

HR-515

SURVEY OF D. O. T.'S
TRAFFIC PAINT COSTS
IN 1979

MATERIALS AND RESEARCH DIVISION

Technical Paper 80-2
February 1980

Prepared By:

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and

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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

TRANSPORTATION BUILDING

STATE HOUSE STATION 16

AUGUSTA, MAINE

04333

mdot

RICHARD A. LUETTICH
Acting Commissioner

ADDRESS REPLY TO: MATERIALS & RESEARCH DIVISION
BOX 1208, BANGOR, MAINE 04402

February 14, 1980

Mr. B. F. Himmelman, Materials Engineer
Chairman AASHTO Materials-Tech. Section 4B
% Materials, Research and Standards Division
Department of Transportation
St. Paul, Minnesota 55101

Re: Traffic Paint - 1979 Survey of States' Cost

Dear Blaine,

At the AASHTO Sub-Committee of Materials Round Table discussions last summer in Cranston, Rhode Island, there was a general concern noted over the higher cost of yellow traffic paint and the confusion within many of the Department's Staff as to its use. At a smaller regional group of the Northeastern States, the same subject arose. As a result, we initiated a summary of costs and asked for comments from the various States.

While there are many degrees of "fast dry" we have used the term loosely to identify paint which dries within 60 seconds of application. "Regular dry" traffic paint requires about 20 minutes to dry.

Because of the interest in this subject and the involvement of others than within the Materials Field, we are sending three (3) copies of this report to each Materials Engineer of each State. If you would like to see the raw data, please advise. Hope this provides your Technical Committee 4b "Coatings, Paints, Preservatives, Bonding Agents and Traffic Markings" with "food" for this year's session.

Very truly yours,



Frederick M. Boyce
Engineer of Materials and Research

FMB/r

MAINE DEPARTMENT OF TRANSPORTATION



**MATERIALS AND RESEARCH
DIVISION**

PREPARED BY D. S. LEYLAND & P. B. DAY

SURVEY OF D.O.T.'s TRAFFIC PAINT COSTS IN 1979

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ABSTRACT

This report presents the results of a survey on the use of yellow versus white traffic paint. It was found that in most states the white paint was less expensive than the yellow. A substantial savings could be realized if an all white traffic marking system was permitted by the Federal Highway Administration. Paint costs from each state are presented, as well as by each region.

INTRODUCTION

At the Annual AASHTO Subcommittee on Materials this past year, the author of Article 3.3 of General Manufactured Materials, R. V. LeClerc of Washington State suggested, "...that if we could use white paint for all markings, the cost of traffic paint would go down considerably..." A nationwide survey with the other Transportation Departments dealing with the use of white and yellow traffic paint has been completed. Although many agree with this concept, the use of yellow traffic marking is required by the Federal Highway Administration in the National Manual of Uniform Traffic Control Devices. States such as New Hampshire and Texas were quick to point out that the use of a color that fell outside these limitations, as white obviously does, may lead to law suits in the event of an accident. Liability as such would fall under the Torts Claim Act.

While the use of yellow paint was established with the first printing of the Manual of Uniform Traffic Control Devices in 1971, a number of engineers at the Materials Subcommittee in Providence were not aware of its role. Limited surveys as to the reason for the yellow line in Maine, Massachusetts and a few other states noted that few people knew the meaning of the difference in color. It was estimated that perhaps 95 percent of those questioned within the highway field were not versed as to the true concept of the paint color.

Maine Technical Paper 79-9L noted that there was a lack of improved visibility with this paint. Combined with increased costs due to foreign pigments, it appears that AASHTO Technical Section 4B should bring this information before the Main Subcommittee on Materials at this summer's

meeting in Nashville, Tennessee. Perhaps a unified position could be agreed upon that would request that the FHWA consider revising the manual on Uniform Traffic Control Devices.

MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES

In 1971 the FHWA Administrator adopted a manual on Uniform Traffic Control Devices for Structures and Highways. This manual was developed with the cooperation of the American Association of State Highway Officials and the National Joint Committee on Uniform Traffic Control Devices. This committee was composed of representatives from AASHTO, the Institute of Traffic Engineers, the National Committee on Uniform Traffic Laws and Ordinances, the National Association of Counties and the National League of Cities. This manual has received wide circulation to the point where in the past few years it has become the "Bible" for most traffic engineering personnel. Because of the extent of descriptive material contained therein, it has become a source of ready reference for legal people in tort cases. Reference has been made to Part III Markings, Section B, "Application of Pavement and Curb Markings", and particularly Section III B-1 "Centerlines". In this description, it was noted the centerline separating traffic traveling in opposite directions shall be painted yellow. The exact wording is as follows:

"The center line markings on two-lane, two-way highways shall be either:

1. A normal broken yellow line where passing is permitted (#2, sec. 3A-7), or
2. A double line consisting of a normal broken yellow line and a normal solid yellow line where passing is permitted in one direction (#5, sec. 3A-7), or

3. A double line consisting of two normal solid yellow lines where passing is prohibited in both directions (#6, sec. 3A-7).

The center line on undivided highways where four or more lanes are always available, is usually a double solid yellow line.

On a three-lane highway it is preferable to designate two lanes for traffic in one direction and mark it as illustrated in figures 2-1b, 3-1c.

Center lines are desirable on paved highways under the following conditions:

1. In rural districts on two-lane pavements 16' or more in width with prevailing speeds of greater than 35 MPH.
2. In residence or business districts on all through highways, and on other highways where there are significant traffic volumes
3. On all undivided pavements of four or more lanes. Center lines are also desirable at other locations where an engineering study indicates a need for them."

