Public Opinion Survey Methods as Related to Certain Phases of Traffic Engineering

JOHN E. BAERWALD
Research Engineer, Joint Highway Research Project
Purdue University

Public opinion has always had a dynamic effect upon the social, economic, and political trends. It influences the conduct of leaders, office holders, engineers, writers, inventors, and others. Thus, it can serve effectively as a means of evaluating policies and practices if proper survey techniques are applied to the problems under consideration.

Only within recent years have attempts been made to actually measure and evaluate the effect of public opinion. The results thus far obtained were accomplished by obtaining statistically controlled samples in a wide variety of opinion and attitude studies in several types of endeavor.

By determination of the attitudes of the public toward existing conditions, important trends can be determined. The 1950 United States Census is an excellent example of the use of this controlled sampling technique.

Predictions of future events and trends form the second major use of opinion survey techniques. The mistakes made in forecasting the 1948 general election seem to have been remedied. Accurate predictions of election results in New York, Canada, Australia, and England have since been made in which the average error has been held to about one per cent of the final election returns (1).

The third major type of opinion and attitude studies include surveys directed toward finding new applications for existing opinion sampling methods; improving upon known techniques; and developing new survey methods (2). The study reported in this paper is of this type. The main objective was to investigate the practicality of applying public opinion sampling procedures to solving certain problems in traffic engineering. In order to do this, the following three general steps were necessary:

1. Design an effective, understandable, and efficient survey questionnaire.

2. Study various means of obtaining public cooperation in answering the survey questionnaire.
3. Determine the type and degree of analysis required to properly evaluate the data obtained in the survey.

"Open" and "closed" type questions were considered for use in the survey form. The open type is designed to give the respondent complete freedom in answering the question. The closed type limits the respondent to choosing one or more of several given plausible responses which, in his opinion, best answers the question. Closed type questions were mainly used in the survey questionnaire. This facilitated answering by the respondents and made possible more rapid tabulation of the results.

The main interest of this study concerns a method of obtaining traffic engineering data and as a result the questions were chosen to cover those phases of traffic engineering which would be most familiar to the respondent without requiring excessive deliberation or experience.

Three different methods of obtaining public cooperation were used in this study:

1. Employees of commercial service establishments, such as roadside restaurants and tourist courts, were asked to present the survey questionnaire form to the drivers they served.
2. Interviewers presented the questionnaire to the drivers.
3. Survey forms were mailed to various groups for distribution to their drivers.

Thus, it was possible to observe the effect of each method upon completeness of return and driver cooperation.

The completed questionnaire forms were tabulated by means of IBM mark sensing cards and summaries of replies to certain of the questions are discussed later in the report.

PREVIOUS INVESTIGATIONS

Opinion surveys have been used in recent years to determine public interest in certain phases of traffic engineering. Included among these is a study entitled, *The Public's Attitudes on Traffic Safety*. This survey was conducted in 1945 by the Opinion Research Corporation for the National Committee for Traffic Safety and dealt mainly with questions concerning traffic safety, enforcement, and education (3).

The American Institute of Public Opinion occasionally conducts surveys in the field of highway traffic which are reported in a syndicated newspaper column. A recent study contained questions pertaining to periodic physical examinations for motor-vehicle operators, ease in obtaining driver's licenses, and the maximum speed limit for automobiles on an "open-country" highway (4).

The types and amounts of highway mileage driven by various classes of motor-vehicle operators were studied by Iowa State College investigators. Questions concerning the driver's average speed and yearly mileage under day and night conditions were included in the survey. In addition, the respondents were asked to list, "Ten suggestions on how to improve automobile driving and reduce highway accidents."

A survey conducted by the Missouri State Highway Commission used a different sampling technique. In order to obtain driver opinion on the "quarter-point" type of no-passing-line location, which the state had just adopted, prepaid return-address post cards were used to poll the drivers of that state. In this method, the drivers were asked to answer the printed questions and then place the post card in the mail. Over 25 per cent of the 12,000 questionnaire post cards distributed were returned. A majority of the respondents favored the new quarter-point-no-passing line and a yellow color for this line (5).

The prepaid, return-address post card method as well as personal interviews have been used to augment certain Origin-Destination Surveys and Cordon Counts made in conjunction with urban-traffic-planning studies (6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16).

