PUBLIC RESPONSE TO BRIDGE COLORS

by

William Zuk Consultant

Virginia Highway Research Council (A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways and the University of Virginia)

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SUMMARY

To determine people's reactions to bridges painted in colors as white, yellow, green, blue, red, brown, black, and aluminum, two test bridges were selected in Charlottesville, Virginia. One was painted a different color each month and the other was kept a single color for comparison. After each painting, interviews were held with three different groups: motorists seeing the bridges, persons living near the bridges, and people with formal aesthetic training. In all, over 1,300 interviews were held for the ten different bridge colors.

The results show that colors as white, yellow, light blue, and green are definitely preferred over brown, black, and aluminum by all groups. Red and dark blue were liked by aesthetically trained people, while others thought less highly of them. On the basis of this study, it is recommended that the use of popular colors be considered for highway bridges to replace the unpopular aluminum color prevailing on most steel bridges in Virginia.

To aid in making a color selection for any given bridge, a technique has been developed (and explained in the report) to photographically color-alter the picture of a bridge so that color comparisons can be easily and inexpensively made.

FINAL REPORT

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METHODOLOGY

As outlined in the working plan for this study (dated July 1972), a steel bridge in Charlottesville, Virginia, was selected for painting in different colors and determining the response of people to these colors. The bridge selected was the Locust Avenue bridge (Figure 1) over the Charlottesville bypass (Rte. 250). Within a few blocks of Locust Avenue, along the same highway heading west, is a similar bridge on Park Street (Figure 2), which was used as a comparator or control bridge. Throughout the study the Park Street bridge remained light green. A traffic light is located just west of the Park Street bridge, which fact allowed for convenient interviewing of motorists viewing the two bridges, when they stopped at the red signal.

Three different groups of people were interviewed as to their color preferences for these bridges. The first group (A) included a random sampling of motorists and vehicle occupants who immediately before had viewed the bridges. During periods of such interviewing, a large sign was placed east of the Locust Avenue bridge on the bypass to alert travellers that a bridge color survey was under way and ask them to take note of the colors of the two bridges. The second group (B) of people included residents in the area of the bridges. It was believed that such people, feeling that the bridges were a permanent part of their neighborhood and that they therefore were more personally concerned, would represent a different point of view from transient motorists. The third group (C) consisted of people with professional training in the arts, as artists, architects, and landscape architects. These people, selected mostly from the University of Virginia, would represent still another point of view. This third group was requested to view the bridges firsthand and comment on their attitudes toward the different colors.

PAINTINGS AND RESPONSES

After permission was obtained from the City of Charlottesville, Virginia, to conduct this study in September of 1972, the eastern face of the steel girder on the Locust Avenue bridge (originally light green) was painted its first color, white. Reference to colors used is made to the Federal Standard Color Book #595a⁽¹⁾ White is #17886. The paint used was an alkyd industrial enamel, applied by the Forest Hill Painting Contractors of Charlottesville under a contract with the Virginia Department of Highways.



Figure 1. Locust Avenue Bridge.



Figure 2. Park Street Bridge.

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Surveys of the three groups described previously were then begun. For group A (the motorists) only quick interviews were made while they were stopped at the traffic signal. The interviews consisted mainly of obtaining the preference of the colors on the Locust Avenue and Park Street bridges. Interviews of the other groups were more extensive and allowed time for general comments regarding the color.

Table 1 presents the results of the survey for the color white.

At intervals of approximately one month, the Locust Avenue bridge was repainted another color and surveys again taken. The sequence of colors which followed is as given below:

Yellow (Federal Standard Color #13538) Light Blue (Federal Standard Color #15200) Dark Blue (Federal Standard Color #15050) Red (Federal Standard Color #11105) Brown (Federal Standard Color #10091) Black (Federal Standard Color #17038) Aluminum (Federal Standard Color #17178) Dark Green (Federal Standard Color #14062)

Tables 2 through 9 show the results for these colors in chronological order.

Color slides or prints of photographs of the Locust Avenue and Park Street bridges in their various colors are available from the writer to those with special interest in this project. *

It may be mentioned that after the Locust Avenue bridge had been repainted all its colors, color prints of the bridge in its 10 different colors were mounted on a panel for an informal survey of the opinions of 48 employees of the Research Council. The most popular color was light blue, chosen by 23% of this group. The second most popular was red (17%), and the third most popular was yellow (15%). The least popular colors were aluminum and black.

*Approximate cost of this set is \$3.50 to those outside the Virginia Department of Highways.

