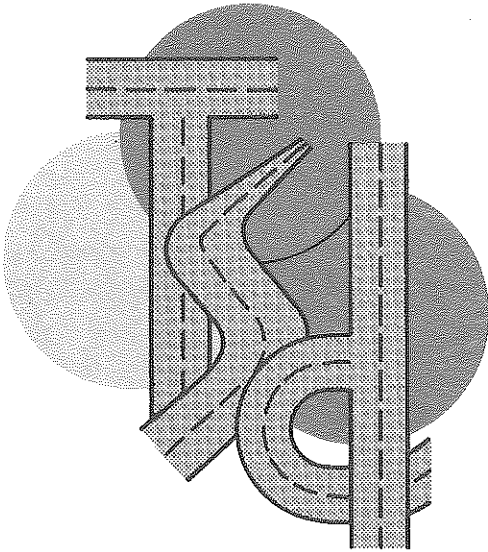


TE
176
.R67
1969

FINAL REPORT
INTERCHANGE RAMP COLOR DELINEATION
AND
MARKING STUDY
TSD-TR-120-69



**TRAFFIC and
SAFETY
DIVISION**

LIBRARY
michigan department of
state highways
LANSING

**DEPARTMENT OF STATE HIGHWAYS
STATE OF MICHIGAN**

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

FINAL REPORT

INTERCHANGE RAMP COLOR DELINEATION
AND
MARKING STUDY

TSD-TR-120-69

LIBRARY
michigan department of
state highways
LANSING

By

Walter J. Roth

Traffic Research Section
Traffic & Safety Division

in cooperation with

U.S. Department of Transportation
Federal Highway Administration
Bureau of Public Roads

September 1969

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Bureau of Public Roads.

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	
COLOR STUDY AREA MAP	
INTRODUCTION	1
STUDY LOCATION	1
Figure 1 - Interchange Map.	2
DETAILS OF THE COLOR CODING SYSTEM	4
Figure 2 - Color Application Typical.	6
Figure 3 - Color Application Typical.	7
ERRATIC MOVEMENT SURVEY STUDY.	9
Table I - Location Volumes	10
Table II - Erratic Movements.	11
Table III - Erratic Observations	12
Table IV - Erratic Movement Distribution.	13
Table V - Delayed Exit Movements	14
Table VI - Deceleration or Swerve Movements	14
Table VII - False Exit Movements	15
Table VIII - Stopped or Slowed Movements.	15
Table IX - Day and Night Distribution	16
Erratic Study Conclusions	16
US-23 EXIT INTERVIEW STUDY	17
Figure 4 - Color Interview Sheet.	18
Schedule of Installation and Studies.	20
Table X - Classifications of Drivers	21
Table XI - Exit Interview Distribution.	22
Table XII - What Told Drivers They Were Approaching Exit	24

	<u>Page</u>
Table XIII - What Told Drivers They Were At Exit	26
Table XIV - Attention Getting Items Mentioned	27
Entrance Distribution Groups	31
Table XV - Vehicle Entrance Distribution by Locations	32
ACCIDENT DATA ANALYSIS.	33
Table XVI - Accident Distribution	34
Conclusions of Accident Review	35
US-23 THRU TRAFFIC INTERVIEW STUDY	36
Figure 5 - Thru Study Interview Sheet.	37
Data Analysis of Thru Study.	38
CONCLUSIONS OF COLOR CODING APPLICATION	40
DISCUSSION AND RECOMMENDATIONS.	42
APPENDIX A - EXIT INTERVIEW PROCEDURE	44
APPENDIX B - THRU TRAFFIC INTERVIEW PROCEDURE	47

ABSTRACT

This is a final report on a study to determine the traffic effects of special color coding applied to a series of conventional interchanges on a 40-mile rural freeway system. The 18 interchanges with the color coding in the northbound direction only contained diamond, loop and connector ramp types.

The color scheme duplicated the Michigan Pilot Study on US-27 reported on in 1965 and the original Minnesota study.

In successive stages, the "Exit Gore" signs were changed to blue background followed by placement of Ramp Delineation and Edgemarkings in blue and yellow. The final stage changed the "Exit Direction" signs from green to blue backgrounds. This sign is referenced in the text as "Destination Ramp Sign". All elements of the color scheme were reflectorized.

The blue exit edgemarkings were applied by placing an 8-inch blue painted stripe on the outside edge of the exit ramp from 250 feet in advance of the ramp takeoff, and from the gore point on the inside edge, to the ramp termini. Blue 4 x 10 inch retro-reflective delineators were placed at the shoulder point along both blue edgelines. A 4-inch white edgeline was placed along the right hand edge of the thru lane from the exit gore point to the entrance gore point. The yellow entrance ramp markings were placed in 4-inch lines along the ramp edges and continued to the points where the ramp meets the edges of the thru pavement. Yellow delineators followed this same edgemarking.

Interviews of drivers, in the four different phases, were taken at 14 of the exits to learn the degree of driver recognition and knowledge of the color coded areas. While the interviews were being taken, observations were made of erratic driving patterns at the exits. Other studies analyzed the accident experience for one-year-before to one-year-after the color coding installation.

A sample of drivers was also interviewed on the thru route to study recognition factors and the drivers' knowledge of the color coding scheme.

Erratic driving was significantly reduced following the color application with the greatest reductions occurring at other than diamond ramps. The color scheme was as effective during day as it was at night.

A study following the blue application indicated a 5 to 11 times increase in percentage of drivers who noted edgemarking and showed that the blue color was the greatest single attention-getting item. This fact was substantiated in the next year's Interview Study of Thru Traffic. It would seem the "newness factor" of the blue did not depart in a years time.

The Exit Direction sign is a major item used by motorists to identify their exit. Changing this sign to blue background was noticed more in day than at night.

Of the once-a-year or less users, 67 percent of the daytime group interviewed and 83 percent of the nighttime group knew

the correct meaning of the color scheme.

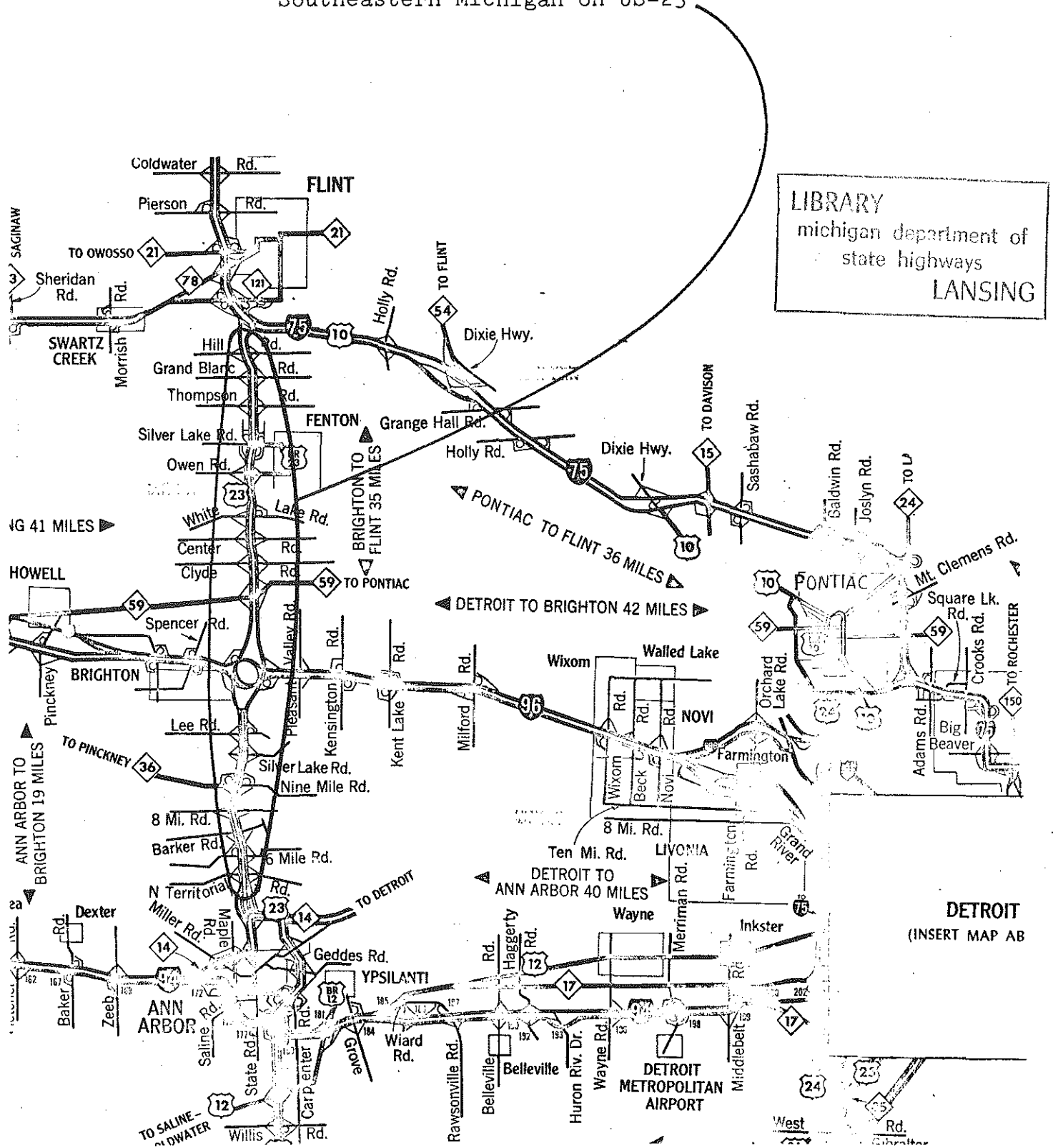
The accident occurrences were not directly relatable to the color application, however, the increase in accidents in the southbound non-color coded direction was three times greater than in the color coded direction.