COSTS

Pigment

Recently, the price of gold has increased at an alarming rate. As a result the cost of other valuable metals such as chromium has escalated right along with it. This coupled with the increasing use of trade sanctions around the world could further aggravate this situation, because the United States has very limited chromium deposits. Although the cost of titanium will also no doubt rise, it is not likely to increase at the rate chromium will because this Country is one of the major producers of titanium. In light of these arguments, it is reasonable to assume that the savings incurred from using white traffic paint in the place of yellow should only increase in the future.

Because of this high pigment cost, a major manufacturer of paints (N. L. Industries) developed a substitute pigment - Oncor Y47A. This pigment is also a lead chromate compound but it is bound to a silica type matrix. This is much the same as Basic Lead Silico Chromate paint for steel which replaced the red and white lead paints. Maine Department of Transportation Technical Paper 79-9L provided some background on Maine DOT's use with this pigment. The report concluded that at a test site near the ocean the Oncor Y47A withstood the elements better than the Reichhold, or medium chrome yellow.

Utah and Arizona also noted excellent results with their experimentation of Oncor Y47A. Utah (Bennett) noted they had changed to Oncor Y47A two years ago and they are pleased. The performance has been good and with an annual purchase of 400,000 gallons of yellow traffic paint their savings are close to \$300,000.

Arizona's (Cornelison) "...reduced the amount of chrome yellow medium in our yellow traffic paint by 43.4%, which achieved an actual reduction of 43.5% in the lead chromate rate that was being utilized..." "...replaced the chrome yellow with calcium carbonate, a cheaper product, and realized a reduction in paint costs..."

Iowa (Sheeler) also reported excellent results with the substitute pigment but they have gone one step further. They "...find that a blended pigment containing 52% chrome yellow, 43% calcium carbonate and 5% silica is equivalent to (Oncor) Y47A and is slightly lower in costs." They also find the color is equivalent to FHWA needs and similar to their previous mixture of old yellow paint containing chrome yellow at 2.2 volumes to 1 volume of white.

California (Shirley) indicated that Oncor Y47A "...does not have the color stability to stand up during summer months on our desert areas on A/C pavements." Texas (Walker) indicated they had "...made several traffic paints in the past with Y47A and have yet to make one that exhibits day or night color that falls within the color limits established by FHWA. We have made a couple of paints that meet the color requirements initially, but upon exposure soon fall outside the color limits. We test all our pigments to assure that the finished product will be within the color limits and remain with the limits throughout its life span on the roadway." "...we do not desire to participate (in a study of Y47A) because such figures will be used as an endorsement to use a pigment that will not produce a traffic paint conforming to color requirements throughout its lifespan on the roadway. We do not endorse any manufacturer's pigment, we only use pigments, regardless of manufacturer, that meet our color requirements."

From this information perhaps the states using this substitute pigment do not monitor their color as closely as California and Texas.

Environmental

Another benefit to be derived from allowing white to be substituted for yellow would be environmental. Both lead and chromium are health hazards, while titanium is not. The toxicity of lead is well documented. In fact, the present trend in the paint industry is to move away from the use of lead because of this. This is also true of chromium, because hexavalent chromium is a known carcinogen. Instead of applying traffic lines containing lead chromate (yellow), it would be better for both our pocketbooks and the environment if one was to use titanium (white) which is both less costly and less toxic.

Blending - White and Yellow

In 1974 MeDOT reduced the cost of yellow traffic paint by reducing the amount of prime pigment (medium chrome yellow) specified in the yellow traffic paint from a minimum of 25 percent to a minimum of 20 percent. This was brought about when the Traffic Engineer requested a less intense color. Since then, on a trial basis, we have diluted the yellow traffic paint with white traffic paint by a ratio of up to 1:2. The Traffic Section was not concerned over physical color tests in the field.

Iowa (Sheeler) indicated they blended 2.2 white to 1.0 parts yellow. Texas (Walker) indicated that in "...FHWA reports FHWA-RD-77-165 (Volume I) and FHWA-RD-77-166 (Volume II) wherein an indication is made that up to 50% of the lead chromate pigment may be replaced with white pigment. That is an assumption made on limited tests under conditions not normally encountered on the highway. Furthermore, several states including Texas are currently entering into a field study to evaluate motorist reaction and recognition of several traffic paints containing reduced lead contents or no lead content. In the past we have studied, on a limited scale, yellow traffic paints containing reduced lead and increased white pigment content. We found that once a ratio of yellow to white is less than about 5:1 (depending on the quality of the yellow pigment), the color no longer meets FHWA color requirements. We do, however, use a ratio of yellow to white of 7:1 to achieve a paint close to the middle of the color limits under daylight conditions. It exhibits a nighttime reflected color very close to its day color with improved reflectance. We are of the opinion that if we place a marking on the roadway with a color that does not fall within the FHWA color limits as shown in the National Manual of Uniform Traffic Control

Devices (the Texas MUTCH conforms to the National Manual), we are liable under the Torts Claim Act. The cost of one liability under Torts would more than offset any savings gained by reduced lead pigment content."

The FHWA bulletins were distributed in the fall of 1978 and the States of Maryland, Nebraska, New Jersey, Ohio and Texas are currently participating in the evaluation of the diluted yellow paint. This field effort is to substantiate the research effort by evaluating test sections as to their effectiveness, durability and total cost savings. Interest in winter observations of the diluted paint under snow and heavy rains were major items for collection of data.