The personal interview technique has been used by the Virginia Traffic and Planning Division to obtain out-of-state driver's opinions of Virginia (17).

In the study reported in this paper, three experimental questionnaires were distributed in the summer of 1949 to facilitate formation of the survey questionnaire form. These experimental forms made it possible to:

1. Improve the various questions from the standpoint of clarity and phrasing.
2. Test the method of obtaining data by having the operators of certain roadside businesses give questionnaires to their patrons.

3. Observe the reactions of the motor-vehicle operators to being polled on their highway-traffic opinions while they were enroute.

DISTRIBUTION OF TRIAL QUESTIONNAIRES

The first questionnaires were distributed in the vicinity of Lafayette, Indiana. In order to obtain cooperation of as many non-local drivers as possible, four rural-truck-stops (combination gasoline station and restaurant sites) and three tourist courts were chosen as distribution points, because they had a large through-traveling clientele. The project was explained to the operator of each of these establishments. After the operator signified he was willing to cooperate, he was given some trial questionnaires with instructions for their proper completion.

Approximately one week later each of the sampling sites was checked. All of the survey forms were completed at two of the truck-stops. About 50 per cent of the forms were completed at a third truck-stop. None of the questionnaires were answered at the fourth truck-stop and at the three tourist courts.

It was interesting to observe the proprietors' comments on the driving public's reaction to the trial questionnaires. While good cooperation was reported by three of the truck-stops, the patrons of the tourist courts were quoted as saying that they did not have time to answer the questions or that their opinions were not of sufficient interest to warrant the completing of a survey form. It was also clearly evident that the truck-stop establishment with unanswered forms had made no real effort to distribute the questionnaires.

An adequate number of completed forms were obtained to validate the questions. Thus some questions were eliminated or modified and others were left unchanged.

The second trial questionnaires were placed in five Lafayette-area locations. They included the three truck-stops which proved successful on the first trial and two tourist courts. Forms were also placed in four truck-stops in northern Indiana for periods of 16 to 48 hours.

When the forms were collected from the Lafayette stations, only a small number had been answered. This was probably caused by the lack of cooperation of the sampling-site employees in distributing the survey forms to their patrons. Many drivers were reluctant or refused to fill out a second trial form because it was

similar to the previous one that they had answered. Better results were obtained from three of the four northern Indiana stations where 250 forms had been distributed. Over half of the forms were completed. The third modification of the questionnaire received a limited distribution in the Lafayette area and in southwestern Indiana.

It became evident in these three trial distributions that when the operator and employees of the roadside distributing sites cooperated, the driving public was also willing to cooperate. Over half of the respondents took the time to write a note of appreciation on the questionnaire for having had the opportunity to express opinions on certain highway-traffic problems.

DISTRIBUTION AT THE 1949 INDIANA STATE FAIR

The questionnaire actually used in the investigation was designed after careful study of the completed returns of each of the three trial forms.

The 1949 Indiana State Fair, held in Indianapolis from September 1 to 9, provided an excellent opportunity for obtaining a large sample of public opinion on traffic matters in a short time. Interviewing tables were placed in the Purdue University Educational Building and in the Indiana State Highway Commission Exhibit in the Industrial Building.

A 16 by 24 inch sign, shown in Figure 1, was the only publicity used to obtain public cooperation. The sign was placed over the interviewing station in the Purdue Education Building.

Public interest was aroused by the sign and by such interviewer queries as: "Do you drive a car, sir?" or "How about you, Ma'am? If you drive we would like to have your opinion also." After the prospective respondents were convinced that it was not a test and that it was not necessary to sign their names, they generally were willing to fill out a copy of the questionnaire.

Of the 3,000 forms distributed at the two stations, 2,653 or 88 per cent were answered and returned. Of those returned, 2,250 were filled out in the Purdue Education Building and 403 at the State Highway Exhibit. These replies constituted about 90 per cent and 81 per cent, respectively, of the forms distributed at the two stations. The larger number was obtained at the Purdue Building station where the exhibits were more educational than commercial and more room was available for answering questionnaires.

Fig. 1. Sign used for interviewing station in Purdue Building at 1949 Indiana State Fair.