The "Thru Interview Study" also showed a high degree of recognition and understanding of the color scheme (80 percent).

In summary, it appears there is a good potential to ease the drivers' task by presenting a better delineated path, more easily understood and resulting in less confusion and apparently fewer accidents.

COLOR STUDY AREA MAP

Location of Color Study Area in
Southeastern Michigan on US-23



INTERCHANGE RAMP COLOR DELINEATION AND MARKING STUDY - CONTINUOUS ROUTE APPLICATION

INTRODUCTION

This final report covers the application of special color coding to a series of conventional interchanges on a continuous route.

This study was an outgrowth of the successful usage of color coding at two left-hand exit interchanges on US-27. The approaching drivers' view at these two interchanges gave the impression that the exits were the thru roadway.

The details of that application and background information can be found in two earlier reports: "Interchange Ramp Color Delineation and Marking Study (Pilot Project)", Michigan State Highway Department, June 1965, and "The Effect of Color in Guidance of Traffic at Interchanges", published by the Minnesota Highway Department in 1963.

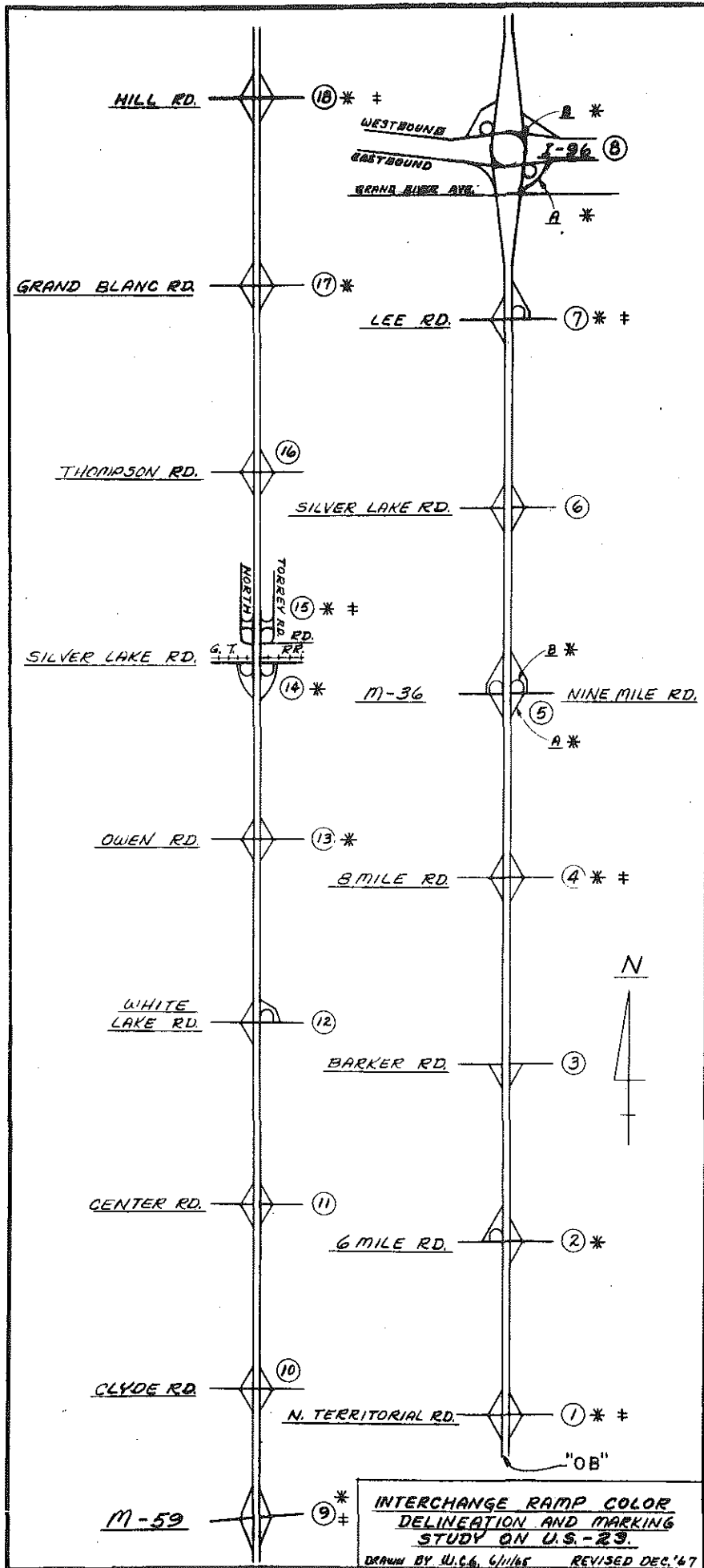
STUDY LOCATION

The study area embraces a 40-mile section of US-23 in the northbound direction from Territorial Road near Ann Arbor to Hill Road South of Flint, Michigan. (See Color Study Area Map).

The northbound exit ramps include 14 diamonds, four loops, one left-hand connector ramp and one right-hand connector ramp as shown by the Interchange Map in Figure 1.

This is a four-lane divided rural limited access freeway with A.D.T.'s varying from 12,000 to 19,000. The summer study

INTERCHANGE MAP



NOTE:
 * = Phase I & IV
 Interviews Taken.
 + = Phase II & III
 Interviews Taken.

FIGURE 1

period variation was not this great, however, as the weekday northbound volumes through the study area averaged 7,800 vehicles per day.

PURPOSE

The purpose of this study is to evaluate the effects of color coding a series of conventional interchanges along a continuous route.

RELATED RESEARCH

Experimentation with color coding at interchange ramps has been conducted by the Minnesota Department of Highways and the State Road Department of Florida. The Minnesota experiment¹ applied color paint to the entire surface of the ramps and installed corresponding delineators. The Florida experiment² applied only colored edgemarking with corresponding delineators. In both experiments, white color indicated the thru roadway, yellow was used for on-ramps, and blue for the off-ramps.

Both experiments reported that the application of color coding provided definite benefits for motorists. There was a decided reduction in confusion for both exiting and thru traffic. "Glance"

¹This project was conducted in cooperation with the Minnesota Mining and Manufacturing Company and was reported by Mathew J. Huber, Yale Traffic Bureau in 1960.

²Reported by J. T. Fitzpatrick Minnesota Mining and Manufacturing Company, at the World Traffic Engineering Conference in Washington, D.C., August 1961 (New Techniques in Interchange Traffic Guidance.)

notification in advance of the interchange permitted earlier alignment of exiting traffic.

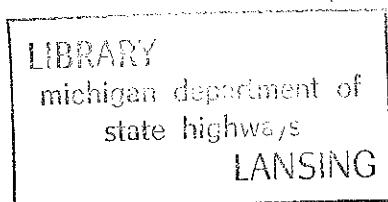
These experiments generated widespread interest in the color coding of interchange ramps for better notification and guidance to freeway motorists. The project here in Michigan was planned in 1961 and was initiated in 1962 with preliminary material investigations. Michigan added the factor of color coding to the exit and directional signs, whereas the previous projects were concerned only with edgemarking and delineation. Since then other states have become interested in similar projects. Ohio has experimented with color edgemarking at interchange ramps on a limited basis. Oregon initiated a project in the summer of 1964. The Oregon project consists of the application of color coding to five successive interchanges. This project included the exit signs at the ramps in the color system.

These latter projects continued the identical color designations in the color system as were initiated in Minnesota and used in the Florida and Michigan projects.

DETAILS OF THE COLOR CODING SYSTEM

I. Selection of Colors

The selection of colors are based upon compatibility and consistency with present highway usage, the colors already selected in the related projects, and a review of colors available for use. This review resulted in the retention of white for the thru roadway, blue for the exit ramps,



and yellow for the entrance ramps. The white edgemarking and clear delineators are already used to delineate the thru roadway. The use of yellow for the entrance ramps is a natural extension of its use as a warning or caution color. Blue color for exit ramps provided a distinct contrast with the thru roadway white and entrance-ramp yellow. The subdued characteristic of blue, by contrast, emphasized the white of the thru roadway and still provided sufficient differentiation and attraction. In addition, blue is the standard background color for Interstate "REST AREA" and "GAS-FOOD-LODGING" signs. These signs imply an exiting movement from the freeway and the blue color conforms with this familiar usage.