Costs - Bid Price 1979

Based upon the Subcommittee of Materials Round Table discussions and concern over rising costs with less available dollars, a survey was quickly organized by MeDOT. A questionnaire form was sent to each Materials Engineer of each state on November 1, 1979. The form for this survey is shown in Appendix A of this report. A quick response was made by most states. As of December 1st all but 9 states had provided the data. As of the last of January all states had submitted the data requested. See Appendix B for the results from each state. This is a great tribute to the Materials groups because in many cases the bid prices and quantities were outside of their materials "shop". Table BI in Appendix B provides the tabulation of Regular Dry Traffic Paint and Table BII provides the same data for Fast Dry Traffic Paint.

There is a large differential in the cost per gallon of paint between the different states. Some of this difference in costs is due to the different specifications of the states. The following Table is derived from the 50 states that answered the questionnaire.

TABLE I COST OF TRAFFIC PAINT

Price Per Gallon				
	Regular Dry		Fast Dry	
	Yellow	White	Yellow	White
Number Reporting	34	34	42	42
Overall Average	3.771	3.375	3.740	3.461
Range	2.399-8.00	2.335-7.00	2.34-6.34	2.29-5.70

The cost between each FHWA region shows considerable price differences (See TABLE II). Even neighboring states show considerable differences in prices (See TABLES B III through B XI). Unless there is a specific need for paint with differing specifications, states may well be able to save a large amount of money if specifications were nearly alike. It is reasonable that a state like Arizona with some hot arid regions and a moderate climate would not need paint with the same characteristics as a state like Maine with a climate that is harsher. However, the states in Region I should be able to use paint that is nearly the same and, therefore, the cost should be more nearly equal. For example, Region I fast dry white shows a range of \$2.00 per gallon from the lowest price paint to the highest (\$2.70-\$4.70). Admittedly, some of this difference may be due to distribution, 10 to 15 cents per gallon difference between 5 gallon and 55 gallon drums, as well as pigment quantity. Rhode Island, which should have a benefit as to shipping costs, pays the most (\$4.70 per gallon). Although most of the difference may be due to the small

TABLE II COST PER GALLON FOR EACH REGION

	Regular Dry		Fast Dry	
	Yellow	White	Yellow	White
Region I Ave. Range	3.28 3.875 ⁺ - 4.50	3.12 3.757 - 4.15	2.34 2.850 - 5.30	2.29 2.750 - 4.70
Region III Ave. Range	2.43 2.528 - 3.293	2.59 2.749 - 3.22	2.72 3.143 - 3.95	2.50 3.075 ⁺ - 4.33
Region IV Ave. Range	2.399 4.018 - 5.03	2.335 3.869 - 4.16	2.37 3.824 - 4.59	2.296 3.679 - 4.54
Region V Ave. Range	3.105 3.170 - 4.15	2.97 2.948 - 3.98	2.46 3.799 - 4.66	2.46 2.899 - 4.10
Region VI Ave. Range	3.08 4.314 - 4.46	2.94 3.991 - 4.42	3.71 5.271 - 6.34	3.50 4.924 - 5.70
Region VII Ave. Range	3.484 4.242 - 4.61	3.18 3.543 - 3.93	3.34 4.068 - 4.19	3.16 2.627 - 3.69
Region VII Ave. Range	2.85 3.585 ⁺ - 3.65	2.55 2.889 - 3.60	3.71 4.136 - 4.61	3.49 3.700 - 3.90
Region IX Ave. Range	3.33 3.635 ⁺ - 8.00	3.10 3.309 - 7.00	3.335 3.531 - 3.861	3.01 3.238 - 3.606
Region X Ave. Range	3.34 3.883 - 4.96	3.16 3.456 - 4.60	4.07 4.465 - 5.28	3.81 4.168 - 4.79

quantity. When taking the above mentioned differences into account, Rhode Island may be paying more than they should per gallon. Similar situations can be shown in the other Regions throughout the Country.

Cost Differential Between Paint Colors

A very large amount of money, over 2 million dollars could be saved by using white traffic paint instead of yellow. This supposition, of course, considers that no additional paint would be necessary if white were substituted for yellow. Some states have indicated that they believed additional paint would be needed to obtain the required traffic control so that the 2 million dollars may be somewhat high.

TABLE II presents a comparison of prices between regions. As can be seen, the prices are apparently more or less random. This seems to indicate that there is no set pattern as to the prices charged per gallon. It seems that in most cases (Hawaii an exception) shipping, climate and amount of traffic have little effect on the price. However, if this is investigated more thoroughly and the northern-most states are compared to the southern-most states (TABLE III), there appears to be a substantial difference in favor of the northern-most states. This difference ranged from about \$.24 per gallon for regular yellow to as much as \$.84 for fast dry yellow. White pigment showed differences of \$.32 for regular to \$.71 for fast dry. Hot climatic conditions could probably account for the need of a more expensive paint.