DISTRIBUTION OF MOTOR VEHICLE SUPERVISOR'S TRAINING COURSE

Through the courtesy of the Purdue Public Safety Institute, it was possible to solicit the cooperation of the representatives of trucking companies attending the annual motor vehicle fleet supervisors training course held in Indianapolis, Indiana, September 12 to 16, 1949. A total of 1,746 questionnaires was given to 32 of the representatives for distribution among their drivers. Completed survey forms were returned by 209, and 329 additional forms were reportedly answered and mailed but were presumably lost in the mail. The fleet supervisors also reported that they had lost or misplaced 288 questionnaires. Thus there is an accounting for 47 per cent of the distributed forms.

Seventeen companies were asked to cooperate in the distribution of questionnaires to their salesmen in order to obtain a better cross-section of the motor vehicle drivers who use the Indiana highways for business purposes. Eight companies agreed to cooperate, one was unable to do so and the remaining eight firms did not acknowledge the request. Nearly 59 per cent (252 out of 428) of the questionnaires were answered.

With the cooperation of the Purdue University Agricultural Extension Service, it was possible to obtain the opinions of those who do considerable driving on all types of Indiana's rural roads. Two hundred and ten copies of the survey questionnaire were sent out to county agricultural agents and to home economics demonstrators. A total of 144 forms (69 per cent) were returned by the group.

Copies of the survey questionnaire were sent to members of the Highway Research Board Committee on Roadway Pavement Markings. They were asked to comment on the technique employed and many pertinent comments were received. The members were also asked if they would be able to distribute copies of the questionnaire in their respective states. Committee members from Iowa and Michigan were able to do so. Of the 200 forms distributed in Iowa, 135 were answered and 76 of the 100 questionnaires sent to Michigan were completed.

The number and classification of the 3,683 motor vehicle operators interviewed in this survey will be found in Table I.

The Joint Highway Research Project is continuing its investigation in this field. A revised form has been developed which may eliminate certain shortcomings of the questionnaire used in this study.

SURVEY RESULTS

Public interest and cooperation were of prime importance because the survey was conducted to investigate the possibility of applying public opinion survey methods to certain phases of traffic engineering. Except for a few cases in the trial samplings, it became apparent that the motor vehicle operators welcomed a chance to express an opinion on certain phases of highway traffic. Each respondent was asked to comment on the questionnaire technique employed in obtaining this information. The results for this and certain other survey questions may be found in the following paragraphs. The italicized questions are as they appeared in the questionnaire.

What do you think of this method of obtaining public opinion in regard to traffic conditions? Have you any suggestions to assist us in obtaining this information?

The actual survey confirmed the preliminary observation that the motor vehicle operators appreciated having the opportunity to express their opinions on certain highway traffic problems. A record

TABLE I

Distribution of Respondents

Classification	No. of Respondents	Classification	No. of Respondents
Total	3,683	AGE IN YEARS	
STATE		15-19	196
Indiana	3,133	20-24	537
Non-Indiana	550	25-29	718
SEX		30-34	576
Male	2,967	35-39	422
Female	716	40-44	437
OCCUPATION		45-49	293
Salesman[a]	426	50-54	194
Truckdriver[a]	441	55-59	127
Professional Person[a]	456	Over 60	97
Other[a]	736	No age given	86
Total Professional Drivers	2,059	YEARS DRIVING	
Farmer[b]	432	1 or less	102
Businessman[b]	107	2-3	164
Businesswoman[b]	39	4-5	223
Worker who drives to work[b]	276	6-7	271
Housewife[b]	333	8-10	484
Pleasure Driver[b]	425	11-15	668
Other[b]	12	16-20	505
Total Non-Professional Drivers	1,624	Over 20	1,202
		No experience given	64

[a] These subgroups tabulated as one group entitled Professional Drivers.

[b] These subgroups tabulated as one group entitled Non-Professional Drivers.

was kept of the type and number of comments written on the questionnaires. For ease in tabulating, the comments were divided into four main classes:

1. One or two word comments of a favorable nature.
2. Favorable comments of more than two words. Many of these were of several sentences in length.
3. Unfavorable comments.

4. Comments of such a nature that they were neither favorable nor unfavorable but made suggestions as to possible ways of improving the questionnaire or other means of obtaining the desired information.