II. Application of the Color System

The elements of the color system are presented in Figures 2 and 3 representing typical applications at a diamond and loop ramp. Specific details regarding these elements which are pertinent to the study are as follows:

AT EXITS:

a. The Exit W/Arrow sign in gore was changed from green to blue background.

b. Edgemarking

Both sides of the ramps were painted with 8-inch blue reflectorized line. This line began on the right side of ramps 250 feet in advance of the ramp takeoffs from the thru lane. This permitted initial visibility of the blue edgeline along the thru roadway for a clearer lead

TYPICAL DIAMOND INTERCHANGE COLOR CODING

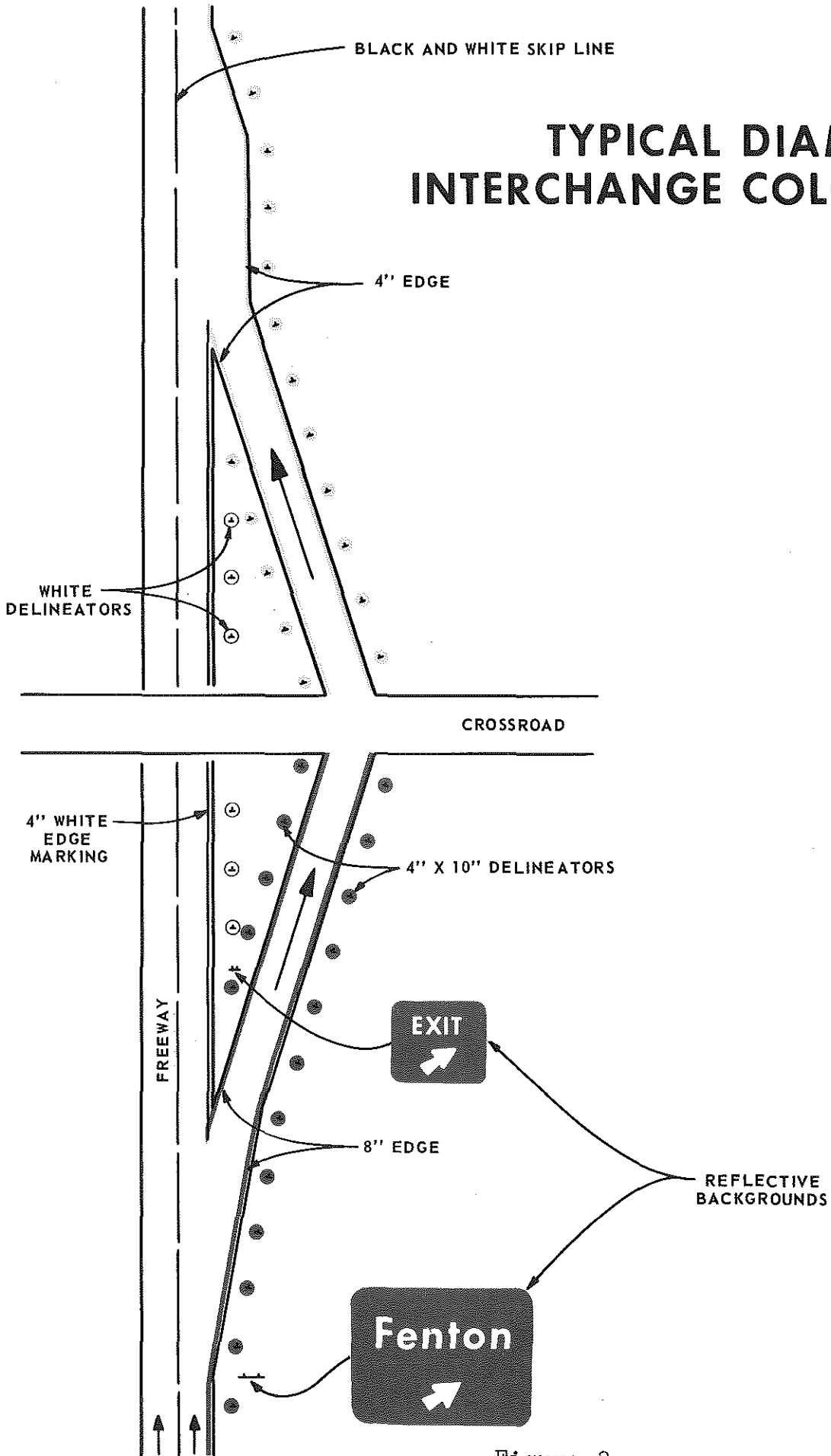


Figure 2

TYPICAL PARCLO INTERCHANGE COLOR CODING

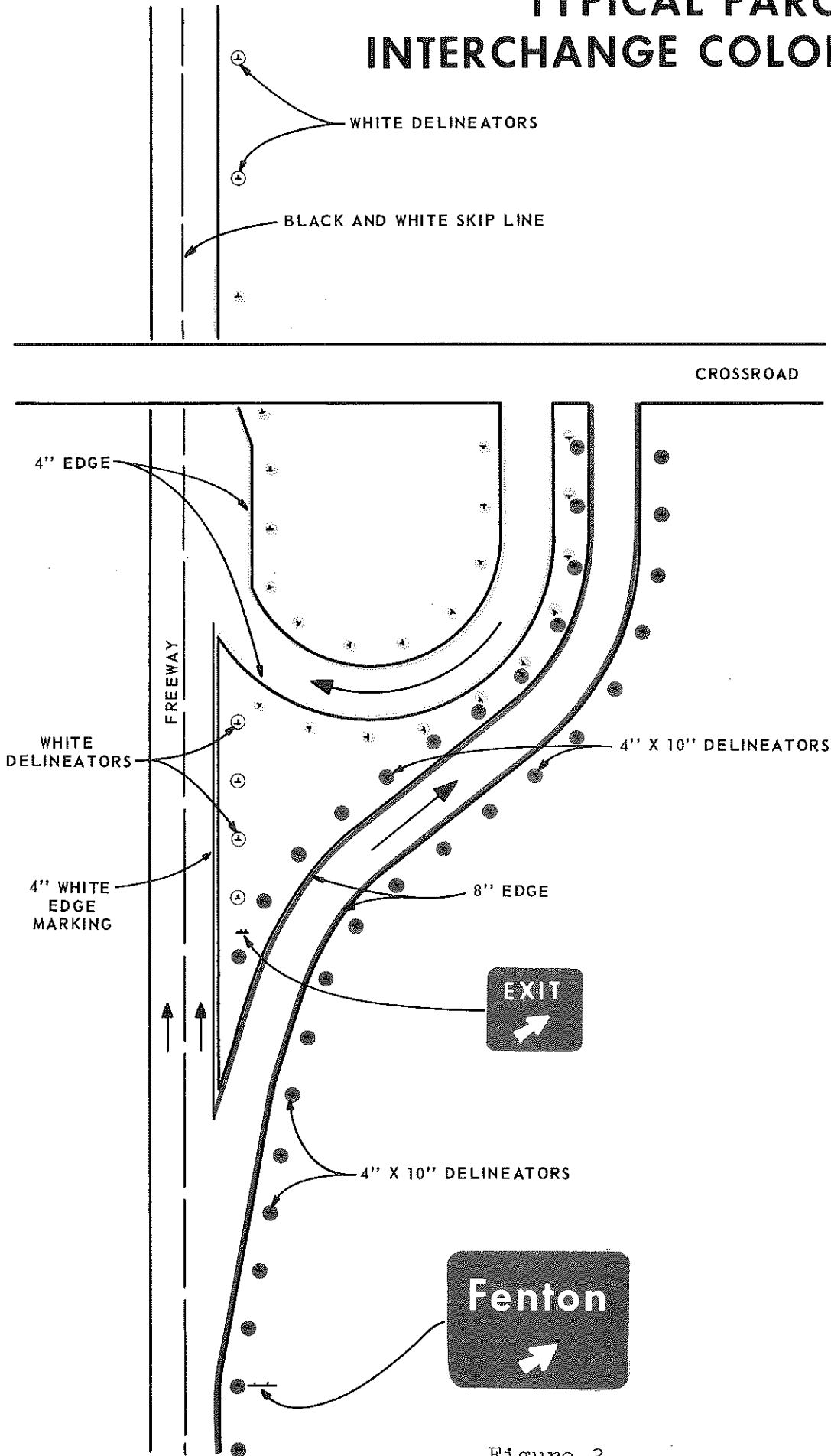


Figure 3

into the exit. The left edges were also painted from the gore point to the end of the ramps. The motorists were interviewed at the stop sign position at the ramp ends.

c. Delineators

All 3-inch amber exit delineators were replaced with special 4" x 10" blue retro-reflective delineators. In addition these delineator posts were painted blue. The extent of the delineators followed the length of the blue edgeline.

d. Signs

The Exit Direction signs herein referred to as "Destination Ramp Signs", were changed from green reflective background to blue reflective background.

