>
<thead>
<tr>
<th>Binder</th>
<th>Fastrack™ 3427</th>
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<tbody>
<tr>
<td>Formulation</td>
<td>GTC-104-14B</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Yes</td>
</tr>
<tr>
<td>DA (50-75g/m²)</td>
<td>No</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>WFT Thickness</th>
<th>360 um WFT</th>
<th>530um WFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>45% RH</td>
<td>0:20</td>
<td>0:30</td>
</tr>
<tr>
<td>80% RH</td>
<td>1:25</td>
<td>2:20</td>
</tr>
</tbody>
</table>

530um WFT:
- 45% RH 0:30 0:20
- 80% RH 2:20 0:20
Drying Additive - effect on Dry Through Performance

With Drying Additive  Without Drying Additive
Drying Additive - Effect on Washout Resistance - on road
Improved early rain resistance

Heavy rain 1hr after last line applied

Low level DA used
High level DA used
NO DA used
Test Deck Results
Rain Immediately Following Application

Line 21:
Contains Drying Additive

Heavy rain ~ 2 hours after application.

Line 20:
Contains NO Drying Additive

875 micron WFT
Air temp 21C / 65 %RH / cool and overcast day
Rain prior and following application.
Application: Route 202S, Doylestown, PA
Industry Testimonials- Australia

- Mick Brennan-Senior Project Manager - Asset Maintenance
  RoadTek Asset Services- Townsville Australia

.....Thanks to all in sundry who participated in the development of the Paint Accelerant system now in use on the Townsville machine. We can report a significant increase (sic) in the dry time of paint applications (300 or 500um) on longlines. This should result in a productivity gain (yet to be measured), but from recent applications in the Townsville city we can report a dry time of 15-20 mins. In the past this dry time could be up to 40mins or more..Further investigations are still required, but from initial findings it appears to work well.........

......Retained retroreflectivity is important. It was very common to see beads plucked from lines after 6-8months, we are not seeing that now.......

......the guys are very happy with it and are now using on chevrons, arrows and general transverse marking.....
Colin Schulz - Operations Coordinator (Lines) Brisbane CityWorks

The reason we converted our longitudinal line marker to use Visilok is that we were having trouble with the amount of time it was taking for the paint to dry in our winter weather conditions here in Brisbane. By using Visilok it reduced the drying time by half. We trialled Visilok on our test deck on Kingsford Smith Drive first before we installed the Visilok guns on our machine. After being down for more than twelve months it proved to have no effect at all on the longevity of the paint.

The setup cost was also very reasonable considering the amount of time lost capping out the work area and waiting for the paint to dry. Because of the length of time it was taking to dry we were experiencing a lot of tracking from vehicles. With Visilok we can have a pilot vehicle about one hundred metres behind the line marking machine and have no tracking problems at all. Because of the Visilok we can now install more lines on our night and day shifts.
Industry Testimonials Australia

Ian Clark - Oz Linemarking

{umaquote} had not intended to use any Visilok but looks like Bob had got there before me. It was specified in as part of a high performance contact in Eastern Victoria.......{umaquote}

{umaquote} Separate mobile retro testing underway while I happened be on road in the same area about six months later, showed some really high numbers. Much higher than the surrounds. This was great to see.........{umaquote}

{umaquote} I ended up using it on bends and stuff I knew I was going to have problems with. As it turns out it obviously works well. I watched as a car travelling behind drifted onto the edge line that had only been down for maybe 10seconds. Virtually no tracking at all.......{umaquote}

{umaquote} we have a current 9 year contract in metro Melbourne that I will certainly consider using Visilok based on prior experience{umaquote}
Industry Testimonials- New Zealand

• Jeremy Van Noord- Fulton Hogan Christchurch NZ

.....while are not fully set up yet, in fact more like evaluation mode, it does show a lot of promise. We have 2 crews all on night work and with P22 and P20 contract work requiring higher life expectancy in waterborne we will have to get on with it....

... as we do more night work in urban areas we really need to take the risk out of the work. The reduced chance of early washout due to rain will be important and the opportunity to apply thicker or quicker application rates is interesting....
2009 ATSSA Conference Customer Survey

• Is Drying time of high build waterborne paints problematic? (50 responses)
  • 28% Not an issue
  • 24% Yes, prevents usage
  • 34% Yes, restricts usage
  • 14% Don’t know/ No opinion

  – Results: Majority (~60%) say the dry time contributes to either preventing or limiting use. ~25% say not an issue – these predominately in the South (ie AL DOT). In conversations with northern DOTs/MOTs, they confirm that improved dry time would be a benefit and eliminate a main barrier to acceptance. The cost of coning the road for a slow drying system is substantial
How to use a drying additive- Dual Gun preferred method
How to use a drying additive- single paint gun

To deliver optimal drying and maximise durability 2 conditions are required:
1- Precise calibration of the equipment via the correct angle of Additive flow in the paint flow.
2- An accurate dosage system to avoid saturation of the paint by the Additive which can lead to excessively rapid dry and poor glass bead embedment.
Other potential equipment setups

USA Sandwich (air assisted)

ACT and North Queensland

A1 Roadlines

USA Dual bead back set up (air assisted)
When to use a drying additive

The use of a Drying Additive is recommended when

• Drying Conditions are less than optimal
  – High humidity, low temperature, low air flow

• Chance of rain leading to wash out of paint and premature glass bead loss

• Protection of the work is limited by local regulations, complex traffic management or road geometry

• Specifications are calling for Wet Film Thickness in excess of 500um and some or all of the conditions above may exist
Summary

- Road Authorities are demanding higher levels of road marking performance. These changes include higher WFT for waterborne paints and the incumbent increase in drying times.

- Combined with this is a changing work environment, limiting the available time to protect newly laid work through either higher traffic volume or the need to limit worker’s exposure or presence on road.

- Limited capacity to improve the drying profile of waterborne paints by direct formulation or chemical changes.

- FASTRACK emulsion based paints don’t need a drying additive in most conditions. However, the use of an external Drying Additive is a logical step when conditions are inadequate for full drying.

- Dow believe Potters Industries are in the best position to not only supply this product to the Contractor base but also technically support its adoption and correct use.

- As such this Drying Additive is available through Potters as Visilok™TPD and carry a FASTRACK™ co-brand on all labelling.