Visibility of Yellow Paint

A Federal Highway Administration Bulletin dated November 21, 1978, referred to Research Report Nos. FHWA-RD-77-165 (Volume I) and FHWA-RD-77-166

TABLE III NORTHERN Vs. SOUTHERN STATES

	NORTHERN STATES				SOUTHERN STATES				
	Regular		Fast Dry		Regular		Fast Dry		
	Yellow	White	Yellow	White	Yellow	White	Yellow	White	
AK	3.34	3.16	-----	-----	CA	3.33	3.10	3.46	3.18
WA	3.93	3.27	5.28 4.53	4.79 3.81	AZ	3.681	3.371	3.861	3.606
ID	4.96	4.60	4.07	3.82	NM	-----	-----	6.34	5.70
MT	3.03	2.55	-----	-----	TX	-----	-----	5.75	5.22
ND	-----	-----	4.61	3.87	LA	4.46	4.42	3.71	3.50
MN	3.105	2.97	2.65	2.50	MS	-----	-----	4.5423	4.2833
WI	4.15	3.98	3.18	4.00	AL	-----	-----	3.534	3.372
MI	-----	-----	2.56	2.54	FL	-----	-----	3.96	3.56
NY	4.28	3.95	2.34	2.29	GA	4.45	4.16	-----	-----
VT	3.59	3.35	3.112	2.95					
NH	3.28	3.12	3.52	3.17	AVE.	3.980	3.763	4.395	4.053
MAINE	-----	-----	3.27	3.017					
AVE.	3.741	3.439	3.557	3.342	DIFFERENCE BETWEEN NORTH AND SOUTH				
					0.239	0.324	0.838	0.711	

(Volume II) entitled "Driver's Visibility Requirements for Roadway Delineation". These reports indicate that up to 50 percent (by weight) of the lead chromate pigment may be replaced with the less expensive white pigment. The resulting mixture of traffic paint is a lighter shade of yellow. The report further indicates that the diluted yellow paint has a higher degree of reflectance and, therefore, improved overall visibility qualities. This claim of improved visibility is reasonable and is substantiated by a few simple medical facts. The rods and cones are the photo sensors within the retina of the eye. The rods which are only capable of detecting black and white are much more light sensitive than the cones which detect only color. This explains why in poor light conditions a person can see shapes but finds it very difficult to distinguish colors. Facts such as these might cause one to question why most of our traffic paint is not white instead of yellow.

CONCLUSIONS

There is an old "adage" which states "figures don't lie, but liars use figures". We do not intend to state that 2 million dollars could be saved by converting to all white traffic paint but a substantial savings could be realized in many states.

There is a paramount need for FHWA's Traffic Control System Division to review the data obtained in this survey:

1. Apparently most people are not versed with the reason for using yellow traffic paint.
2. Yellow traffic paint is usually more difficult to see in adverse weather, especially at night.

3. Yellow traffic paint costs more than white traffic paint and substantial savings in dollars could be realized if the Manual of Uniform Traffic Control Devices was modified.
4. Many states do not investigate to the degree of quality control specified within the manual. Because FHWA has inquired about blending white with yellow traffic paint, FHWA may not be as strict in compliance either.
5. Environmentally yellow pigment is a toxic substance (lead and chromate), whereas white has only titanium dioxide which is nontoxic. Since the United States does not have much in the way of chromium deposits, that which we import could be used more profitably in ways other than in the yellow pigment for traffic paint.

APPENDIX A

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November 1, 1979

TO: Materials & Research Engineers

FROM: F. M. Boyce, Engr. of Materials & Research - Maine DOT

RE: Traffic Paint

In a recent meeting with several New England State's Materials Engineers it was stated that a large percentage of the population is not aware why a yellow line vs white line is painted on our highways. We ran a survey of 19 people in our shop and only found one who knew the answer!

We recently provided a review about the visibility concept of white vs yellow paint:

"The rods and cones are the photo sensors within the retina of the eye. The rods which are only capable of detecting black and white are much more light sensitive than the cones which detect only color. This explains why in poor light conditions a person can see shapes but finds it very difficult to distinguish colors. Facts such as these might cause one to question why most of our traffic paint isn't white instead of yellow."

Because yellow pigment is more expensive, I believe it would make a startling figure if we could tabulate the savings across the nation if our traffic people would revert back to a straight white paint. In our state alone we purchased 155,000 gal. of fast dry paint. Only 40,000 of this was white with an average bid for white at \$3.017/gal. whereas the yellow was \$3.27. If we purchased all white Maine would have saved \$29,095 this year. We would like to tabulate what a nationwide savings might be. We will make this information available to our Technical Section 4b for their input too.

Would you please provide your cost differential for regular dry yellow and white and fast dry yellow and white and the approximate quantities purchased for 1979. The attached sheet has been made in duplicate so you can keep a copy for your files. For those received, we will return a summary. If everyone gets at this, we would be able to have a turnaround within 30 days. Thanks for your assistance.

FMB/ajt

**SURVEY OF TRAFFIC PAINT PURCHASED
IN 1979**

STATE _____

REGULAR DRY

YELLOW

No. of Gals.	Bid Price/Gal.	Total Cost
(A) _____	(B) _____	_____

WHITE

(C) _____	(D) _____	_____
-----------	-----------	-------

FAST DRY

YELLOW

No. of Gals.	Bid Price/Gal.	Total Cost
(A) _____	(B) _____	_____

WHITE

(C) _____	(D) _____	_____
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Savings if all white purchased:

Regular A (B-D) = _____

Fast Dry A (B-D) = _____

Total Savings

Please return to: F. M. Boyce, Engr. of Materials & Research
Maine Department of Transportation
Materials and Research Division
P. O. Box 1208
Bangor, Maine 04401

APPENDIX B

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TABLE BI REGULAR DRY TRAFFIC PAINT