AT ENTRANCES:

a. Edgemarking

4-inch wide yellow reflectorized edgeline was painted along each side of the ramp to the points of contact with the thru lane.

b. Delineators

The 3-inch amber standard delineators were retained throughout, and the posts were painted yellow.

c. Color Identification Study

North of the I-96 Interchange three study identification signs were placed: one denoting study area next 25 miles, and two stating, "Exit on Blue-Enter on Yellow".

ERRATIC MOVEMENT SURVEY STUDY

This section was contained in a separate interim report of December 1967.

This report covers the analysis of erratic movements as observed in July and August 1965 on the US-23 study section as shown in Figure 1.

I. Study Procedure

Observation of driver's exit performance was made before and after the application of the color code. Sixteen hours were observed at each of 14 locations. The before study was conducted July 6 through July 20. (Phase I) The after study was conducted August 23 through September 3. (Phase IV) Hereafter, in this section, these observations will be referred to as "before" and "after" respectively.

Erratic movements were classified according to the following descriptions:

1. Delayed Exit - This is a vehicle that delays its exit long enough to drive across the painted gore or dirt.
2. False Exit - This is a vehicle that begins its exit but returns to the through lane.
3. Backing at Gore - This is a vehicle which stops beyond the gore and then backs up to go in a different direction. It was noted if vehicle backed up on ramp, or on the through roadway.

4. Rapid Deceleration or Swerve on Correct Path -
This is a vehicle which drives the ramp on the path but has to take an abrupt action to do so.
5. Stopped or Slowed - This is a vehicle which comes to a complete stop to decide which way to go or is definitely confused on its direction and slows down to decide.

DATA AND ANALYSIS

Total traffic volumes were only slightly lower in the after period. For each location, the exit traffic volume is listed in Table I.

Table I

<u>Location</u>	<u>Before</u>	<u>After</u>
2	838	857
4	656	696
5A	346	310
5B	371	336
7	842	669
8A	1044	879
8B	1630	1477
9	555	752
13	483	512
14	304	307
15	244	255
17	411	355
18	626	516
TOTAL	8350	7921

There was very little volume change in the before and after periods of each location, so volumes were not considered in the analysis.

Table II

Erratic Movements

	<u>Before</u>	<u>After</u>
Delayed Exits	263	72
Stopped or Slowed	133	61
Rapid Deceleration or Swerve	158	116
False Exit	67	39
Backing at Gore	<u>7</u>	<u>8</u>
Total	628	296

Total erratic movements reduced from 628 to 296. To test significant reduction of erratic movements in each location, we use the t-test:

Null Hypothesis $H_0: \mu^1 = \mu^2$

i.e. There is no change of the mean in the "before" and "after" periods.

$H_a: \mu^1 > \mu^2$

In Table III, we have the data of before and after periods of each location.

Table III

Record of Observations

13 Locations	Period	Delayed Exit	False Exit	Rapid Decel. or Swerve	Stopped or Slowed	*Backing at Gore	
						Ramp	Thruway
2	Before	11	0	7	9	1	0
	After	5	1	21	5	0	0
4	Before	16	0	13	16	0	0
	After	16	6	17	4	0	0
5A	Before	1	9	12	7	0	0
	After	0	4	14	3	0	1
5B	Before	11	3	7	10	0	0
	After	5	2	9	5	1	0
7	Before	22	6	15	12	1	0
	After	1	6	1	5	1	0
8A	Before	1	3	34	9	0	1
	After	3	3	8	4	0	1
8B	Before	70	0	25	12	2	0
	After	13	2	6	6	0	1
9	Before	33	4	19	11	0	0
	After	10	5	4	10	1	0
13	Before	8	3	3	12	1	0
	After	2	0	2	0	0	0
14	Before	5	0	6	8	0	0
	After	4	1	16	6	0	1
15	Before	6	21	4	10	0	0
	After	0	6	5	0	0	0
17	Before	34	3	9	7	0	1
	After	9	2	11	13	0	1
18	Before	34	6	4	10	0	0
	After	4	1	2	0	0	0

*Backing at Gore excluded from analysis for the Table.

Table IV

ERRATIC MOVEMENT DISTRIBUTIONS

<u>Location</u>	X_i <u>Before</u>	Y_j <u>After</u>
2	28	32
4	54	43
5A	29	22
5B	31	22
7	56	14
8A	48	19
8B	109	28
9	67	30
13	27	4
14	19	28
15	41	11
17	54	36
18	65	7
Total	628	296

Testing Hypothesis: $H_0: \mu_1 - \mu_2 = 0$ i.e. There is no difference of erratic movements in "before" and "after" study.
 vs
 $H_a: \mu_1 > \mu_2$

$\bar{X} = 48.307$ $\bar{Y} = 22.769$

$S^2 = 356.961$

$S = 18.87$

$t = 3.45275$

use $\alpha = .01$ $t_{.99, 24} = 2.94 < 3.45$

Reject the hypothesis H_0 . It gives very strong significance of reducing the erratic movements in each location.

For Table V through VIII, exits numbered 2, 4, 5A, 9, 13, 14, 17 and 18 were grouped in Table V, VI, VII, and VIII since they presented the driver with a Diamond Exit Ramp. Exits 5B, 7, 8A, 8B and 15 were grouped under "Other Ramps".

Table V

Delayed Exit Movements

	Before	After	Total
Diamond Ramps	153	50	203
Other Ramps	110	22	132
Total	263	72	335

Hypothesis tested : Diamond Ramps and other ramps shared equally in the improvement.

$$X^2 = 3.0066 < X^2 .95, 1 = 3.84$$

Accept H_0 : The apparent greater improvement in other ramps as compared to Diamond Ramps might be attributed to chance.

Table VI

Rapid Deceleration or Swerve Movements

	Before	After	Total
Diamond Ramp	73	87	160
Other Ramp	85	29	114
Total	158	116	274

Same hypothesis as Table V

$$X^2 = 22.832 > 3.84$$

Reject H_0 : i.e. Other Ramps were aided more by the color scheme than Diamond Ramps.

Table VII

False Exit Movements			
	Before	After	Total
Diamond Ramp	34	20	54
Other Ramps	33	19	52
Total	67	39	106

$$\chi^2 = .004175 < 3.84$$

Accept H_0 : Diamond and other ramps were aided equally in this movement.

Table VIII

Stopped or Slowed Movements			
	Before	After	Total
Diamond Ramp	80	41	121
Other Ramps	53	20	73
Total	133	61	194

$$\chi^2 = .889 < 3.8$$

The hypothesis is accepted. Diamond and other ramps were equally improved for this movement.

<p>LIBRARY michigan department of state highways LANSING</p>

Table IX

Day and Night Movements

	Day	Night	Total
Before	517	111	628
After	244	52	296
Total	761	163	924

$\chi^2 = .00016 < 3.84$ Accept the hypothesis.

Day and Night showed equal reductions in erratic movements.

II. Conclusions:

By using the t-test, we found erratic movements were significantly reduced following the application of the color scheme.

The reduction in erratic movements "Rapid Deceleration or Swerve Movements", was greatest at exit ramps which were not diamonds. (Table VI)

The reduction in "Delayed Exit Movements", "False Exit Movements" and "Stopped or Slowed Movements" was the same at diamond and other ramps. (Table V, VII, VIII)

The reductions in erratic movements were proportionately the same for day and night. This would indicate that the color scheme aids the motorist in daytime as much as at nighttime. (Table IX)

US-23 EXIT INTERVIEW STUDY

STUDY SCHEDULE

The schedule of events in the Summer of 1965 studies is shown on Page 20.

PHASES OF STUDY

Phase I studies or the "before" interviews were conducted at 14 interchange exits at the ramp termini as indicated by a (*) on the Interchange Map, Figure 1. The "US-23 Color Interview Sheet" (See Figure 4) was completed for each exiting vehicle at each of these ramps for a 16-hour period. The balance of the ramps carried volumes so small that meaningful data could not be obtained. An observer also recorded any erratic movements at each of these exits for the total study period. These results were reported in an earlier interim report which we are including under the "Erratic Movement Studies" section. In addition, entrance data was procured from the above interviews which is shown on pages 31 and 32.

Following Phase I all the exit gore signs were changed to blue background color.

Phase II studies were then taken at the six exits marked (≠) indicated on Figure 1.

Following Phase II studies all of the edgemarking and posts were painted and the blue delineators were installed.

Phase III was conducted at the same six exits indicated for Phase II.

