

Pavement Markings:

What to Use, How to Choose

& Get What You Pay For



PARTNER BY CHOICE. SAFETY BY DESIGN.

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President

PK Contracting



»» Purpose

- » Pavement markings are used to provide safety for the motoring public, pedestrians and bicyclists, traffic control on roadways, and traffic-flow management at road construction sites.



»» The Next 30 Minutes: *Discussion*

- › History of Pavement Marking
- › Terms & Definitions
- › Materials: *Binders with Optics*
- › Selecting Appropriate Materials
for Desired Service Life
- › Get What You Pay For:
Specifications, Contractors, Inspection, Verify



»» History of Pavement Markings



»» **Woodward Ave** – 1st paved mile of concrete road (U.S.)



»» **Davison Freeway** – 1st depressed freeway (U.S.)



»» MI County Engineers Set the Trend



»» **River Road, Trenton**
1911: Edward Hines, 1st use
of painted centerline (U.S.)

»» **County Rd 492, Marquette**
1917: Kenneth Sawyer, 1st
use of painted centerline
on rural highway, "Dead
Man's Curve"



Terms & Definitions



»» Presence or Delineation

- » The ability to see a marking.



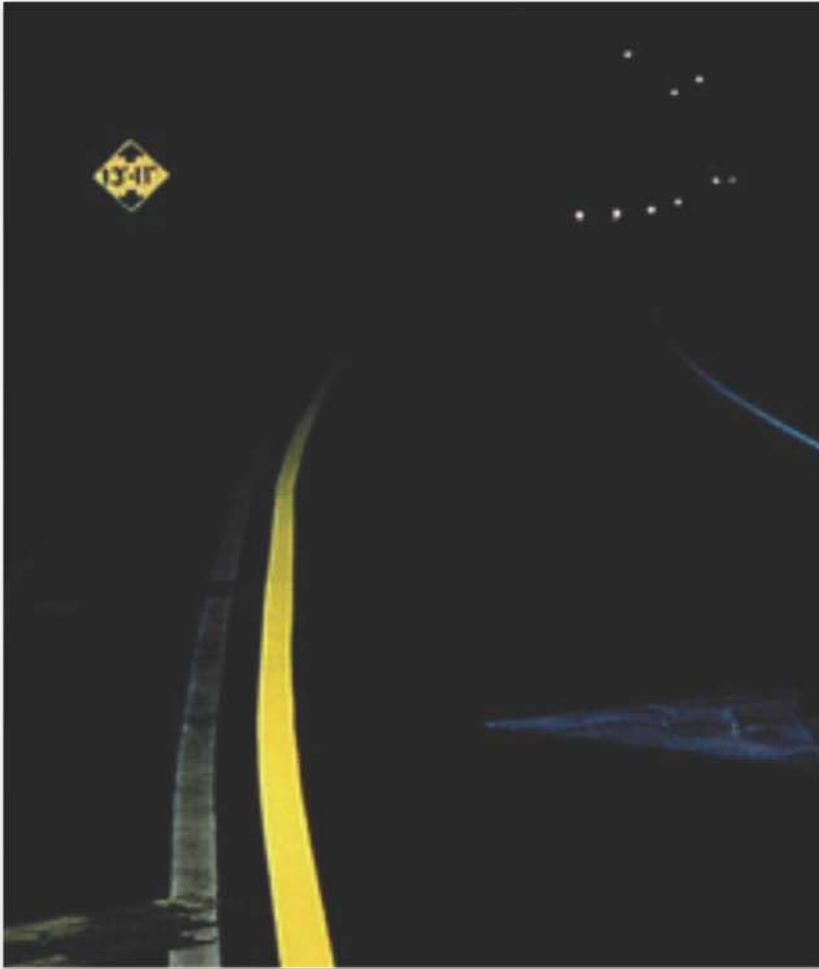
»» Daytime Presence



- » The ability to see a marking in daytime.



»» Nighttime Presence



- » The ability to see a marking in nighttime.



»» Nighttime Presence in Rain – *Wet Reflective*



- » The ability to see a marking in nighttime during rain.



»» Binders

- » Liquid or solid material provides color for daytime presence.
 - » Paint
 - » Thermoplastic
 - » Plural Component Liquids
 - » Cold Plastic Tape



»» Optics

- » Glass beads applied on top of binder to provide nighttime presence.
- » Add elements for nighttime WET REFLECTIVITY.
 - »» Standard Glass Beads – special coatings (depending on what binder)
 - »» Higher Reflectivity Beads (Big Beads)
 - »» Elements



»» Double Drop

- » The application of both standard beads and big beads for enhanced reflectivity.



