DTM Coatings for Rail

Polyaspartic Ester Technology

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Polyaspartic Topics

- **Resin Technology**
- **Use in Rail Market**
- **New Developments in Technology**

Polyaspartic Coatings

- **What is a Polyaspartic Coating**
  - **Aliphatic polyurea based on secondary aliphatic diamines (polyaspartic esters) cured with an aliphatic polyisocyanate**

- **Features**
  - **Fast cure - productivity improvements**
  - **DTM**
  - **Aliphatic (Color and UV stability)**
  - **Moderately high film build (up to 15 mils)**
  - **Near zero VOC possible, but can be solventborne**
  - **Variable cure speed**

Technology for the Future

- Wide VOC range
  - Low viscosity
  - Most common 330-400 g/l
  - Capable of near zero
- Pot life
  - Adjustable
    - 5-120 minutes
- Dry time
  - Minutes to 2-3 hours
  - Fast dry – No bake

Resin Family

Properties	Resin A	Resin B	Resin C-1	Resin C-2
% Solids	100	100	100	90 (BuAc)
Eq. Wt.	229	277	291	323
cps @ 25ºC	150	1500	1500	150
Amine	Linear	Cycloaliphatic	Cycloaliphatic	Cycloaliphatic
Reactivity	High	Mid-high	Low	Low
Gel Time[1]	< 5 min	12-120 min	6-24 hrs	6-24 hrs
APHA Color	250 max	250 max	250 max	250 max

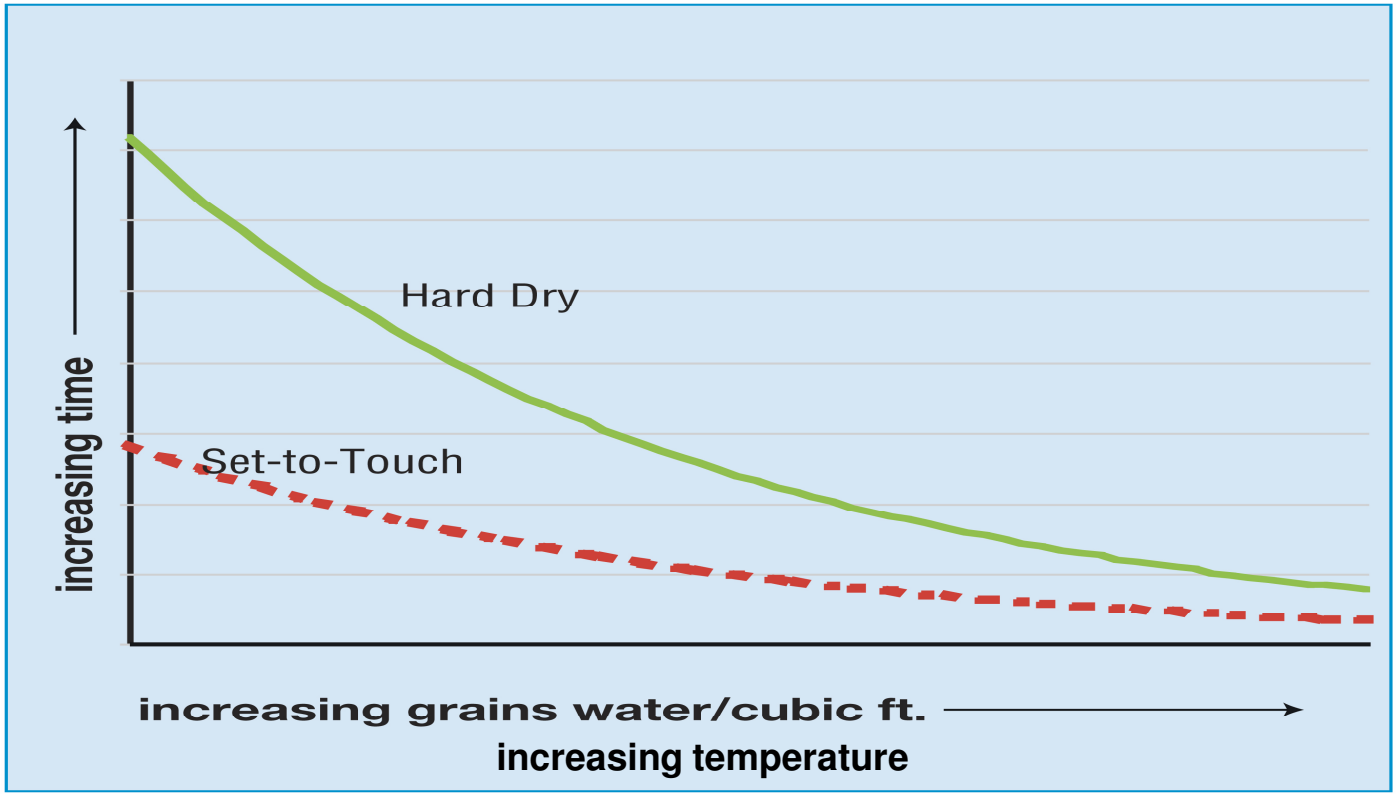
Polyaspartics are Adaptable to High Solids Coatings