US-23 COLOR INTERVIEW SHEET

1. INTERVIEW NO.

1

4. DATE

9

2. RECORDER

(assigned letter) 5

5. HOUR

(service time) 15

3. LOCATION

(number from map) 6

6. LIGHT CONDITION

(D or N) 17

7. LICENSE Michigan use first two letters & numbers
Out-of state first two letters state name

18

8. AGE 1. 25 & under 2. 25-40 3. 40-55 4. 55 & over (estimate)

22

9. SEX

(M or F) 23

10. HOW OFTEN DO YOU USE THIS EXIT?

24

- 1. once a year or less
- 2. 2 or 3 times a year
- 3. 3 to 12 times a year
- 4. 12 times a year or more

11. DID YOU HAVE ANY DIFFICULTY IN FINDING THIS EXIT?

(Y or N) 25

If answer is yes, what was the difficulty? _____

12. WHAT FIRST TOLD YOU THAT YOU WERE APPROACHING YOUR EXIT?

26

- 1. edge marking
- 2. delineators
- 3. Exit arrow sign
- 4. destination ramp sign
- 5. route marker
- 6. destination sign advanced
- 7. advertising sign
- 8. landmarks
- X prior interchange
- 9. Other _____
(specify)

13. WHAT TOLD YOU THAT YOU WERE AT YOUR EXIT?

29

- 1. edge marking
- 2. delineators
- 3. exit arrow sign
- 4. destination ramp sign
- 5. route marker
- 6. ramp design
- 7. interchange area
- 9. Other _____
(specify)

14. WHAT DREW YOUR ATTENTION (TO THE ABOVE MENTIONED ITEM?)

32

- 1. destination name
- 2. location
- 3. arrow
- 4. appearance
- 5. white color
- 6. green color
- 7. blue color
- 8. yellow color
- X If color is mentioned - what did this color mean to you _____
- 9. Other _____
(specify)

15. DO YOU FEEL THAT THIS EXIT IS ADEQUATELY MARKED

Enter X if driver has an opinion

(Y or N) 35

If answer is no, what would you suggest to improve the marking of this exit? _____

16. WHERE DID YOU ENTER US-23?

37

Use no. of interchange on map. Use B for beginning of area.

17. DO YOU FEEL THAT THE ENTRANCE WAS ADEQUATELY MARKED

Enter X if driver has an opinion

(Y or N) 39

If answer is no, what would you suggest to improve the marking of this entrance? _____

18. WHAT MARKINGS DID YOU NOTICE?

41

- 1. delineators
- 2. edgelines
- 3. signs
- X If color is mentioned, what did this color mean to you? _____
- 9. Other _____
(specify)

19. HAVE YOU BEEN INTERVIEWED AT THIS LOCATION BEFORE?

(Y or N) 44

Figure 4

After Phase III the last part of the color coding was placed by changing all the exit destination ramp signs to blue background.

Phase IV covers the final "after" interviews and erratic movements were recorded at the same 14 exits as in Phase I.

Only the six exits were studied in Phases II and III for two reasons: (1) to reduce the survey time between the separate applications of the color coding elements and thereby be able to complete the study in the one summer period, and (2) the six provided a representation of the various interchange types with sufficient volumes to secure an adequate data base. This was apparently not accomplished in entirety as there are indications that the one unchanged control interchange at Territorial Road probably was not completely adequate to act as a control. On the other hand some degree of "control" data was present from the total information derived from Phase I which was taken prior to any changes in the area.

SCHEDULE OF INSTALLATION & STUDIES

1965

July 2	Interview Trial	
July 6 thru 20	a. "Before" interview phase and erratic observations at 14 exits	Phase I
July 21 thru 23	"Exit" signs installed, 18 + 2 gore signs in blue background	
July 26 thru 28	Interviews and erratic obser- vations at 6 exits (1 control)	Phase II
July 29 thru August 6	a. Installation of blue, yellow and white edge scheme b. Blue delineators installed at exits c. Painting of blue & yellow posts	
August 9 thru 12	a. Interviews and erratic observations	Phase III
August 13 thru 20	Install destination ramp sign overlays in blue background	
August 23 thru September 3	Interviews and erratic obser- vations at 14 exits for final after phase	Phase IV

INTERVIEW STUDY ANALYSIS SECTION

Table X

Classifications of Drivers Interviewed

	Phase I		Phase II*		Phase III*		Phase IV	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
<u>Age of Drivers</u>								
Under 25	1078	11.5	508	13.8	375	9.9	1253	14.3
25-40	4894	52.4	1830	49.7	1988	52.4	3930	44.9
40-55	2522	27.0	965	26.2	1117	29.4	2637	30.1
55-over	843	9.0	338	9.2	313	8.3	937	10.7
<u>Sex of Driver</u>								
Male	7466	18.5	2864	77.2	3089	80.0	6952	78.0
Female	2099	21.9	847	22.8	774	20.0	1958	22.0
<u>Frequency of Use</u>								
once a year	1719	18.5	682	18.7	711	18.9	1453	16.8
2-3 times year	486	5.2	179	4.9	183	4.9	504	5.8
4-12 times yr.	795	8.5	270	7.4	281	7.5	814	9.4
more than 12	6317	67.8	2516	69.0	2594	68.8	5867	67.9
<u>Michigan License</u>	8936	93.4	3398	91.6	3515	91.0	8253	92.6
<u>Out of State</u>	629	6.6	313	8.4	348	9.0	657	7.4

It is obvious that the group of drivers in each phase show a marked likeness in all categories when the distribution by percents are compared.

*Phase II and Phase III were taken only at Locations 1, 4, 7, 9, 15 and 18.

The following Table XI shows the distribution of exit interviews by exits studied and by each of the four phases.

TABLE XI

Exit Interview Distribution

Location	Phase I Totals	Phase II Totals	Phase III Totals	Phase IV Totals
1	871	673	657	722
2	838			857
4	656	509	640	696
5A	346			310
5B	371			336
7	842	913	871	669
8A	1044			879
8B	1630			1477
9	555	638	772	752
13	483			512
14	304			307
15	244	214	224	255
17	411			355
18	<u>626</u>	<u>627</u>	<u>628</u>	<u>516</u>
	9221	3574	3792	8643

The results of the question "What first told you that you were approaching your Exit?" are given in Table XII. The answers to the question in terms of the six categories and in percent are shown by phases, by day and night and frequency of use in terms of less than once a month or at least once a month.

From this data it is evident that the primary first notification of a coming exit is the "advance destination" sign. A significant difference does exist, however, between the "less than once a month" user at approximately 68 percent reporting this item, and the "at least once a month" user at about 54 percent. The data also shows a high reliance by the familiar driver on advertising signs or landmarks, about 33 percent, as opposed to about 20 percent for the less familiar. An average of seven to ten percent of the drivers first notification of the exit seems to be the Exit Direction Sign, referred to on our interview form as "Destination Ramp Sign". The other items mentioned may have been due in part to a misinterpretation of the question. Little change occurs in the percents mentioning the "advance destination" signs between the phases as might be expected, inasmuch as no changes were made in these signs throughout the study.

It would also appear that very little use of route marker guidance is made, however, crossing numbered routes do occur at four interchanges in the study section.

Differences in the groupings on a day and night comparison appear insignificant in the replies to the question.

TABLE XII

Question 12

What First Told You That You Were Approaching Your Exit?

Condition: Day, Usage Less Than Once A Month

Phases	Edge-marking		Exit Arrow Sign		Destination Ramp Sign		Route Marker		Advance Destination Sign		Advertising of Landmark		Totals
		%		%		%		%		%		%	
I	3	.1	62	2.8	139	6.2	66	2.9	1653	73.5	326	14.5	2249
II	1	.1	10	1.4	78	10.9	7	.1	448	62.6	172	24.0	716
III	9	1.15	2	.25	40	5.1	4	.5	543	69.6	182	23.3	780
IV	45	2.5	15	.8	196	10.6	83	4.5	1178	63.8	327	17.7	1846
													<u>5591</u>

Condition: Day, Usage At Least Once A Month

I	4	.1	113	2.4	325	6.9	108	2.3	2554	54.6	1575	33.6	4678
II	2	.1	27	1.6	150	8.7	5	.3	984	57.2	553	32.1	1721
III	45	2.4	12	.1	98	5.3	5		1078	58.6	598	32.5	1839
IV	129	2.9	30	.1	377	8.4	39	.1	2413	54.0	1478	33.1	4471
													<u>12709</u>

Condition: Night, Usage Less Than Once A Month

I	0		11	4.0	18	6.5	19	6.9	177	64.4	50	18.2	275
II	0		3	3.6	15	18.1	0		46	55.4	19	22.9	83
III	8	8.	1	1.	11	11.	0		60	60.0	20	20.0	100
IV	5	1.8	0		15	5.4	7	2.5	217	77.8	35	12.5	279
													<u>737</u>

Condition: Night, Usage At Least Once A Month

I	4	.5	11	1.5	60	8.1	33	4.4	338	45.4	295	39.7	744
II	0		1	.4	19	7.1	0		146	54.5	102	38.1	268
III	10	3.6	0		12	4.3	0		164	58.8	90	32.3	279
IV	38	5.8	2	.3	59	9.0	2	.3	357	54.3	197	29.9	658
													<u>1949</u>

Table XIII presents the data from the question "What told you that you were at your Exit?" Here the replies are listed under seven categories, by phase, by day or night and frequency of use (less than once a month, and at least once a month).

First, it is noted the major answer was the Destination Ramp Sign, and had the greatest impact on the daytime drivers who noticed this sign when it was changed to blue background just before Phase IV. It also shows in this table that the more familiar user relies more on general "interchange area" appearance than the less familiar driver.

The point at which the blue edgemarkings were installed is reflected in the great increases (5 to 11 times) in percentages that mention this item between Phases II and III for all four groups.