Forty-seven per cent of the 3,683 respondents made comments that were favorable to the survey method, while only one per cent were of an unfavorable nature. One per cent of the respondents made comments having no marked preference, and the remaining 51 per cent failed to comment on the survey.

Nearly one half of the favorable comments were given in a few words such as O.K., Fine, Good idea, etc. The following statements are examples of more detailed favorable comments:

> An Indiana truck driver wrote, "I think it is a very good way to get uniform laws to keep down confusion when traveling from state to state."
>
> "O.K.," commented an Indiana housewife. She continued, "Method could have wider distribution through service clubs."
>
> "Good—give questionnaire with application for renewal [of] driver's license," was the comment of a Michigan salesman.
>
> "Excellent, but how about getting large motor fleets to question their drivers, and asking all people on receipt of their car license, to fill out [a] form," was the view expressed by an Indiana woman who drives for the Red Cross.

In Table 2, the per cent of each type of comment is shown for the several classifications—Indiana and Non-Indiana Drivers, Sex, Occupation, Age, and Years of Driving Experience.

TABLE II
Distribution of Respondent Comments

	Respondents	Favorable		Unfavorable	Other or None
		One Word	More Elaborate		
TOTAL	3,683	23%	24%	1%	52%
STATE					
Indiana	3,133	23	22	1	54
Non-Indiana	550	22	32	1	45
SEX					
Men	2,967	24	24	1	51
Women	716	19	22	1	58

	Respondents	Favorable		Unfavorable	Other or None
		One Word	More Elaborate		
OCCUPATION					
Salesman	426	24	31	*	45
Truckdriver	441	24	25	0	51
Professional Persons	456	27	25	1	47
Other	736	22	24	1	53
Total Professional Drivers	2,059	24	26	1	49
Farmer	432	26	14	1	59
Businessman	107	18	32	3	47
Businesswoman	39	23	28	0	49
Worker who drives to work	276	19	19	2	60
Housewife	333	18	19	*	63
Pleasure Driver	425	22	28	1	49
Other	12	42	25	8	25
Total Non-Professional Drivers	1,624	22	21	1	56
AGE					
15-19	196	23	31	3	43
20-24	537	21	26	3	50
25-29	718	21	26	4	52
30-34	576	20	25	2	53
35-39	422	27	23	1	49
40-44	437	27	20	*	53
45-49	293	23	20	0	57
50-54	194	27	22	1	50
55-59	127	26	18	1	55
Over 60	97	17	20	1	62
No age given	86	15	16	1	68
YEARS DRIVING					
1 or less	102	20	26	5	49
2-3	164	25	29	2	44
4-5	223	24	23	2	51
6-7	271	22	23	1	54
8-10	484	18	26	1	55
11-15	668	22	28	*	50
16-20	505	22	24	1	53
Over 20	1,202	26	20	1	53
No experience given	64	24	9	0	67

* Less than one-half per cent.

SOLID vs. DASHED CENTERLINE

Which type of centerline do you prefer on a concrete (or blacktop) surface? Solid, dashed, or dotted?

The survey results for this question and the following questions are worthy of attention because of the possible effect of the survey technique on the results and from a technical standpoint of driver opinion versus actual practice.

As of June, 1950, all but 8 of the 48 states used the dashed type of centerline marking as recommended by *The 1948 Manual on Uniform Traffic Control Devices* (18, 19). Indiana was one of the states which used a solid centerline marking and thus did not conform to the recommended practice but since that time dashed centerlines are being utilized in the state.

The survey results indicated that 87 per cent of the Indiana and 80 per cent of the non-Indiana respondents favored a solid centerline marking on concrete surfaces as shown in Figure 2;