	cps as supplied	cps @ 75% Weight Solids
Resin A	150	15
Resin B	1,500	18
Resin C-1	1,500	18

Comparing Technologies

- Polyaspartics
  - DTM / 2 Coat System
  - Fast cure - productivity improvements
  - Aliphatic (Color and UV stability)
  - Thin to Moderate film build (up to 25 mils)
  - Near zero VOC possible, but often solventborne
  - Variable cure speed
  - Low Temperature Cure
- Conventional PUR
  - 2 Coat System
  - Moderate cure speed when catalyzed
  - Aliphatic (Color and UV stability)
  - Thin film build (up to 6 mils DFT)
  - Solventborne - 2.8 lb./gal (340 g/L)
  - One cure speed
  - Low Temperature Cure

Influence of Ambient Moisture on Cure Speed



Dry Time Comparison of Polyaspartic to a Commercial Acrylic Topcoat

	Polyaspartic B 100%		Polyaspartic Blend B & C		Commercial Acrylic	
Temperature	40ºF	77ºF	40ºF	77ºF	40ºF	77ºF
To Touch (hours)	0.17	0.17	4	1	2	0.5
To Handle (hours)	1	0.5	16	2	10	6

Dry times depend on film thickness, and to some degree humidity and solvent blend

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Dirt Pick-up / Dry Time

Blast Grit Applied 30 Minutes After Application

Hardeners

	Type	% Solids	% NCO	Viscosity	Reactivity
Hardener A	Biuret	100	23	2500	Faster
Hardener B	Trimer	90	19.6	550	
Hardener C	Trimer	100	23.5	700	
Hardener D	**IPDI Prepolymer**	**86**	**10.4**	**2000**	Slower

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Railcar Study

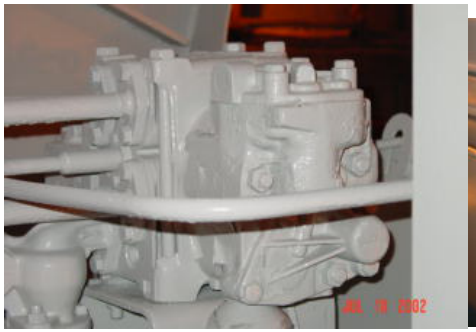
- Single Coat Application
- 52 Hopper Cars
- Airless Application
  - Two Applicators
    - ~16 mils WFT
  - 20 min/car
- Surface Prep SSPC SP-6
  - 2-3 mil profile

Railcar Study

- Coatings Properties
  - 2 hr Pot Life
  - 2 hr Dry Time
    - Cars moved to next station
  - 9 mils DFT
- Stenciled with 3-4 hrs
  - Moved outdoor

Railcar Study

- Excellent application in hard to coat areas
- ~30% Savings in time and labor



Coating System	Material Usage	Labor Usage
DTM Polyaspartic	36 Gallons	10.5 Hours
2 Coat Epoxy/ Urethane	35 Gallons	15.5 Hours