It is also evident that drivers do not recognize delineators, as such. Only a few of the nighttime more frequent users mentioned them. When the "Exit" gore signs between Phases I and II were changed to blue background, it appears only the less frequent user in the daytime noticed these to any degree (7 percent larger in Phase II).

From Table XIV, we have the following indications from question 14, "What drew your attention to the above mentioned items?" which refer to the seven categories in XIII.

The most remarkable difference among the phases or the categories was the blue color percent increase from Phase II to Phase III.

TABLE XIII

Question 13

What Told You That You Were At Your Exit?

Condition: Day, Usage Less Than Once A Month

Phases	Edge-Marking		Delineator		Exit Arrow Sign		Destination Ramp Sign		Route Marker		Ramp Design		Interchange Area		Totals
		%		%		%		%		%		%		%	
I	45	2.0	1		529	23.6	1265	56.4	54	2.4	129	5.8	218	9.7	2241
II	11	1.5	1	.1	224	30.9	341	47.1	5	.7	50	6.9	92	12.7	724
III	134	17.0	1	.1	197	25.0	335	42.5	4	.5	68	8.6	50	6.3	789
IV	291	13.4	7	.3	477	22.0	1098	50.5	60	2.8	68	3.1	172	7.9	2173
															<u>5927</u>

Condition: Day, Usage At Least Once A Month

I	204	4.3	7	.1	911	19.1	1866	39.1	62	1.3	430	9.0	1290	27.0	4770
II	76	4.3	5	.3	322	18.3	685	39.0	3	.2	232	13.2	434	24.7	1757
III	551	29.6	9	.5	327	17.5	515	27.6	2	.1	202	10.8	258	13.8	1864
IV	1050	23.3	34	.8	805	17.8	1606	35.6	53	1.2	285	6.3	677	15.0	4510
															<u>12901</u>

Condition: Night, Usage Less Than Once A Month

I	12	3.9	7	2.3	94	30.8	137	44.9	9	3.0	4	1.3	42	13.8	305
II	4	4.8	0		13	15.5	52	61.9	0		5	6.0	10	11.9	84
III	39	39.0	2	2.0	14	14.0	40	40.0	1	1.0	3	3.0	2	2.0	101
IV	78	27.8	11	3.9	43	15.3	110	39.1	16	5.7	7	2.5	16	5.7	281
															<u>771</u>

Condition: Night, Usage At Least Once A Month

I	40	5.4	18	2.4	145	19.5	258	34.7	15	2.0	19	2.6	248	33.4	743
II	19	7.0	9	3.3	46	17.0	122	45.0	0		14	5.2	61	22.5	271
III	109	38.9	16	5.7	30	10.7	88	31.4	1	.4	13	4.6	23	8.2	280
IV	287	43.0	44	6.6	56	8.4	186	27.9	11	1.6	25	3.7	58	8.7	667
															<u>1961</u>

TABLE XIV

Question 14

What Drew Your Attention To The Above-Mentioned Item? (In Question 13)

Condition: Day, Usage Less Than Once A Month

Phases	Destination Name	%	Location %	Arrow %	Appearance %	White Color	%	Green Color	%	Blue Color	%	Yellow Color	%	Other %	Totals				
I	525	27.1	654	33.7	221	11.4	330	17.0	10	0.5	181	9.3	13	0.7	5	0.2	200	10.3	1939
II	176	24.3	233	32.1	102	14.1	133	18.3	6	0.8	44	6.1	9	1.2	0		22	3.0	725
III	139	17.7	202	25.7	105	13.3	116	14.7	0		26	3.3	187	23.8	1	0.1	10	1.3	786
IV	475	21.9	519	23.9	224	10.3	266	12.3	3	0.1	25	1.2	619	28.5	1	0.04	39	1.8	2171
																			5621

Condition: Day, Usage At Least Once A Month

I	620	13.0	1734	36.5	449	9.4	1044	22.0	75	1.6	359	7.6	10	0.2	8	0.2	455	9.6	4754
II	294	16.8	619	35.3	119	6.8	495	28.3	23	1.3	96	5.5	35	2.0	3	0.2	68	3.9	1752
III	229	12.3	403	21.6	114	6.1	371	19.9	2	0.1	41	2.2	659	35.4	0	0.0	43	2.3	1862
IV	595	13.2	957	21.3	290	6.4	811	18.0	3	.06	37	0.8	1749	38.8	2	0.04	59	1.3	4503
																			12871

Condition: Night, Usage Less Than Once A Month

I	48	15.7	90	29.5	63	20.7	42	13.8	6	2.0	30	9.8	2	0.7	4	1.3	20	6.6	305
II	24	28.9	12	14.5	5	6.0	22	26.5	5	6.0	7	8.4	3	3.6	0		5	6.0	83
III	24	24.0	12	12.0	2	2.0	12	12.0	1	1.0	1	1.0	46	46.0	0		2	2.6	100
IV	47	17.4	25	9.3	38	14.1	19	7.0	1	0.4	2	0.8	129	47.8	0		9	3.3	270
																			758

Condition: Night, Usage At Least Once A Month

I	47	6.4	292	39.5	105	14.2	145	19.6	22	3.0	64	8.7	1	.1	14	1.9	49	6.6	739
II	44	16.4	74	27.6	16	6.0	67	25.0	16	6.0	23	9.6	6	2.2	6	2.2	16	6.0	268
III	43	15.4	44	15.7	7	2.5	38	13.6	1	.4	8	2.9	128	45.7	1	.4	10	3.6	280
IV	92	15.2	25	4.1	47	7.8	53	8.8	2	.3	5	.8	374	61.8	1	.2	6	1.0	605
																			1892

It showed that the change to blue color in edgemarking definitely caught the attention of drivers. This points up more than just the fact that something different was present, it shows the importance of edgemarkings on ramps, inasmuch as very little attention was drawn to the "exit" signs when those were changed to blue background. What is also surprising is the extremely small reference to white color, however, Table XIII did show only minute reference to edgemarking in Phases I and II.

The extent that blue was mentioned increased successively, with frequency of use and at night. The marked increase in blue being mentioned at night by both the frequent and not so frequent user would indicate that the blue edgemarking shows up more pronounced at night than in day. In addition, the increased exposure to the color scheme brought an increased awareness of the blue involvement. By and large, all the other categories were reduced when the increased attention was drawn to blue.

The green color was mentioned about nine percent in Phase I, and successively by each phase lost attention to blue as the percentage dropped to approximately one for both day and night.

On the basis of the categories mentioned in Table III, it is not surprising that "Destination Name", "Location" and "Appearance" were often mentioned as these relate to the fact that the item was there, so it drew some attention. Again, these percentages

were reduced as the attention went to blue. The mention of the arrow was apparently linked in most cases to the Destination Ramp sign.

Some of the large variations encountered with Phase II and III data were due to the small samples occurring in some of the breakdowns.

When any response to Question 14 mentioned a color, the driver was then asked "What did the color mean to you?"

Of the Once a Year Or Less User:

Daytime Interviews: 30% mentioned Blue

Nighttime " : 47% " "

Expressed Correct Meaning of Blue - Day - 62%

-Night- 83%

More Than Once a Year User:

Daytime Interviews: 40% mentioned Blue

Nighttime " : 55% " "

Expressed Correct Meaning of Blue - Day - 76%

-Night- 83%

It would seem the more frequent user was more likely to mention the blue color and also was somewhat more familiar with the correct meaning of the blue, however, the nighttime stranger seemed to be as correct in knowing the proper meaning. The percentages mentioning blue were still significant as it was entirely voluntary that the driver mentioned any color.

The data from Question 15 which asked "Do you feel that this exit is adequately marked?" is presented below by phases.

	<u>Replied Yes</u>	<u>Replied No</u>
Phase I	93.06%	6.94%
Phase II	94.45%	5.55%
Phase III	96.01%	3.99%
Phase IV	96.75%	3.25%

It may be interpreted that for only seven percent to report on inadequacy in exit marking means little, however, it is also true that only a very small percentage of any group of drivers have an accident due to any number of causes, one of which certainly is confusion. In any case, significant reductions are present with each successive phase except Phase III to IV.*

The northern half of the project was identified by three signs as a section of experimental color markings, viz: Blue = Exit and Yellow = Entrance. Nothing in our data showed any difference in knowledge of the scheme by having this portion signed. This is perhaps due to the fact a high percentage of the route users are very frequent users and as such rather familiar with the whole area.

*Note - Used 2 x 2 Chi-Square Test.

LIBRARY
michigan department of
state highways
LANSING

ENTRANCE DISTRIBUTION GROUPS

These groups are displayed in Table XV; overall by frequency of use and by individual access points. The table shows that nearly 70 percent of the exiting vehicles in the study area entered at point "OB". Approximately half of those entering at "OB" were also very frequent users of US-23 and likely very familiar with the route. The balance of the entry points were rather uniformly divided except a little larger percentage (5.1) entered from I-96 Freeway. Of course, this entry group was only interviewed at six locations north of this entrance.