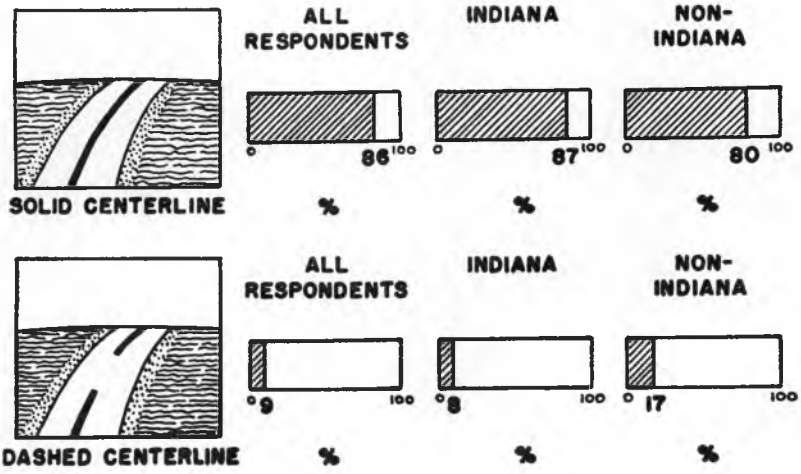


Fig. 2. Type of centerline marking preferred on a concrete surface.

while, as illustrated in Figure 3, 76 per cent of the Indiana and 66 per cent of the non-Indiana respondents favored a solid centerline marking on blacktop surfaces.

Proponents of the dashed line point out that approximately 60 per cent less paint is required for the dashed type of marking, as recommended in the manual (19, p. 18). It would be interesting to investigate the possible effect the knowledge of such a saving

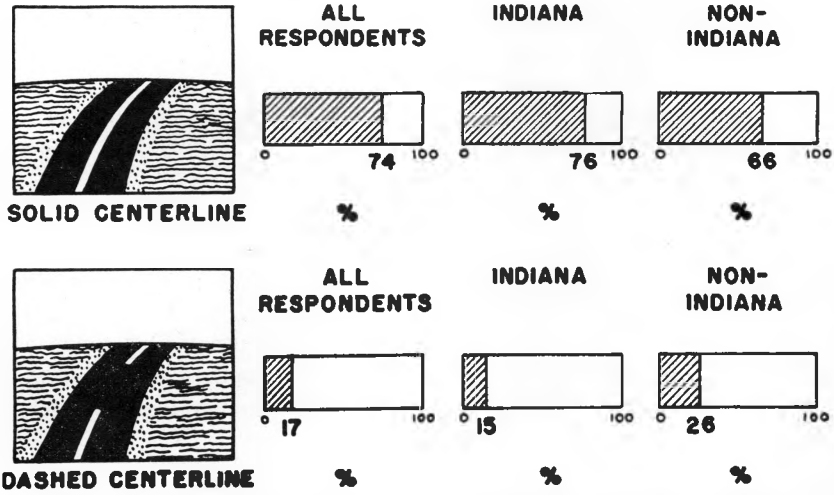


Fig. 3. Type of centerline marking preferred on a blacktop surface.

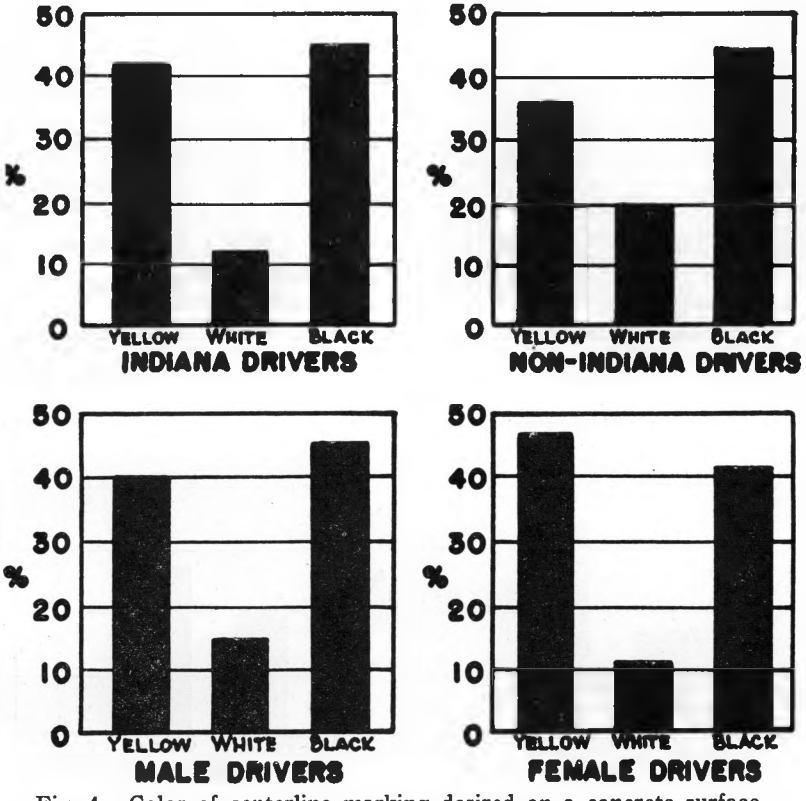


Fig. 4. Color of centerline marking desired on a concrete surface.

would have on the respondents' choice of solid or dashed types of centerline delineation.