STATE	YELLOW			WHITE			WHITE "SAVINGS"	GRAND TOTAL WHITE SAVING (REG. ^{1/2} FAST DRY)
	GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST		
Alabama								\$ 13,832
Alaska	25,400	\$ 3.34	\$ 84,836	24,200	\$ 3.16	\$ 76,472	\$ 4,572	4,572
Arizona	76,340	3.681	281,007	114,620	3.371	386,384	23,665	33,651
Arkansas								64,000
California	100,000	3.33	333,000	210,000	3.10	651,000	23,000	56,600
Colorado	110,315	3.29	362,522	180,545	2.93	528,773	39,713	44,113
Connecticut	1,000	3.79	3,790	7,000	3.56	24,920	230	19,270
Delaware	495	2.94	1,455	365	3.03	1,105	-45	3,330
Florida								84,000
Georgia	200,000	4.45	890,000	300,000	4.16	1,248,000	58,000	58,000
Hawaii	6,200	8.00	49,600	10,000	7.00	70,000	6,200	6,200
Idaho	320	4.96	1,587	1,110	4.60	5,106	115	21,715
Illinois				38,115	3.48	132,640		65,489
Indiana	18,000	3.45	62,100	237,600	2.85	677,160	10,800	75,780
Iowa	4,125	3.484	14,371					64,542
Kansas	129,850	3.62	470,057	152,110	3.18	483,098	57,134	57,134
Kentucky								62,523
Louisiana	150,000	4.46	669,000	90,000	4.42	397,800	6,000	39,600
Maine								29,095
Maryland								-63,080
Massachusetts	55,000	4.12	226,600	36,500	3.96	144,540	8,800	28,275
Michigan	50,100	4.50	225,450	27,600	4.15	114,540	17,535	2,241
Minnesota	83,025	3.105	257,792	83,025	2.97	246,584	11,208	14,087
Mississippi								27,162
Missouri	334,713	4.61	1,543,026	186,390	3.93	732,512	227,605	231,476
Montana	80,795	3.03	244,808	97,795	2.55	249,377	38,782	38,782
Nebraska	103,314	3.86	398,792	193,566	3.46	669,738	41,326	41,919
Nevada								11,932
New Hampshire	80,000	3.28	262,400	15,000	3.12	46,800	12,800	19,800
New Jersey								15,137
New Mexico								113,280
New York	41,000	4.28	175,480	31,700	3.95	125,215	13,530	40,430
North Carolina	243,825	4.12	1,004,559	308,480	4.01	1,237,004	26,821	37,736
North Dakota								17,268
Ohio								46,575
Oklahoma	17,750	3.08	54,670	36,750	2.94	108,045	2,485	14,905
Oregon	32,700	3.60	117,720	38,150	3.43	130,854	5,558	64,037
	95,115	4.11	407,363	167,929	3.52	591,110	58,478	
Pennsylvania	6,900	3.18	21,942	15,850	3.10	49,135	552	333,127
Rhode Island								9,166
South Carolina	70,200	2.399	168,410	85,280	2.335	199,129	4,493	11,842
South Dakota	78,020	2.85	222,357	73,480	2.55	187,374	23,406	23,406
Tennessee	2,600	5.03	13,078	1,700	3.93	6,681	2,860	18,980
Texas								309,610
Utah	75,500	3.65	275,575	99,500	3.60	358,200	3,775	4,295
Vermont	48,000	3.59	172,320	33,000	3.35	110,550	11,520	15,165
Virginia	11,055	3.293	36,404	11,420	3.22	36,772	807	42,790
Washington	5,000	3.93	19,650	21,300	3.27	69,651	3,300	30,524
West Virginia	133,770	2.43	325,061	69,735	2.59	108,613	-21,403	-43,675
Wisconsin	400	4.15	1,660	1,100	3.98	4,378	68	-149,217
Wyoming	96,860	3.08	298,328	123,920	2.73	338,301	33,901	33,901
TOTALS	2,571,687		9,656,770	3,124,835		10,547,361	757,552	2,145,852