The replies to the question of entrance markings adequacy changed very little as the phase percents show:

Percentage Who Replied "No"

Phase I	7.5
Phase II	6.3
Phase III	7.0
Phase IV	7.1

When the drivers were asked what markings they did notice we gained the following grouping from the replies:

MARKINGS NOTICED AT ENTRANCES BY PHASE

	<u>Delineators</u>	<u>Edge Marking</u>	<u>Signs</u>	<u>Other</u>
Phase I	.6%	1.7%	82.7%	14.9% = 100%
Phase II	.3%	2.1%	86.4%	11.1% = 100%
Phase III	.7%	2.4%	85.7%	11.2% = 100%
Phase IV	.9%	4.3%	83.4%	11.4% = 100%

TABLE XV

VEHICLE ENTRANCE DISTRIBUTION BY LOCATIONS

<u>Location</u>	<u>Number of Vehicles</u>	<u>Percentage</u>
OB	16461	69.9
1	704	3.0
2	101	.4
4	645	2.7
5	451	1.9
6	244	1.0
7	248	1.0
8	1199	5.1
9	421	1.8
10	86	.4
11	374	1.6
12	438	1.9
13	577	2.5
14	369	1.6
15	253	1.1
16	302	1.3
17	660	2.8

Vehicles Entering The Study Area By Frequency Of Use

	<u>Once/yr. or Less</u>	<u>2-3 Times per year</u>	<u>3-12 Times per year</u>	<u>12 or More Times per yr.</u>
Entering at "OB" (71.6%)	14.1%	4.2%	6.6%	46.7%
Entering at 2-17 (28.4%)	3.1%	1.1%	2.0%	22.2%

Some gain in noticing the color scheme may be evident in the percentage changes between Phases II and III for delineators and edgemarking, however, this seems to point up two other factors; (1) that signs provide most of the direction necessary for entering vehicles and (2) there seems to be minimal entrance problems connected with a rural facility of this type with the present volumes.

ACCIDENT DATA ANALYSIS

The accident data on the study section of US-23 covers one year before any color coding (July 21, 1964 thru July 20, 1965) and one year after the complete scheme was installed August 23, 1965 thru August 22, 1966.

All accidents included are those that occurred within the interchange area on the thru roadway plus any accidents on ramps or involving ramp terminals at the crossroad. Table XVI shows the Distribution of Accidents in the Color Study Area.

TABLE XVI

ACCIDENT DISTRIBUTION IN COLOR STUDY AREA

Location	BEFORE		AFTER		Comments on Types
	NBd. SBd.	NBd. Only	NBd. SBd.	NBd. Only	
Territorial Rd.*	<u>7</u>		<u>5</u>		2 at ramp terminals
Six-Mile Rd.	7	5	7	5	(AFTER) (NBd.) 1 at ramp terminal
Barker	0		0		
Eight-Mile Rd.	6	5	5	3	
M-36	4	2	4	1	(AFTER) 1 wrong-way
Silver Lake Rd.	4	4	2	2	(BEFORE) 1 backing when missed exit
Lee Rd.	1	1	9	3	(BEFORE) 1 out-of-control on exit (AFTER) 2 lost control on exit; 1 racing, 1 blowout
I-96	15	6	18	7	(BEFORE) 2 confused in direction (AFTER) 2 lost control exiting too fast, 1 struck in rear slowing at ramp
M-59	10	5	6	2	(BEFORE) 3 rear-ends at ramp terminal, 1 rt. angle at ramp terminal (AFTER) 1 rear-end & 1 rt. angle at ramp terminal
Clyde	1	1	2	2	(BEFORE) 1 on slippery bridge
Center	2	1	4	4	(BEFORE) 1 on slippery bridge
White Lake Rd.	2	1	3	1	
Owen Rd.	0		4	2	(AFTER) 1 entering accident
Silver Lake Rd.	4	2	17	7	(BEFORE) 2 accidents on icy bridge NBd. 2 Deck accidents on icy bridge SBd. (AFTER) 5 due to icy bridge NBd.; 4 due to icy bridge SBd.
Torrey Rd.	5	2	4	3	(AFTER) 1 rear-end & head-on in left turn at ramp terminal
Thompson Rd.	3	3	6	4	
Grand Blanc Rd.	4	3	4	2	(BEFORE) 1 missed exit & turned around, 1 rear-end at ramp terminal (AFTER) 1 right angle at ramp terminal
Hill Rd.	<u>4</u>	<u>2</u>	<u>6</u>	<u>4</u>	
Total	72		101		= 40% increase in all accidents
Total		43		52	= 21% increase in NBd. accidents
SBd.	29		SBd. 49		= 69% increase in SBd. accidents

*This interchange unchanged

CONCLUSIONS OF ACCIDENT REVIEW

It appears that quite a random distribution is present concerning the accident patterns. All of the usual accident involvements occurred, from going asleep to striking deer. The comments listed are those involved with ramps all in the northbound direction. In addition, the group of 13 icy bridge accidents are mentioned at the Silver Lake Road Overpass (which also crosses a railroad). This is an example of how a single factor can at times drastically change the accident picture at a location.

None of the accidents were positively relatable to changing the conditions by addition of the color coding. It is probable there was some beneficial effect of color coding accident-wise, inasmuch as, while the northbound accidents increased 21 percent, southbound accidents increased 69 percent (where no changes were made) and the before to after total group increased by 40 percent.

LIBRARY
michigan department of
state highways
LANSING

US-23 THRU TRAFFIC INTERVIEW STUDY

INTRODUCTION

The "thru traffic" study phase was conducted in the summer of 1966 to determine the degree that drivers noticed the presence of the color coded interchanges, and whether, if they did notice the scheme, did they understand the intent of the application.

Drivers were interviewed on the thru roadway near the north end of the Color Study Area such that all entering drivers would have had maximum exposure while passing the various interchanges.

PROCEDURE

After the driver was directed into the interview lane, he was informed that the Michigan Department of State Highways was performing a traffic survey, and asked if he would mind answering a few questions. The interviewer then filled out Items 1 through 9 on the interview sheet. See Figure 5.

Up to this time, no questions were asked of the driver. The interviewer was instructed to record only the drivers' answers with no prompting.

**US-23 COLOR INTERVIEW SHEET
THRU STUDY**

Form 1508A

1. INTERVIEW NO. 4. DATE

2. RECORDER (assigned letter) 5. HOUR (service time)

3. LOCATION (number from map) 6. LIGHT CONDITION (D or N)

7. LICENSE - Michigan use first two letters & numbers
Out-of-state first two letters state name

8. AGE 1. 25 & under 2. 25-40 3. 40-55 4. 55 & over (estimate)

9. SEX (M or F)

10. HOW OFTEN DO YOU TRAVEL THIS ROUTE?

1. Once a year or less 3. 3 to 12 times a year
2. 2 or 3 times a year 4. Once a month or more

24

11. WHERE DID YOU ENTER US-23?

Use number of interchange on map. Use OB for beginning of area.

25

12. DO YOU FEEL THAT ENTRANCE WAS ADEQUATELY MARKED?

(Y or N) 27

If answer is no, what would you suggest to improve the marking of this entrance? _____

13. WHAT DID YOU NOTICE WHILE DRIVING ON THIS ROUTE?

(a) Delineators

Item	Color
28 <input type="text"/>	29 <input type="text"/>

(b) Edge marking

30 <input type="text"/>	31 <input type="text"/>
-------------------------	-------------------------

(c) Signing

32 <input type="text"/>	33 <input type="text"/>
-------------------------	-------------------------

1. Exit arrow sign 3. Destination sign advanced

2. Destination ramp sign 4. Route marker

(d) Color coding information sign

Y if mentioned 34

(e) Geometrics

35

1. Ramp design 2. Interchange area

(f) Other

Y if mentioned 36

Coding for colors

1. White
2. Yellow
3. Blue
4. Green
5. Red

What did this color mean to you? _____

Figure 5

DATA ANALYSIS

MAJOR CATEGORIES OF RESPONSE BY

Once-a-Year or Less Users and More than Once-a-Year Users

I. For the once-a-year or less highway user: 249 or 52% referred to a color.

A. Delineators and Edgemarking Items

*Blue was mentioned 234 times (64%)

41 stated they liked the blue

3 stated they objected to the blue

190 stated no opinion

191 associated the blue with the exit (82% of those mentioning blue).

*Yellow was mentioned 70 times (19%)

14 stated they liked the yellow

2 stated they objected to the yellow

54 stated no opinion

25 associated the yellow with entrance (42% of those mentioning yellow).

B. Signing Group Items (a)

*Blue signing was mentioned 60 times (17%)

7 stated they liked the blue

0 stated they objected to the blue

53 stated no opinion

42 associated blue with the exit (70% of those mentioning the blue).

(a) Includes gore sign, ramp and advance destination signs and route markers.

*Note If a person mentioned more than one item, it was recorded, if he mentioned more than one color for the same item, it was considered as one item.

II. For the more than once-a-year highway user: 191 or 42% referred to a color.

A. Delineators and Edgemarking Items

Blue was mentioned 211 times (59%)

42 stated they liked the blue

5 stated they objected to the blue

164 stated no opinion

161 associated the blue to the exit (76% of those mentioning blue)

Yellow was mentioned 99 times (28%)

21 stated they liked the yellow

0 objected to the yellow

68 stated no opinion

74 associated the yellow with entrance (75% of those mentioning yellow).