CENTERLINE COLOR

What color of centerline do you prefer on a concrete (or a blacktop) surface? Yellow, white, or black?

Although the Uniform Manual recommends a white centerline for all states (*ibid.*, p. 77), the survey results show that 45 per cent of the respondents prefer a black centerline on a concrete surface, 41 per cent prefer yellow, and only 12 per cent desire the recommended white color. The present Indiana practice of using a black centerline on a concrete surface was favored by 45 per cent of the Indiana replies and 44 per cent of the non-Indiana drivers. See Figure 4.

Sixty-two per cent of all the respondents preferred the recommended white color for a blacktop surface while 34 per cent selected yellow and one per cent favored black. As indicated in Figure 5,

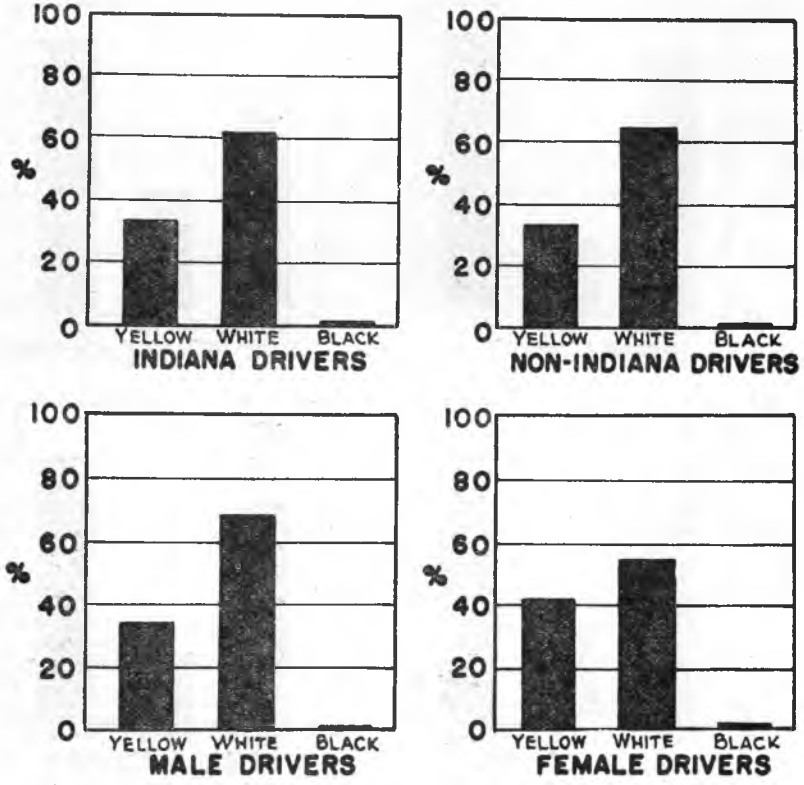


Fig. 5. Color of centerline marking desired on a blacktop surface.

more Indiana, non-Indiana, male, and female drivers preferred the white colored centerline on blacktop.

What color centerline do you consider most visible in bad weather on a concrete (or blacktop) surface? Yellow, white, or black?

Highway markings are designed and placed to aid and protect the highway user. Thus, visibility in all weather conditions is an important criterion for the selection of a color for roadway pavement markings.

Yellow was considered the most visible color for a concrete surface in bad weather by 48 per cent of the respondents. For the same conditions, 35 per cent thought black was the most visible, 15 per cent selected white, and two per cent gave no comment.

For a blacktop surface under bad weather conditions, 54 per cent of the respondents suggested white as the most visible color and 40 per cent suggested yellow.

Do you believe that a no-passing line should be the same color as the centerline? Yes or no?