7.81%
SAVINGS6.74%
TOTAL
SAVINGS

TABLE B II

FAST DRY TRAFFIC PAINT

STATE	YELLOW			WHITE			WHITE "SAVINGS"	GRAND TOTAL WHITE SAVING (REG. vs. FAST DRY)
	GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST		
Alabama	85,380	\$ 3.534	\$ 301,732	103,730	\$ 3.372	\$ 349,777	\$ 13,832	\$ 13,832
Alaska								4,572
Arizona	39,160	3.861	151,197	60,280	3.606	217,370	9,986	33,651
Arkansas	160,000	4.24	677,800	35,000	3.84	134,450	64,000	64,000
California	120,000	3.46	415,200	215,000	3.18	683,700	33,600	56,600
Colorado	20,000	3.71	74,200	24,000	3.49	83,720	4,400	44,113
Connecticut	112,000	2.87	321,440	29,000	2.70	78,300	19,040	19,270
Delaware	15,340	2.72	41,724	28,756	2.50	71,890	3,375	3,330
Florida	210,000	3.96	831,600	330,000	3.56	1,174,800	84,000	84,000
Georgia				Does not use fast dry - thermoplastics instead				58,000
Hawaii								6,200
Idaho	86,400	4.07	351,648	74,500	3.82	284,590	21,600	21,715
Illinois	116,945	4.66	544,960	60,840	4.10	249,440	65,489	65,489
	79,200	2.46	194,830	314,800	2.46	774,400	0	
Indiana	171,000	3.36	574,560	33,000	2.98	98,340	64,980	75,780
Iowa	129,085	4.19	540,866	119,405	3.69	440,604	64,542	64,542
Kansas								57,134
Kentucky	337,962	3.46	1,169,348	186,663	3.275	611,321	62,523	62,523
Louisiana	160,000	3.71	593,600	100,000	3.50	350,000	33,600	39,600
Maine	115,000	3.27	376,050	40,000	3.017	120,680	29,095	29,095
Maryland	166,000	3.95	655,700	242,000	4.33	1,047,860	-63,080	-63,080
Massachusetts	25,800	2.47	63,726	23,600	2.43	57,348	1,032	
	22,700	2.77	62,879	26,000	2.73	70,980	908	28,275
Michigan	112,050	2.56	286,848	270,950	2.54	688,213	2,241	2,241
Minnesota	19,195	2.65	50,866	19,195	2.50	47,987	2,879	14,087
Mississippi	104,873	4.5423	476,365	101,698	4.2833	435,603	27,162	27,162
Missouri	21,505	3.34	71,826	16,940	3.16	53,530	3,871	231,476
Montana								38,782
Nebraska	1,560	4.04	6,302	11,700	3.66	42,822	593	41,919
Nevada	27,973	3.33	93,230	49,780	3.015	149,837	9,091	12,162
	9,907	3.08	30,111	17,445	3.33	58,180	3,071	
New Hampshire	20,000	3.52	70,400	40,000	3.17	126,800	7,000	19,800
New Jersey	84,095	4.75	399,451	68,840	4.57	314,598	15,137	15,137
New Mexico	177,000	6.34	1,122,180	129,000	5.70	735,300	113,280	113,280
New York	538,000	2.34	1,261,341	387,000	2.29	886,810	26,900	40,430
North Carolina	218,310	4.59	1,002,043	207,170	4.54	940,551	10,915	37,736
North Dakota	23,335	4.61	107,574	12,330	3.87	47,717	17,268	17,268
Ohio	115,000	3.46	397,900	115,000	3.055	351,325	46,575	46,575
Oklahoma	82,800	4.62	382,536	98,950	4.47	442,306	12,420	14,905
Oregon								64,037
Pennsylvania	773,430	3.06	2,366,695	469,700	2.63	1,235,311	332,575	333,127
Rhode Island	24,828	4.35	108,000	15,904	4.15	66,000	4,966	9,166
	7,000	5.30	37,100	4,000	4.70	18,800	4,200	
South Carolina	99,320	2.37	235,388	86,580	2.296	198,787	7,349	11,842
South Dakota								23,406
Tennessee	52,000	4.22	219,440	116,500	3.91	455,515	16,120	18,980
Texas	584,170	5.75	3,358,977	387,450	5.22	2,032,929	309,610	309,610
Utah	13,000	3.94	51,220	15,000	3.90	58,500	520	4,295
Vermont	22,500	3.112	70,020	19,500	2.95	57,525	3,645	15,165
Virginia	291,550	2.904	846,661	342,100	2.76	944,196	41,983	42,790
	41,050	5.28	216,744	70,750	4.79	338,893	20,114	30,524
Washington	9,875	4.53	44,734	50,454	3.81	192,230	7,110	
West Virginia	85,690	3.23	276,681	72,330	3.49	252,431	-22,272*	-43,675
Wisconsin	182,055	3.18	578,934	135,645	4.00	542,580	-149,285*	-149,217
Wyoming								33,901
TOTALS	5,913,933		22,118,687	5,378,485		18,614,846	1,387,960	2,145,552

* Yellow is normally about \$0.10 more per gallon

6.28%
SAVINGS6.74%
TOTAL
SAVINGS

TABLE B III

TRAFFIC PAINT REGION 1 (HRA-01)

REGULAR DRY

FAST DRY

STATE	YELLOW			WHITE			WHITE SAVINGS ¹	YELLOW			WHITE			WHITE SAVINGS ¹	GRAND TOTAL WHITE SAVING (REG DRY / FAST DRY)
	GALLONS	COST (PER GAL)	TOTAL COST	GALLONS	COST (PER GAL)	TOTAL COST		GALLONS	COST (PER GAL)	TOTAL COST	GALLONS	COST (PER GAL)	TOTAL COST		
CONNECTICUT	1,000	\$ 3.79	\$ 3,790	7,000	\$ 3.56	\$ 24,920	\$ 230	112,000	\$ 2.87	\$ 321,440	29,000	\$ 2.70	\$ 78,300	\$ 19,040	\$ 19,270
MAINE								115,000	3.27	376,050	40,000	3.017	120,680	29,095	29,095
MASSACHUSETTS	55,000	4.12	226,600	35,500	3.96	144,540	8,800	25,900	2.97	63,726	23,600	2.23	52,348	1,032	28,275
	50,100	4.30	225,930	27,600	4.15	114,540	17,535	22,700	2.77	62,879	26,000	2.73	70,980	908	19,800
NEW HAMPSHIRE	80,000	3.28	262,400	15,000	3.12	46,800	12,800	20,000	3.52	70,400	40,000	3.17	126,800	7,000	15,137
NEW JERSEY								84,095	4.75	399,451	68,840	4.57	314,598	15,137	40,430
NEW YORK	41,000	4.28	175,480	31,700	3.95	125,215	13,530	538,000	2.34	1,261,341	387,000	2.29	886,810	26,900	9,166
PUERTO RICO															
RHODE ISLAND								24,828	4.35	109,000	15,904	4.15	66,000	4,986	15,165
VERMONT	49,000	3.59	172,320	33,000	3.35	110,550	11,520	7,000	3.112	70,020	19,500	2.95	57,525	4,200	
VIRGIN ISLANDS								22,500	3.112	70,020	19,500	2.95	57,525	3,645	
SUBTOTAL	275,100		1,066,040	150,800		566,565	64,415	971,923	2,770,407	653,844	1,797,841	111,923	176,338		
WEIGHTED AVERAGE		3.875 +			3.757		6.04% SAVINGS		2.850		2.750	4.04% SAVINGS	4.60% SAVINGS		
RANGE		3.28 - 4.50			3.12 - 4.15			2.34 - 5.30		2.29 - 4.70					