»» Recessing



- » Cutting a groove in pavement to protect marking from snow plows.



»» Service Life



- » How long a marking will provide desired level of delineation.



»» Longlines



- » Longitudinal markings that separate lanes of traffic.
 - »» Centerlines
 - »» Edge Lines
 - »» Skip Lines & Lane Lines
 - »» Gores



»» Special Markings



- » Markings that delineate intersections and provide info for motorists.
 - »» Stop Bars
 - »» Cross Walks
 - »» Cross Hatching
 - »» Turning Guide Lines
 - »» Symbols
 - »» Legends



»» Tracking



- » Damage caused to pavement markings by vehicles crossing them before they are cured.



»» Convoys & Line Protection



- » Provides advance warning to motorists and protection to the marking as it cures to avoid tracking.



»» Data Logging System (DLS)

- » Monitors in real time all specification parameters:
 - » Material Application Rates
 - » Striping Speed
 - » Weather Parameters
- » Provides detailed reports on a road by road basis.



Materials: *Binders with Optics*



»» One-Year Maintenance Materials

- » **Traffic Paint** – Waterborne or regular dry, using paint as binder and standard beads.
 - » Most widely-used material.
 - » Lowest initial cost marking.
 - » Lasts one year.
 - » Best used as a maintenance marking on low ADT roads in poor condition or when budget constraints dictate.



»» One-Year Maintenance Materials

- » **Sprayable Thermoplastic** – Granular material melted to ~400° before application to road.
 - » Formulated to spray at 30-mil thickness with standard beads producing an overall 40-mil line.
 - » Best used as maintenance marking on high ADT roads in poor condition or when budget constraints dictate.
 - » Lasts one year – dries in less than one minute.
 - » Fast dry time – virtually eliminates tracking.
 - » Fast dry time – virtually eliminates coning or long convoys.



»» Multi-Year Maintenance Materials

- » **Plural Component Liquids** – Resin and catalyst components are mixed at the gun nozzle prior to being sprayed on the road.
 - » Pump meters ensure exact mix.
 - » Lasts 3 to 5 years.
 - » Std beads produce better reflectivity than one year materials.
 - » Double-drop optics produce a higher level of reflectivity.
 - » Std beads with elements produce an even higher level of reflectivity that is WET REFLECTIVE, as well.
 - » Markings should be recessed.
 - » Best for new construction or pavements paved within 5 years.
 - » Can be used as a longline or special marking.



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»» Multi-Year Maintenance Materials

» Types of Plural Component Materials

- » **Epoxy** – Original plural component. Lasts 3+ years.
- » **Modified Urethane (MU)** – Better than epoxy in color retention with a slightly longer life.
- » **Polyurea** – Superior color retention, longer life vs. epoxy or MU. Lasts five years.
- » **MMA** – Originally used in the Pacific Northwest. Now formulated to work well in the Michigan climate. Similar in performance to polyurea.



»» Multi-Year Maintenance Materials

- » **100 mil Thermoplastic** – Granular material melted to ~400° before application to road.
 - » Same optic options as plural components.
 - » 100 mils thick – best to recess for maximum service life.
 - » Lasts five years when recessed.
 - » Bond created by melting into pavement surface.
 - » Only use on new asphalt or asphalt three-years old or less.
 - » Can be used as a longline or special marking.



»» Multi-Year Maintenance Materials

- » **Cold Plastic Tape** – Markings that are supplied in rolls of varying widths.
 - » Precoated, pressure sensitive adhesive “sticks” to road.
 - » Can be manufactured with wet reflective optics.
 - » Lasts up to 10 years when recessed.
 - » MDOT uses recessed, WET REFLECTIVE cold plastic for skip lines on new freeways.
 - » Can be used as a longline or special marking.



»» Multi-Year Maintenance Materials

- » **Preformed Thermoplastic** – Combines attributes of thermoplastic and cold plastic tape.
 - » Comes in varying widths, colors and shapes.
 - » Used as special markings at intersections, bike paths, airport runways and taxiways.
 - » Manufactured in any color – can be custom per project.
 - » Slow to apply.
 - » Used only as a special marking.