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TABLE 1

COLOR - WHITE

Se	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
78%	22%	36%	58%	6%

Group A, Motorists (Total number interviewed, 131)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
57%	14%	25%	4%

Special comments: White gives high visibility, especially desired by truckers.

Group B, Residents (Total number interviewed, 26)

S	Sex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
38%	62%	31%	42 %	27%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
42%	12%	42%	4%

Special comments: White presents a nice clean look, although it may soil easily.

Group C, Artistically Trained (Total number interviewed, 18)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
89%	11%	61%	39%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
72%	22%	6%	0%

Special comments: White is generally liked, but other colors would be preferred.

COLOR - YELLOW

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
64 %	36%	39%	61%	0%

Group A, Motorists (Total number interviewed, 107)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
65%	16%	18%	1%

Special comments: Yellow shows up conspicuously, a feature liked by some and disliked by others.

Group B, Residents (Total number interviewed, 27)

S	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
37%	63 %	30%	52 %	18%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
55%	19%	26%	0%

Special comments: None.

Group C, Artistically Trained (Total number interviewed, 23)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
96%	4%	60%	40%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
69%	9%	22 %	0%

Special comments: Feeling that the shade of yellow used is too bright.



COLOR - LIGHT BLUE

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
76%	$\mathbf{24\%}$	35%	65 %	0%

Group A, Motorists (Total number interviewed, 97)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
63%	32%	3 %	2 %

Special comments: None.

Group B, Residents (Total number interviewed, 23)

S	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
31%	69 %	22%	65%	13%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
61%	0%	39%	0%

Special comments: Light blue stands out noticeably.

Group C, Artistically Trained (Total number interviewed, 21)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
95%	5%	57%	43%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
48%	4%	48%	0%

Special comments: Light blue generally considered a pleasant color, but a somewhat different shade preferred.

COLOR – DARK BLUE

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
73 %	27%	47%	53%	0%

Group A, Motorists (Total number interviewed, 103)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
49%	32%	19%	0%

Special comments: None.

Group B, Residents (Total number interviewed, 24)

S	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
29 %	71%	25%	58%	17%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
37%	0%	63 %	0%

Special comments: None.

Group C, Artistically Trained (Total number interviewed, 29)

Sez	K		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
100%	0%	65%	35%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
79 %	0%	21%	0%

Special comments: Dark blue liked because it suggests "blue" steel.



COLOR - RED

Sex				
Males	Females	0 - 25	26 - 50	51 - 75
75%	25%	45%	55%	0%

Group A, Motorists (Total number interviewed, 102)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
46%	23%	22%	9%

Special comments: Many commented that they preferred the light blue color, which the bridge previously was.

Group B, Residents (Total number interviewed, 28)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
35%	65%	21%	32%	47%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
25%	7%	61%	7%

Special comments: Expression by some that red is too bright a color.

Group C, Artistically Trained (Total number interviewed, 38)

Sex			Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
95%	5%	82%	18%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
77%	0%	23%	0%

Special comments: Red generally preferred by the younger people in the group interviewed, whereas the older ones disliked it.

COLOR - BROWN

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
60%	40%	41 %	58%	1%

Group A, Motorists (Total number interviewed, 103)

Preference (As compared to light green)

Like Evenly Divided		Dislike	Indifferent
18%	21%	51%	10%

Special comments: Many commented that they preferred the light blue color, which the bridge previously was.

Group B, Residents (Total number interviewed, 22)

Sex			Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
36%	64%	18%	64%	18%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
4%	4%	92%	0%

Special comments: Group preferred lighter colors.

Group C, Artistically Trained (Total number interviewed, 17)

Sex			Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
100%	0%	59%	41%	0%

Preference (As compared to light green)

ſ	Like	Evenly Divided	Dislike	Indifferent
	35%	0%	65%	0%

Special comments: None.

COLOR - BLACK

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
71%	29%	40%	59%	1%

Group A, Motorists (Total number interviewed, 93)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
17%	17%	49%	17%

Special comments: Black does not show up well, especially at night.

Group B, Residents (Total number interviewed, 26)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
23%	77%	23%	62%	15%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
23%	0%	73%	4%

Special comments: Preferred lighter colors.

Group C, Artistically Trained (Total number interviewed, 8)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
100%	0%	25%	75%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
37%	0%	63%	0%

Special comments: None.

COLOR – ALUMINUM

S	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
73%	27%	37%	59%	4%

Group A, Motorists (Total number interviewed, 100)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
22%	36%	39%	3%

Special comments: None.

Group B, Residents (Total number interviewed, 28)

Se	ex		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
32%	68%	32%	43%	25%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
18%	14%	68%	0%

Special comments: Many preferred brighter colors.