B. Signing Group Items

Blue signs were mentioned 46 times (13%)

5 stated they liked the blue

1 stated he objected to the blue

40 stated no opinion

29 associated blue with the exit (63% of those mentioning blue).

In terms of items noticed, the delineators and edgemarking scheme was noticed much more than any of the signing group. From the Exit Interview Studies, it would seem here that the recognition was primarily of the edgemarking rather than the delineators as the driver did not seem to recognize them per se. As might be expected the infrequent user became much more familiar with the blue exit theme than the yellow entrance color, because in passing interchanges the entrance markings are not particularly

obvious, and extensive changes were not made in the entrance scheme. These once-a-year or less users come mainly from the beginning of the section or at Interchange #8, and only those entering at #8 would have passed a full entrance theme. This group seems to have readily understood the blue exit theme (82 percent).

The items mentioned by the more familiar group were more numerous but the percentages were rather close to the unfamiliar group. This group did associate the yellow to the entrance theme much more than the unfamiliar, as one would expect.

The degree that the non-exiting driver observed and commented on the color scheme indicates it may, in fact, be of some assistance to this driver by better identifying the exit areas, such that he can more easily stay on the thru path.

CONCLUSIONS OF COLOR CODING APPLICATION

The Pilot Study on US-27 which was the forerunner of this extensive review of a color coding application definitely showed a benefit by reducing erratic driver movements at two left hand exits, apparently a result of reduced driver confusion.

The erratic study movements on US-23 have shown that reductions in driver confusion can be reduced also at more conventional exits as was evidenced previously at left hand types. Reductions in erratic movements were larger at other than diamond ramps. That is to say the more intricate interchanges were aided more than a simple diamond type. The studies also showed that the color scheme was equally effective in the daytime as at night.

Edgemarkings as an item were noticed very little before they were changed to blue at the various exits.

The major item that drivers notice at exits is the destination sign and this sign is used more by the less familiar driver. The change of these signs to blue was noticed more at night than in daytime, apparently the edgemarking part of the scheme stands out more forcibly at night.

The application scheme seemed to be readily understood as even 67 percent of the once a year or less users knew its correct meaning in daytime and 83 percent of the nighttime group understood it.

It is further evident that the major area of guidance need appears to be at exits and that the entrance areas pose little problem. This is based on information received from the interviews wherein nearly 70 percent of the group were "local" drivers rather familiar with the route. Erratic studies or other specific studies were not made at entrances however. The placement of the entrance edgemarking scheme in yellow edgemarking and painted posts resulted in very little notice of these changes from the surveys.

The accident studies from one year before to one year after seemed inconclusive, as they were not directly relatable to the color application. This stems in part, however, from insufficient information on the accident reporting forms. The fact remains that the increase in accidents in the color coded

direction was only one-third as large as in the unchanged direction which was marked by current standards.

The thru traffic study bears out the fact that this scheme was readily understood (about 80 percent) by those who noticed the color scheme even though they were just passing through the area.

The applications of a color scheme to these 18 interchanges over the 40-mile section has produced some beneficial results and, as before, seems to be readily identifiable to the motorist. Dozens of users have in fact testified in correspondence to the Department that they feel the color code approach is logical and beneficial to them and they would like to see the scheme extended statewide.

DISCUSSION AND RECOMMENDATIONS

In 1970 the National Joint Committee on Uniform Traffic Control Devices has recommended certain new applications of color to markings and signs, none of which have apparently been placed or adequately studied. With benefits imminent by making the drivers' task easier through color coding it is logical to investigate the proposed schemes further, at least toward determining that any changes made would be a betterment.

One element of the color scheme as used was expensive to place, namely the reflective granules as used in the blue edgemarking. If corresponding benefits can be derived from applications of more economically available materials, then a change from

some of the present standards becomes far more feasible.

The proposed further review of color coding applications planned for fiscal 1969 and 1970 seems a very reasonable extension in the investigation of the parameters of driver guidance toward simplifying the driving task and thereby contributing to overall route safety. We heartily concur with the Joint Committee's approach toward a modification of existing standards, as it seems highly improbable that the best approach to identifying exits and entrances should entail identical color marking schemes.

APPENDIX A

EXIT INTERVIEW PROCEDURE

The driver interview study sites were located at freeway off ramps and located as near as possible to existing stop signs where the driver was normally required to stop. Some advanced signing was used and placed in a position to be easily seen by a user of the ramp but not seen by the driver on the thru roadway. This was done both for the safety of the interviewers and the motoring public. During the nighttime interview, auxiliary internally illuminated stop signs and portable lighting plants were used. The hours of interviewing were from 7:00 a.m. to 7:00 p.m. for daylight interviews and from 9:00 p.m. to 1:00 a.m. for nighttime interviews: this totaled 16 hours at each location.

As the driver approached the interviewer, items one through nine in the following list were compiled on the interviewer's questionnaire Figure 4.

Item 1: Interview No.	Consecutively numbered forms
Item 2: Recorder	Identify number or letter assigned to all personnel
Item 3: Location	Number or letter assigned to the location the interview was taken
Item 4: Date	
Item 5: Hour	In service time
Item 6: Light Condition	Day or night
Item 7: License	Michigan license - first two letters and numbers Out-of-State the first two letters only
Item 8: Age	An estimate by the interviewer - this question was not asked the driver
Item 9: Sex	

The driver was then informed that the Department of State Highways was conducting a traffic survey, and the interviewer's first question was Item 10 as presented below.

Item 10: Question 1 How often do you use this exit?

This was recorded in four pre-determined categories.

Item 11: Question 2 Did you have any difficulty in finding this exit? The interviewer recorded either yes or no. If the answer was yes, the interviewer asked, what was the difficulty? He then recorded the answer given by the driver.

Item 12: Question 3 What first told you that you were approaching your exit? The interviewer was instructed to record the driver's first answers in one of the nine listed categories.

Item 13: Question 4 What told you that you were at your exit? The interviewer was instructed to record the driver's answer in the proper listed category - what the driver saw that told him that he should leave the freeway here.

Item 14: Question 5 What drew your attention (to the above mentioned item)? The interviewer would insert the answer given in Item 13, Question 4 such as, what drew your attention to the exit arrow sign? If without any prompting on the interviewer's part the driver voluntarily mentioned a color, he was then asked, what did this color mean to you?

Item 15: Question 6 Do you feel that this exit is adequately marked? The interviewer would record yes or no. If the answer was no, the driver would then be asked, what would you suggest to improve the marking of this exit?

Item 16: Question 7 Where did you enter U.S. 23? The interviewer would record the number of the interchange from a provided map if the driver entered the freeway within the color scheme area and proceed to ask Items 17 & 18 or Questions

8 or 9. If the driver didn't enter within the color scheme area, the interviewer would skip Items 17 and 18 or Questions 8 and 9 and proceed to Item 19 or Question 10.

- Item 17: Question 8 Do you feel that the entrance was adequately marked? The interviewer would record yes or no. If the answer was no, the driver would then be asked, what would you suggest to improve the marking of this entrance?
- Item 18: Question 9 What markings did you notice? The interviewer would record the drivers answer in the proper categories.
- Item 19: Question 10 Have you been interviewed at this location before? If the driver at anytime during the interview stated that he had been interviewed that same day, the interviewer would thank him and record yes to this question and no further questions would be asked.

For the questions that provided an indication for more than one reply it was found the strongest factors and those meaningful for analysis was only the first response. Hence, the analysis procedure on these questions considered only the first answer.

APPENDIX B

THRU TRAFFIC INTERVIEW PROCEDURE

The interviewer filled out items one through nine on the form prior to asking any questions of the driver.

- Item 1: Interview No. (Consecutive numbered forms)
- Item 2: Recorder (Identifying number on letter assigned)
- Item 3: Location (Number on letter assigned to the location in this case #18)
- Item 4: Date
- Item 5: Hour (In service time)
- Item 6: Light condition (day or night)
- Item 7: License (Michigan license, first 2 letters and numbers; out-of-state, the first two letters only)
- Item 8: Age (An estimate by the interviewer; this question was not asked the driver)
- Item 9: Sex

All interviewers began the interview with this question:

- Item 10: Question 1. How often do you travel this route?
One of four frequency of use categories was checked.
- Item 11: Question 2. Where did you enter US-23?
Interchange number code was recorded.
- Item 12: Question 3. Do you feel that the entrance was adequately marked?
Yes or no. If no is stated, then they are asked Question 4.
What would you suggest to improve the marking of the entrance?

Item 13: Question 5. What did you notice while driving on this route?

If one of six categories was mentioned, this was indicated on the form, also, if a color was mentioned. When a color was mentioned, the driver was asked "What did this color mean to you?"

End of Interview.

The amount of personnel required to operate this interview station was 11 men: 8 interviewers, 1 man to count traffic, 1 utility relief man and 1 supervisor.