Selecting Appropriate Materials



»» Know What Affects Service Life

- » Assuming that materials are applied according to specifications:
 - » Type of binder used – one year or multi-year marking
 - » ADT
 - » Surface applied marking vs. recessed marking
 - » Condition of pavement



»»» Considerations

Type of Marking

Desired Service Life

Condition of Pavement

Initial Application Cost

Snow Plowing
Philosophy

Annualized
Application Costs

Level of Desired
Delineation

Recessing vs.
Not Recessing



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**Recessing vs.
Not Recessing**



»» Keep in Mind...

- Different materials can be used on same road.
- Use long-life materials for special markings.
- Accident data shows where higher delineation is needed.
- Materials are determined by pavement condition.
- Try to recess long life materials on new pavements.
- A second application of a recessed, durable marking after the original five-year service life means a road is striped only twice in 10 years.
- When a project is federally funded, the direct cost to the agency is dramatically reduced.



»» Consider: A Selection Matrix

Guide to Appropriate Longline Pavement Marking Materials

Assumption: Bare Pavement Policy
 Minimum Level of Delineation – Nighttime Presence
 All Multi-Year Materials to be Recessed

	SCENARIO 1		SCENARIO 2		SCENARIO 3	SCENARIO 4
Type of Pavement	Asphalt or Concrete	Asphalt or Concrete	Asphalt or Concrete	Asphalt or Concrete	Asphalt or Concrete	Asphalt or Concrete
Condition of Pavement	Poor	Poor	Good	Good	Good	Good
Budget for Safety	N/A	N/A	No	No	Yes	Yes
Average Daily Traffic	Low	High	Low	High	N/A	N/A
Wet Reflective	N/A	N/A	N/A	N/A	No	Yes
Appropriate Material	PAINT with STD Optics	40 mil STP with STD Optics	PAINT with STD Optics	40 mil STP with STD Optics	Any Multi-Year Material with Double Drop Optics <i>(No 100 mil Thermoplastic on concrete)</i>	Any Multi-Year Material with STD Bead with Elements <i>(No 100 mil Thermoplastic on concrete)</i>



Anticipated: *Bid Prices*

Anticipated Bid Prices Per 4" LFT						
	LESS THAN 20,000 LFT		20,000 - 50,000 LFT		GREATER THAN 50,000 LFT	
	SURFACE APPLIED	RECESSED	SURFACE APPLIED	RECESSED	SURFACE APPLIED	RECESSED
PAINT WITH STD BEADS	\$0.20		\$0.10		\$0.05	
SPRAY THERMOPLASTIC WITH STD BEADS	\$0.30		\$0.20		\$0.15	
MODIFIED URETHANE WITH DOUBLE DROP BEADS	\$0.55	ADD \$0.50	\$0.50	ADD \$0.45	\$0.45	ADD \$0.40
POLYUREA WITH DOUBLE DROP BEADS	\$0.65	ADD \$0.50	\$0.60	ADD \$0.45	\$0.55	ADD \$0.40
MMA WITH DOUBLE DROP BEADS	\$0.75	ADD \$0.50	\$0.70	ADD \$0.45	\$0.65	ADD \$0.40
100 MIL THERMOPLASTIC WITH DOUBLE DROP BEADS	\$0.65	ADD \$0.50	\$0.60	ADD \$0.45	\$0.55	ADD \$0.40
MODIFIED URETHANE WITH BEADS AND ELEMENTS	\$0.70	ADD \$0.50	\$0.65	ADD \$0.45	\$0.55	ADD \$0.40
POLYUREA WITH BEADS AND ELEMENTS	\$0.80	ADD \$0.50	\$0.75	ADD \$0.45	\$0.65	ADD \$0.40
MMA WITH BEADS AND ELEMENTS	\$0.90	ADD \$0.50	\$0.85	ADD \$0.45	\$0.75	ADD \$0.40
100 MIL THERMOPLASTIC WITH BEADS AND ELEMENTS	\$0.80	ADD \$0.50	\$0.75	ADD \$0.45	\$0.65	ADD \$0.40
COLD PLASTIC TAPE WET REFLECTIVE	\$2.75	ADD \$0.50	\$2.50	ADD \$0.45	\$2.25	ADD \$0.40



In a Perfect World...



»» Use the Best Material All the Time

- » Using recessed – WET REFLECTIVE durables provides **twenty-four hour a day, seven day a week, three-hundred sixty-five day a year** delineation – day or night, rain or shine.

But...



Reality:
*Budgets Ultimately Determine
Materials Selection*

Imperative:
You MUST Get What You Pay For



»» Get What You Pay For: *Specifications*

- » Set specifications that are reasonable and you are able, and willing, to enforce.
- » The four requirements of a pavement marking spec:
 - » Binder and optic application rates.
 - » Striper speed during application.
 - » Weather parameters.
 - » Convoy requirements and line protection.
- » All four must be met simultaneously to...