Group C, Artistically Trained (Total number interviewed, 8)

Sez	K		Age (years)	
Males	Females	0 - 25	26 - 50	51 - 75
100%	0%	62%	38%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
0%	0%	100%	0%

Special comments: Aluminum too ordinary a color.

COLOR – DARK GREEN

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
68%	32%	34%	63%	3%

Group A, Motorists (Total number interviewed, 96)

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
51%	45%	4%	0%

Special comments: Most like both colors.

Group B, Residents (Total number interviewed, 25)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
40%	60%	8%	56%	36%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
60%	20%	20%	0%

Special comments: Many commented that they like the lighter colors.

Group C, Artistically Trained (Total number interviewed, 11)

Sex		Age (years)		
Males	Females	0 - 25	26 - 50	51 - 75
100%	0%	63%	37%	0%

Preference (As compared to light green)

Like	Evenly Divided	Dislike	Indifferent
63%	10%	27%	0%

Special comments: Some disliked light green because it was a shade of light green they did not care for.

The data in Tables 1-9 are obviously subject to many interpretations. In order to present the results in the most succinct fashion, the percentage of people in each of the three groups preferring the particular color of the bridge is shown in Figure 3. Because of the comparative technique used in the study wherein each bridge color was compared against the constant standard one of light green, the preference for the standard color itself had to be arrived at by inference. (This is why in Figure 3 light green is positioned at the end.) Based on an overwhelming number of comments by those interviewed who responded that their preference for the light green and dark green were almost the same, those who were evenly divided between the two colors and those who disliked the dark green with respect to the light green were considered as preferring the light green. These percentages are so recorded in Figure 3.

For purposes of further division, a 50% line is drawn across the chart in Figure 3 so that at a glance the more popular colors are separated from the less popular ones.

The colors persons in group A (motorists) prefer are white, yellow, light blue, and dark green; closely followed by dark blue, light green, and red.

Persons in group B (residents) prefer the colors of yellow, light blue, and dark green; closely followed by white and light green.

Group C people (aesthetically trained professionals) prefer white, yellow, dark blue, red, and dark green; followed closely by light blue.

Colors unpopular with all groups include brown, black, and aluminum.

Inspection of Figure 3 shows that there is not a significant difference of preference between groups A and B, which suggests that whatever colors are acceptable to transient motorists are also acceptable to persons who live near the bridge and consider it as part of their permanent neighborhood environment. But, as expected, the opinions of group C are somewhat at variance with those of groups A and B. Whereas some colors such as yellow and dark green are liked by all groups, group C differs in holding a strong preference for dark blue and red.

Color preference is a subtle determination, subject to time, place, mood, fashion, past association, and the like; however, as a generalization drawn from the data in the tables and the numerous comments it can be said of the people interviewed that they would, by and large, be receptive to bridges painted in different colors.

The newspaper for the region in and around Charlottesville (<u>The Daily Progress</u>) carried three feature articles on this study during various phases of the project. This fact also is somewhat of an indication of the public's interest in the subject.

A very small percentage voiced the negative opinion that no extra money should be spent painting bridges different colors. There is also a group of the public that is not particularly aware of the color of bridges at all, and would accept any reasonable color.



Figure 3. Color preference chart.

% Preferring color

- ^ <u>3</u>3

A great deal of quantitative information (see references and selected bibliography) is available on color and its effect on people; however, none is in regard to bridge structures. Universally, if there is any one color more popular than any other it is that of blue.⁽²⁾ This study shows that blue is indeed popular, but that for bridges other colors are liked as well.

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METHODOLOGY FOR SELECTING BRIDGE COLOR

To provide a rational methodology for the selection of bridge colors, a relatively inexpensive procedure is proposed. It is predicated on the hypothesis that a concensus of opinions from a group of people is apt to be more generally acceptable than an opinion from a single "expert". The method involves altering the color of the bridge by purely photographic means rather than by actually painting the bridge as was done in this study. In this way, the bridge color can be evaluated by a random or selected group of people very conveniently and efficiently by merely viewing a series of colored slides or prints of the same bridge in different colors.

For older bridges requiring repainting, photographs of these bridges can be taken "as is" including the actual background or setting they are in. For new bridges, the selection of the final paint color is to be deferred until the bridge construction is essentially complete. The color-altering process to be described can be accomplished in but a few days, which will not significantly delay the full completion of any new bridge. This procedure for new bridges eliminates the time and expense of either small-scale model making of the new bridge for color studies (as has been done on occasion) or test painting of the actual bridge (only to find that perhaps the wrong color was selected).