Eighty-one per cent of the respondents thought that the no-passing line should be a different color than the centerline. This color differentiation is recommended by the 1948 Manual on Uniform Traffic Control Devices (*ibid.*, p. 82).

If you answered NO to the above question (color of centerline vs. color of no-passing line), what color do you suggest for the no-passing line? Black, yellow, white, or red?

Out of every 100 respondents who thought there should be a color distinction between the no-passing line and the centerline, 67 preferred a yellow colored no-passing line, 25 preferred red, seven chose white, and one thought black the best color. These groups constitute 54 per cent, 20 per cent, six per cent, and one per cent, respectively, of the total sample. A yellow color is recommended by the Uniform Manual, although white is given as a "permissible alternative" (*ibid.*). Figure 6 illustrates the preferences of several driver classifications on this question.

LOCATION OF TRAFFIC SIGNAL LIGHTS

What location do you prefer for traffic signal lights in the intersection shown? A and C, B and D, hanging overhead, E, in the center of the intersection, or A, B, C, and D? What location seems to be poorest?

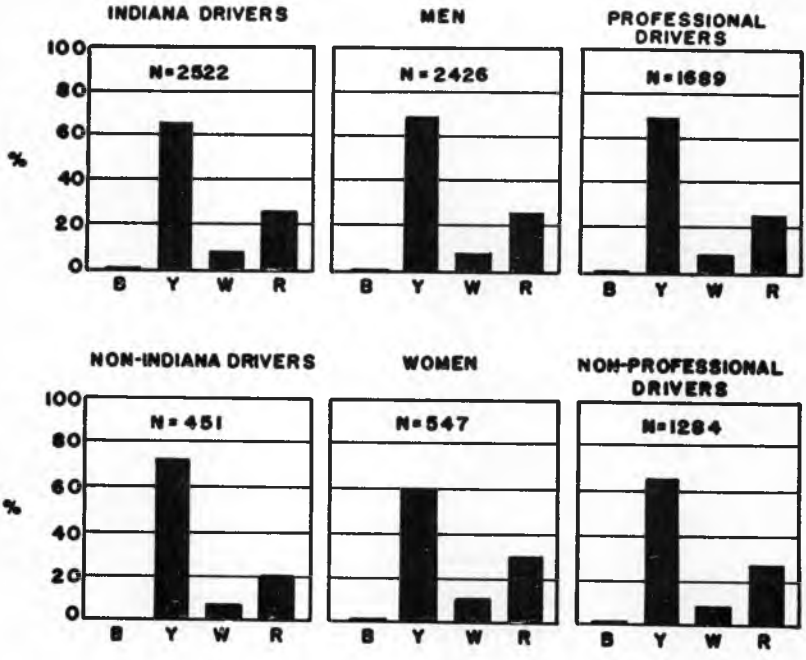


Fig. 6. Color preference for no passing barrier line.

One of the more controversial points in the standardization of traffic signal practice has been the matter of signal-face location at intersections. The advantages of far-side, near-side, mast arm, and center-suspended locations have been sufficient to induce the choice of all these locations for various types of the far right corner location. When asked in a recent poll to express their preference as to signal location, a group of 36 outstanding traffic engineers could not develop a majority for their first choice for either rural or urban intersections, although the greatest number of votes was cast for the center-suspended loca-

tion in rural areas and for the far-right—far-left location in urban areas (*ibid.*, p. 111).

The respondents, like the traffic engineers mentioned above, were divided in their choice of the preferred location for traffic signal lights in a regular four-way intersection. It may be observed in Figure 7 how the favored location differed among the various groups of drivers.