Get what you pay for.



»» Get What You Pay For: *Contractor*



- » Vet your striping contractor.
 - »» Consider MDOT prequalification for contractor and equipment.
 - »» Get references from other agencies and material suppliers.
 - »» Remember, every profession has its small share of unethical folks.



»» Get What You Pay For: *Inspection*

- Since pavement marking takes up such a small percentage of an agency's time, inspectors with an in-depth knowledge are few.
- Many agencies don't have the manpower to support a constant on-site inspector.
- Even the most experienced equipment operator or inspector cannot tell the difference between 14 gal/mile and 16 gal/mile on the fly.



»» Get What You Pay For: *Verify*

- » Data Logging System (DLS)
 - » Provides accurate information on all specification parameters on a road-by-road basis.
 - » Information can be provided via real time or printed reports.
 - » Captures more data accurately with less chance of human error.
 - » MDOT requires use of DLS on all region-wide striping contracts.
 - » When enforced, appropriate penalty provisions ensure you'll only pay for what you get.
 - » The actual cost to the agency is approximately 3/10,000 of a cent per 4" LFT. That equates to merely \$150 on a project of a half-million LFT.



»» Data Logging System (DLS)

The screenshot displays the Data Logging System (DLS) interface. It features a speedometer showing 15.4 MPH, a job description 'M-49_From State Line North To US-12', and a 'Next Job' button. Below these are fields for 'Begin Day' and 'End Day', and a table of 'Last Set' data including latitude, longitude, miles traveled, and footages for yellow and white materials. The main display area shows three columns of data: Yellow (14.88 Mils, 15-Gallons), White (15.02 Mils, 11-Gallons), and Beads (8.54 Lbs/Gal, 0-lbs 5.4 lbs/gal and 367-lbs 3.14 lbs/gal). At the bottom, there are four buttons: 'Stop Distance Record (F1)', 'Log And Reset All Data (F12)', 'Show The Current Excel Report', and 'Main'.

Material	Speed (MPH)	Distance (Mils)	Volume (Gallons)	Weight (lbs)	Density (lbs/gal)
Yellow	15.4	14.88	15	-	-
White	15.4	15.02	11	-	-
Beads	15.4	-	-	0	5.4
Beads	15.4	-	-	367	3.14

Field	Value
Last Set	11/3/2015 7:44
Last Set	11/1/2015 17:20
Latitude	46.880422
Longitude	-96.855302
Miles Traveled	21.44
Yellow Footage	14230
White Footage	85228




»»» Data Logging System (DLS)

Main


File Gun Settings (F11) Log Report Distance Record Set GPS Start Point Large Screen (F6)

Yellow Paint



15 Gallons In Tank
44 Gallons Applied
14.88 Mils
323 Ft/Gallon Applied
16.3 Gallon / Mile
92 Tank Temp

White Paint




11 Gallons In Tank
266 Gallons Applied
15.0 Mils
320 Ft/Gallon Applied
16.4 Gallon / Mile
91 Tank Temp


15.4MPH

Job: No Job Selected
Click to Change

Tuesday
November 3, 2015
12:51:15 PM



Bead 1
0 Lbs
1620 Lbs Applied
5.4 Lbs/Gallon



Bead 2
367 Lbs
942 Lbs Applied
3.14 Lbs/Gallon

Total Lbs/Gal 8.54 Total Lbs/100SqFt 7.28

46.880422	Current Latitude	-96.855302	Current Longitude
113,203	Total Distance Traveled	98	Surface Temperature
21.44	Total Miles Traveled	85	Ambient Temperature
18	Humidity	NaN	Average Speed
<input type="checkbox"/>	Display Average Environmental Values	37	Dew Point

Start Re-Trace

Stop Distance Record (F1)

Log Data

Gun Settings (F11)

Fill Tanks

Gun Footage

Log And Reset All Data (F12)