The color-altering photographic technique to be described has been developed, tried and tested at the Research Council for a variety of bridge types and colors and found to be quite realistic. (A comparison of photographs of the actual Locust Avenue bridge in its various colors was made against pictures using the photographically color altering process and observers could not tell which were the real colors and which were the "fake" ones.)

The process is basically the same for all bridge types and colors, but modified somewhat depending on the darkness of the original color of the bridge in question. These original colors will be classified as light (aluminum, white, yellow, etc), medium (light or medium green, blue, orange, etc.) and dark (black, rust, etc.).

The color-altering process is outlined as follows:

- 1. Photograph the bridge on outdoor color slide film.
- 2. Develop an 8" x 10" color print from the slide or slides selected. The print should be of good quality.
- 3. For light and medium original bridge colors, photographically reverse the color slide onto a black and white film which produces a black and white negative of the color slide. (For dark original bridge colors, this step may be omitted, as explained in step 4).

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4. From the black and white negative, enlarge a number of black and white prints of the section of the bridge that will be color altered. The enlargement must correspond exactly in size with the 8" x 10" color print. This "line-up" can be done by placing the color print under the enlarger and carefully lining up the black and white negative projection with the color print.

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For originally dark bridges, project the original color negative on to black and white paper so as to produce the reverse black and white tones.

5. For originally light or dark bridges, apply colored transparent overlays of plastic acetate onto the black and white sections to be color altered. (The commercially available zip-a-tone rub-on overlays can be had in 144 different colors.)

For originally medium colored bridges, coloring of the black and white prints must be made with photographic oil paints or tints that are commercially available for the purpose. For best results with oils, the black and white print should be on rough "mat" surface paper.

- 6. Carefully cut out the color-altered section of the black and white print, darken the white edges of the paper where cut, and place this section (a bridge beam for example) on the corresponding section of the 8" x 10" color print.
- 7. Using color slide film, photograph the 8" x 10" print with the added color-altered section. Repeat this step, using as many different color-altered sections as desired.
- 8. Process the film used in step 7, for use as colored slides, colored prints, or both.

With an array of slides or prints of the same bridge in its different possible colors, the results can thus be easily judged by any group of people desired. It is recommended that several people in the group be ones who have had formal training in the arts, as architects, landscape architects, or artists; although the views of others should not be excluded.

The author has on hand photographs of several bridges in the light, medium, and dark categories which have been photographically color altered. Copies of these in colored slide or print form are available on request for those who wish to view the actual results of this technique.*

^{*} Approximate cost of a set of 9 is \$3.00 to those outside the Virginia Department of Highways.

RECOMMENDATIONS

Except for some recently built steel bridges employing hot dipped galvanized coatings, or "weathering" steel (which normally requires no painting), exposed structural steel requires repainting at intervals from 5 to 15 years. In light of this fact, it is recommended that when existing steel bridges are to be repainted, consideration be given to painting them a final color other than the standard aluminum. In view of the extensive undercoating system required for bridges and the labor of painting, the cost of using colored paint for the last two finish coats would be little or no more than that for using aluminum paint.

For new steel bridges, the same would be true as to the desirability of finishing the steel in colored tones. In using alkyd paint for the final coat or coatings, it is not expected that the subcoatings in the painting system need be changed over present practice.

However, there are two new problems colored bridges present. The first is that the maintenance shops may be required to have on hand small amounts of various colored paints for use in touching up portions of the bridge that may need it due to corrosion or accident damage.

The second problem involves the selection of a final color to be used for a particular bridge. It is almost the unanimous opinion of the architects, artists, and landscape architects interviewed that the color of each bridge be decided on the basis of its unique features and on environmental factors. For example, a color that would be suitable for a bridge in an urban area may not necessarily be suitable for a similar bridge in a rural area. Or, where there is a sequence of bridges (as overpass bridges along a throughway), it may be desirable to paint each of these a different color to create a sense of interest and define special location for the motorist. These expert opinions are borne out by the survey, which shows that many colors are acceptable by both the public and the color experts. No one color pleases everyone, and thus no one color provides an easy answer. The interviews revealed that aluminum, the prevailing color of most existing steel bridges in Virginia, is unpopular in large measure because it is too widely used and thus is too commonplace and too neutral, or "blah", for the taste of today's public.

It is noted that a number of states are now painting their steel bridges colors other than the standard ones of aluminum or green. Maryland, West Virginia, Pennsylvania, Michigan, Massachusetts, Florida, California, and Washington are known to use colors as light blue, yellow, white, beige, rose, and maroon on highway bridges. Reactions expressed to the writer by those who have seen bridges so painted are generally quite favorable.

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