TABLE B V

TRAFFIC PAINT REGION 4 (HRA-04)

REGULAR DRY

FAST DRY

STATE	YELLOW			WHITE			WHITE SAVINGS ¹	YELLOW			WHITE			WHITE SAVINGS ²	GRAND TOTAL WHITE SAVING (REG $\frac{1}{2}$ FAST DRY)	
	GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST		GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST			
ALABAMA																
FLORIDA																
GEORGIA	200,000	4.45	890,000	300,000	4.16	1,248,000	58,000	85,380	\$ 3.534	\$ 301,732	103,730	\$ 3.372	\$ 349,777	\$ 13,832	\$ 13,832	
KENTUCKY								210,000	3.96	831,600	330,000	3.56	1,174,800	84,000	84,000	
MISSISSIPPI								DOES NOT USE FAST DRY — THERMOPLASTICS INSTEAD								
NORTH CAROLINA	243,825	4.12	1,004,559	308,480	4.01	1,237,004	26,821	337,962	3.46	1,169,348	186,663	3.275	611,321	62,523	62,523	
SOUTH CAROLINA	70,200	2.399	168,410	85,280	2.335	199,129	4,493	104,873	4.5423	476,365	101,698	4.2833	435,603	27,162	27,162	
TENNESSEE	2,600	5.03	13,078	1,700	3.93	6,681	2,860	218,310	4.59	1,002,043	207,170	4.54	940,551	10,915	37,736	
SUBTOTAL	516,625		2,076,047	695,460		2,690,814	92,174	1,107,845		4,235,916	1,132,341		4,166,354	221,901	314,075	
WEIGHTED AVERAGE		4.018			3.869		4.44% SAVINGS		3.824				3.679	5.33% SAVINGS	4.976% SAVINGS	
RANGE		2.399 - 5.03			2.335 - 4.16			2.37 - 4.59					2.296 - 4.54			

TABLE B VII

TRAFFIC PAINT REGION 6 (HRA-06)

REGULAR DRY

FAST DRY

STATE	YELLOW		WHITE		WHITE "SAVINGS"	YELLOW		WHITE		WHITE "SAVINGS"	GRAND TOTAL WHITE SAVING (REG. DRY / FAST DRY)
	GALLONS (PER GAL.)	COST TOTAL COST	GALLONS (PER GAL.)	COST TOTAL COST		GALLONS (PER GAL.)	COST TOTAL COST	GALLONS (PER GAL.)	COST TOTAL COST		
ARKANSAS											
LOUISIANA	150,000	4.46 669,000	90,000	4.42 397,800	6,000	160,000	\$4.24 \$677,800	35,000	\$3.84 \$134,450	\$64,000	\$64,000
NEW MEXICO						177,000	6.34 1,122,180	100,000	3.50 350,000	33,600	39,600
OKLAHOMA	17,750	3.08 54,670	36,750	2.94 108,045	2,485	82,800	4.62 382,536	98,950	4.47 442,306	12,420	14,905
TEXAS						584,170	5.75 3,358,977	387,450	5.22 2,032,929	309,610	309,610
SUBTOTAL	167,750	723,670	126,750	505,845	8,485	1,163,970	6,135,093	750,400	3,694,985	532,910	541,395
WEIGHTED AVERAGE	4.314		3.991		1.17% SAVINGS	5.271		4.924		8.69% SAVINGS	7.89% SAVINGS
RANGE	3.08 - 4.46		2.94 - 4.42			3.71 - 6.34		3.50 - 5.70			

TABLE B IX

TRAFFIC PAINT REGION 8 (HRA-08)

REGULAR DRY

FAST DRY

STATE	YELLOW			WHITE			WHITE "SAVINGS"	YELLOW			WHITE			WHITE "SAVINGS"	GRAND TOTAL WHITE SAVING (REG. DRY / FAST DRY)
	GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST		GALLONS	COST (PER GAL.)	TOTAL COST	GALLONS	COST (PER GAL.)	TOTAL COST		
COLORADO	110,315	3.29	362,522	180,545	2.93	528,773	39,713	20,000	3.71	74,200	24,000	3.49	83,720	4,400	44,113
MONTANA	80,795	3.03	244,808	97,795	2.35	249,377	38,782	23,336	4.61	107,574	12,330	3.87	47,717	17,268	17,268
NORTH DAKOTA	78,020	2.85	222,357	73,480	2.55	187,374	23,406	13,000	3.94	51,220	15,000	3.90	58,500	520	23,406
UTAH	75,500	3.65	275,575	99,500	3.60	358,200	3,775	5,000	3.94	19,700	15,000	3.90	58,500	520	4,295
WYOMING	96,860	3.08	298,329	123,920	2.73	338,302	33,901								33,901
SUBTOTAL	391,490		1,403,591	575,240		1,662,026	139,577 9.94% SAVINGS	56,335		232,994	51,330		189,937	22,188 9.52% SAVINGS	161,765 9.88% SAVINGS
WEIGHTED AVERAGE RANGE			3.585 +			2.889		4.136		3.701					
			2.85 - 3.65			2.35 - 3.60		3.71 - 4.61					3.49 - 3.90		

TABLE B XI

TRAFFIC PAINT REGION 10 (HRA-10)