Show The Current Excel Report

Setup

Master Reset And Start New Job



»» Get What You Pay For: *Verify*

CONTRACTOR NAME / ID#:	PK		Seq#:	6525	7035	6525-B
DATE:	7/28/2015 12:00:00 AM		Total Yellow 4in:	- 0	- 0	- 0
TRUCK #:	581		Total White 4in:	- 0	- 0	- 0
FOREMAN:	_____		Total Yellow 6in:	- 0	- 0	- 0
			Total White 6in:	78,950	63,792	94,095
			Total White 12in:	- 0	- 0	- 0
SEQ#	ROUTE	BMP-EMP	DIRECT	CL//EL	START TIME	END TIME
Null	Null	Null	Null	Null	8:00 AM	5:00
6525	91__US-31_SCL to M-88	0-18.298	South	EL	07:52:25	08:11:23
6525	91__US-31_SCL to M-88	0-18.298	South	EL	08:11:23	08:11:47
6525	91__US-31_SCL to M-88	0-18.298	South	EL	08:11:23	08:31:10
6525	91__US-31_SCL to M-88	0-18.298	South	EL	08:31:10	08:31:34
6525	91__US-31_SCL to M-88	0-18.298	South	EL	08:31:10	08:50:18
6525	91__US-31_SCL to M-88	0-18.298	South	EL	08:50:18	08:50:39
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	South	EL	08:50:18	09:10:36
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	South	EL	09:10:36	09:11:00
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	North	EL	09:10:36	09:27:09
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	North	EL	09:27:09	09:27:30
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	North	EL	09:27:09	10:18:15
7035	92__US-31_CLTL Taper N of GT Resort to NCL	8.826-15.029	North	EL	10:18:15	10:18:36
6525-B	91__US-31_SCL to M-88	0-18.298	North	EL	10:18:15	10:37:27
6525-B	91__US-31_SCL to M-88	0-18.298	North	EL	10:37:27	10:37:53



»»» Get What You Pay For: *Verify*

6530	6615	6620	6945	6965	6640	6560	6540	7745	7755
- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0
- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0
- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0
35,012	45,792	44,033	8,727	20,579	69,066	26,009	58,730	- 0	59,237
- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0	- 0
YEL GAL/MI	WHT GAL/MI	YEL MILS	WHT MILS	BEADS LBS/ GAL	AVG SPEED	AIR TEMP	PVMT TEMP	DEW POINT	HUMID
NaN	NaN	-	-	Null	Null	Null	Null	Null	Null
NaN	NaN	-	-	7.78	18.00	73.00	81.00	61.00	67.00
NaN	24.13	-	14.66	7.78	18.00	73.00	81.00	61.00	67.00
NaN	NaN	-	-	7.81	18.00	76.00	76.00	62.00	62.00
NaN	23.59	-	14.33	7.81	18.00	76.00	76.00	62.00	62.00
NaN	NaN	-	-	7.83	18.00	79.00	85.00	64.00	59.00
NaN	23.58	-	14.33	7.83	18.00	79.00	85.00	64.00	59.00
NaN	NaN	-	-	8.14	18.00	80.00	90.00	64.00	55.00
NaN	23.81	-	14.47	8.14	18.00	80.00	90.00	64.00	55.00
NaN	NaN	-	-	8.57	17.00	81.00	88.00	64.00	54.00
NaN	23.11	-	14.04	8.57	17.00	81.00	88.00	64.00	54.00
NaN	NaN	-	-	8.05	18.00	85.00	95.00	65.00	45.00
NaN	23.33	-	14.18	8.05	18.00	85.00	95.00	65.00	45.00
NaN	NaN	-	-	8.96	18.00	83.00	90.00	67.00	55.00
NaN	23.46	-	14.25	8.96	18.00	83.00	90.00	67.00	55.00



»» Get What You Pay For: *Verify*

Yellow 4in	White 4in	Yellow 6in	White 6in	White 12in	YEL VENDOR-BATCH #	WHT VENDOR-BATCH #	BEAD VENDOR-BATCH#
-	-	-	-	-	EmptyFirstLine	Nullnull	Nullnull
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	26,416.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	52,803.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	78,950.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	26,420.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	43,023.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	20,769.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	-	-	ennis 1505y0317	ennis 1505y0317	potters 112214
-	-	-	26,410.00	-	ennis 1505y0317	ennis 1505y0317	potters 112214



Conclusion



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- Pavement markings are installed for the safety of motorists, pedestrians, bicyclists and workers.
- A myriad of striping materials are available to use.
- A multitude of factors dictate what to choose.
- Informed decisions allow for the right choice.
- Technology can provide 24/7/365 delineation – day or night, rain or shine.
- Budget ultimately determines material selection.
- Enforcement of project specs increases the likelihood of a project's success.
- Most importantly – **get what you pay for.**



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Q & A



Thank You



PARTNER BY CHOICE. SAFETY BY DESIGN.

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