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Industrial Examples

Three (3) Coat vs. Two (2) Coat System, Bridge No. 1199 over I-84 Cost Per Square Foot Comparison			
Item	3-Coat	2-Coat	Difference
Maintenance & Protection of Traffic			
Traffic Control Devices	$9.26	$5.97	$3.29
Containment (Rig./DeRig.) Equipment (Mob./Demob.)	$6.55	$5.63	$0.92
Abrasive Blasting	$1.71	$0.99	$0.72
Primer Coat	$0.91	$0.70	$0.21
Intermediate Coat	$0.38	$0.00	$0.38
Top Coat	$0.60	$0.67	($0.07)
Contractor QC	$0.05	$0.04	$0.01
Inspection (Owner's Consultant)	$1.97	$1.74	$0.23
Owner's Oversight	$0.56	$0.47	$0.09
Lead Health Protection	$1.28	$1.04	$0.24
Road User Cost	$78.89	$60.27	$18.62
	$102.16	$77.52	$24.64

New Coating System Slashes Energy Costs, Improves Productivity and Performance for Light Pole Manufacturer

As a result, energy consumption at the facility has been reduced by 75 percent. Time savings have been impressive as well, with poles being moved off the line nearly 70 percent faster.

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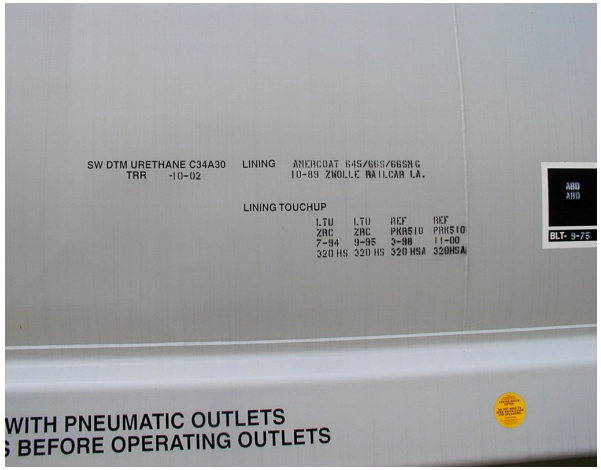
Four Years into Service



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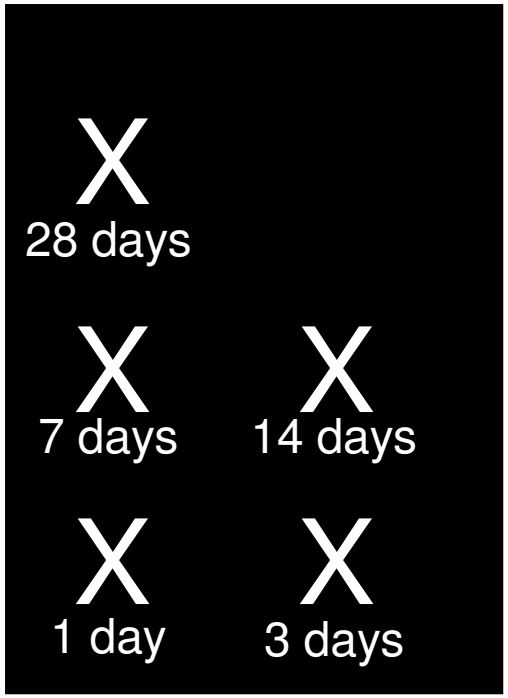
Improved Water Resistance with New Hardener