REGULAR DRY

FAST DRY

STATE	YELLOW		WHITE		WHITE SAVINGS ¹	YELLOW		WHITE		WHITE SAVINGS ¹	GRAND TOTAL WHITE SAVINGS (FAST DRY)				
	GALLONS	COST (PER GAL)	TOTAL COST	GALLONS		COST (PER GAL)	TOTAL COST	GALLONS	COST (PER GAL)			TOTAL COST			
ALASKA	25,400	\$ 3.34	\$ 84,836	24,200	\$ 3.16	\$ 76,472	\$ 4,572	86,400	\$ 4.07	\$ 351,648	74,500	\$ 3.82	\$ 284,590	\$ 21,600	\$ 4,572
IDOH	320	4.96	1,587	1,110	4.60	5,106	115	86,400	4.07	351,648	74,500	3.82	284,590	21,600	21,715
OREGON	32,700	3.60	117,720	39,190	3.43	130,854	8,538	41,000	5.28	216,744	70,750	4.79	338,893	29,114	64,057
WASHINGTON	59,119	4.11	407,563	187,829	3.52	661,110	58,276	91,000	4.83	441,794	50,468	5.61	339,893	29,114	30,524
WASHINGTON	5,000	3.93	19,650	21,300	3.27	69,651	3,300	91,000	4.83	441,794	50,468	5.61	339,893	29,114	30,524
SUBTOTAL	162,535		631,156	252,689		873,193	\$ 72,024	137,325		613,126	195,704		815,713	\$ 48,824	120,848
WEIGHTED AVERAGE		3.883					11.41% SAVINGS							7.96% SAVINGS	9.71% SAVINGS
RANGE		3.34 - 4.96						4.07 - 5.28						3.81 - 4.79	

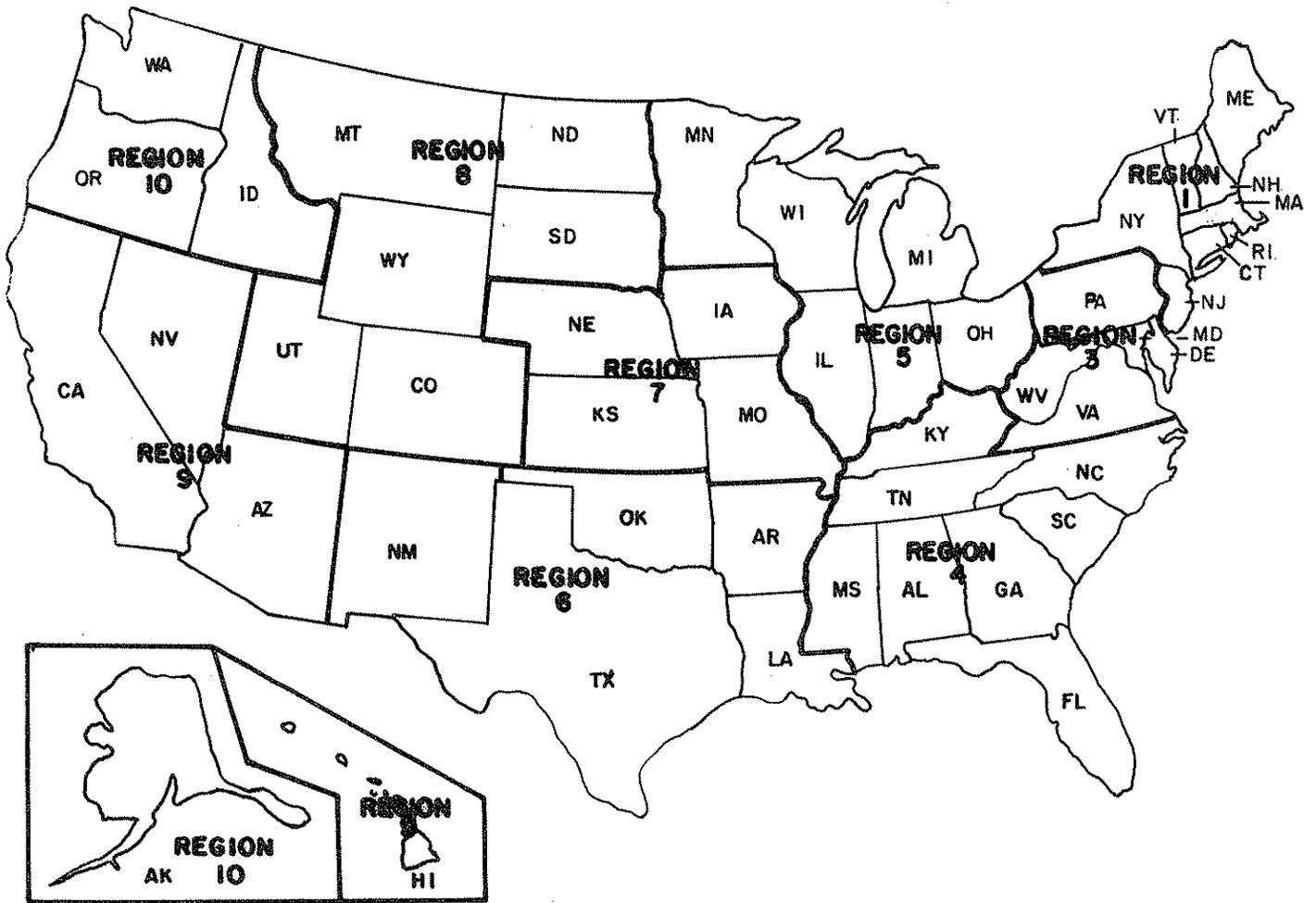


Figure 1 Map of Regions