Hardener A

Hardener D

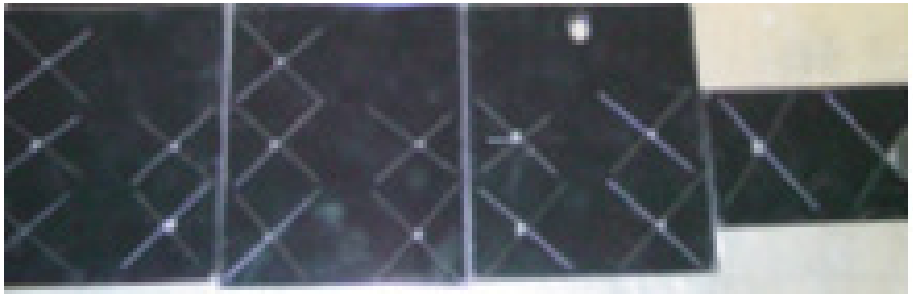
Improved Recoat

- Touch-up



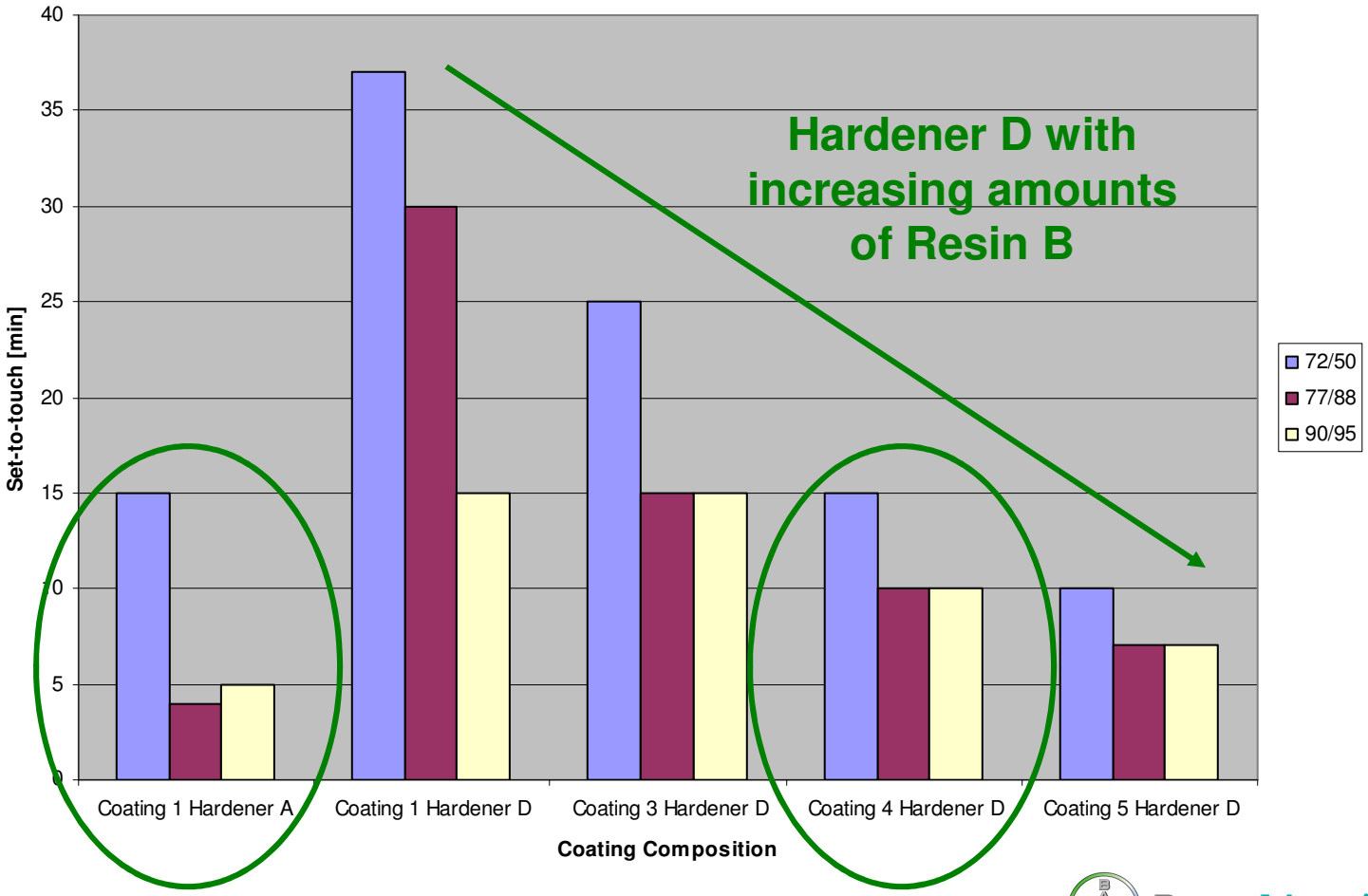
Hardener A

Hardener D

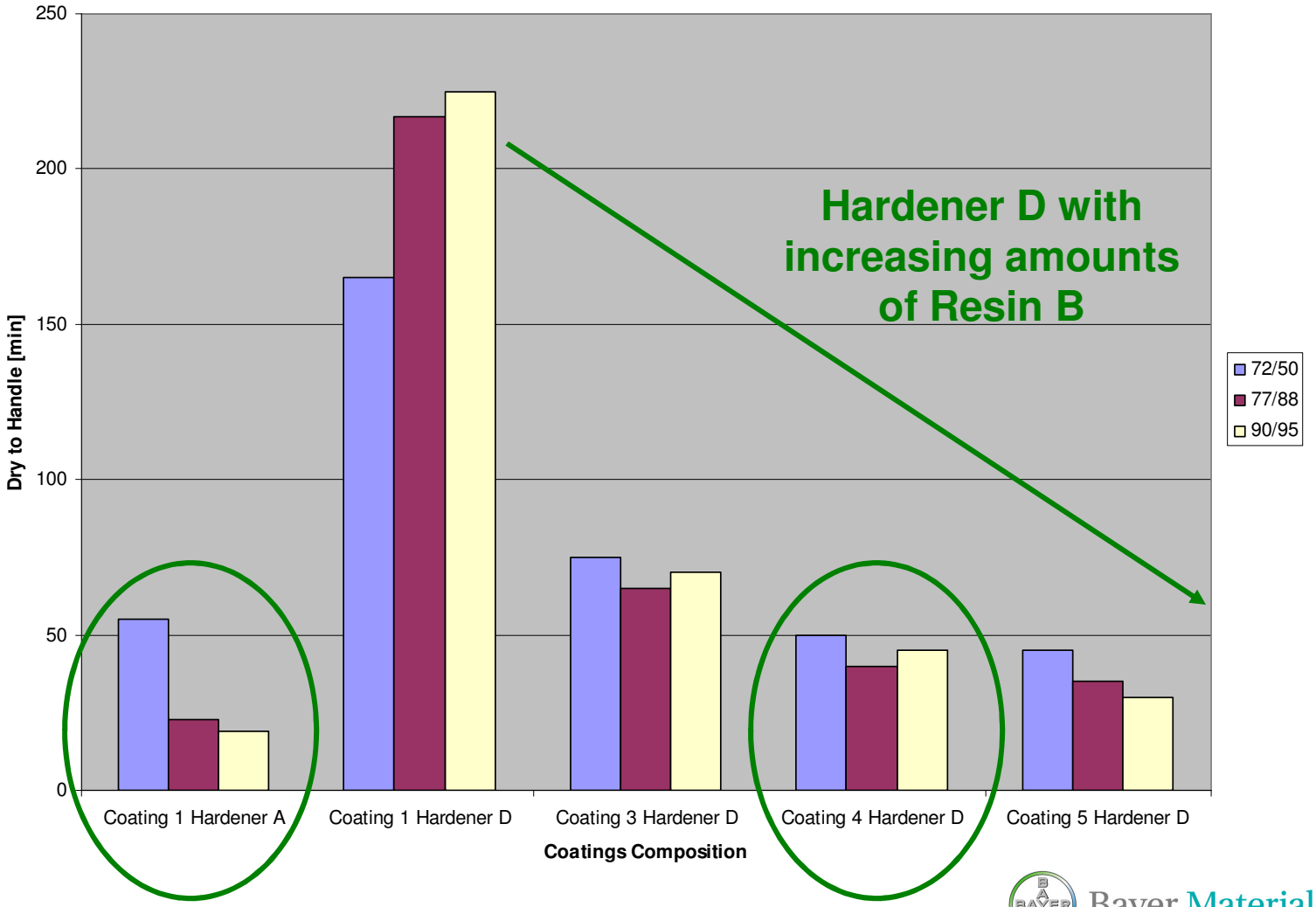


1 day 3 days 7 days 14 days

Improved Cure Response STT



Improved Cure Response Hard Dry



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DTM Railcar Coating Summary

- Mature resin technology
- Robust spray properties
- Proven productivity enhancement
- Demonstrated service life
- Next Generation Technology
  - Increased open time
  - Improved water resistance
  - Improved recoat / touch-up