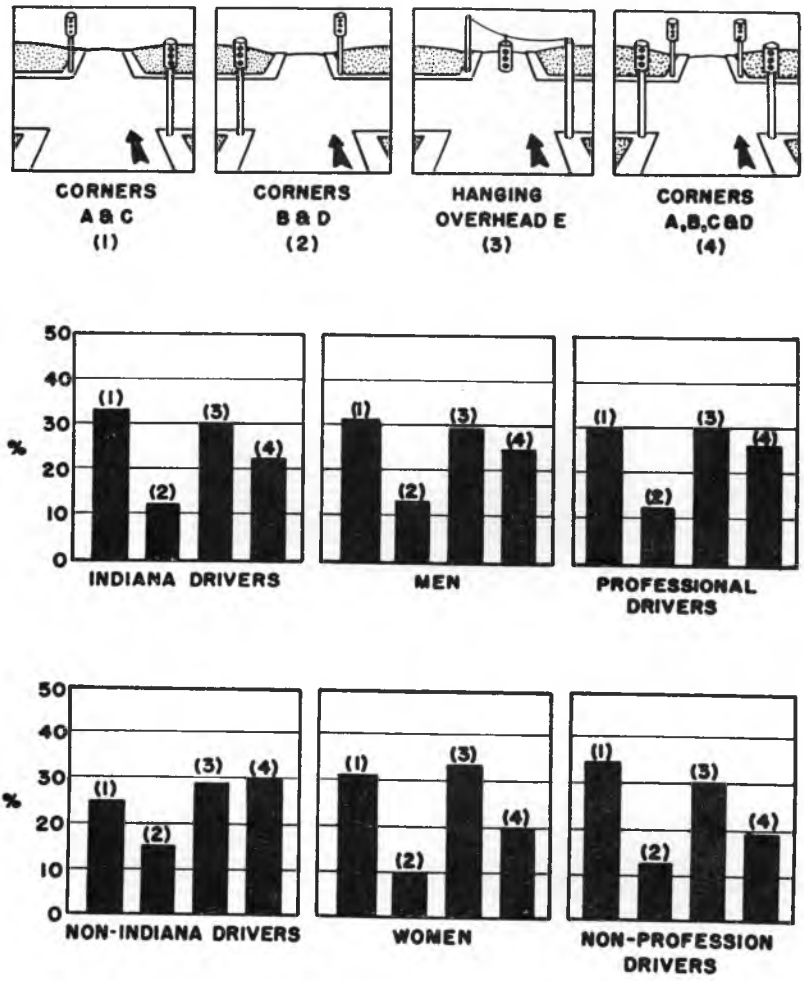


Fig. 7. Preferred locations of traffic signal lights.

Forty-nine per cent of the respondents thought that the overhead signal in the center of the intersection was the "poorest" location.

Because it appeared in this study that the answers varied between rural and urban intersections, the revised survey form contains questions pertaining to both localities. The questions are now arranged so that the respondent may select any combination of possible locations as desirable or least desirable.

MAXIMUM SPEED LIMIT

Do you believe there should be a maximum legal speed limit in Indiana (or in your state)? Yes or no?

Early in 1950 the Indiana State Police asked all the other states of the nation what speed regulations they then had in effect. The replies received from the various states revealed that, as of May 1, 1950, Indiana was one of 12 states without a maximum speed law for passenger cars on rural highways. The remaining 36 states have some type of maximum speed law (20).

The Indiana State Police have recommended that the 1951 General Assembly enact a state speed limit of 60 miles per hour for daytime and a maximum of 50 miles per hour at night. Samuel C. Hadden, Chairman of the Indiana State Highway Commission, endorsed the recommendation and said that if the proposed speed limits were rigidly enforced, traffic deaths would be reduce (21, 22, 23, and 24).

Sixty-eight per cent of all the respondents favored the establishment of a maximum speed limit. A similar number of Indiana drivers and 67 per cent of the non-Indiana replies also answered in the affirmative.

It should be noted that for the special out-of-state distributions (40 per cent of the total non-Indiana respondents), the phrase "your state" was substituted for the word "Indiana" in the question. No separate analysis was made on the basis of question phrasing. The phrase "your state" is used in the revised questionnaire.

If you believe there should be a speed limit, what do you suggest as a maximum legal speed limit for passenger cars in daylight? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

A speed limit of 60 miles per hour was suggested by 47 per cent of the respondents who indicated a maximum speed for passenger cars in daylight. (These drivers constituted 28 per cent of the total sample.) Only 17 per cent of the drivers favoring speed controls (11 per cent of the total sample) preferred a limit of 65 miles per hour, while a maximum of 50 miles per hour was selected

by 15 per cent of these respondents (10 per cent of the total). As shown in Figure 8, the greatest number in each of the several classifications of replies favored the 60 miles per hour limit. This limit is higher than the limit most favored in two other recent surveys.

In a survey conducted in 1945, on a nationwide basis, 3,659 respondents were asked the question, "If you were asked to set one

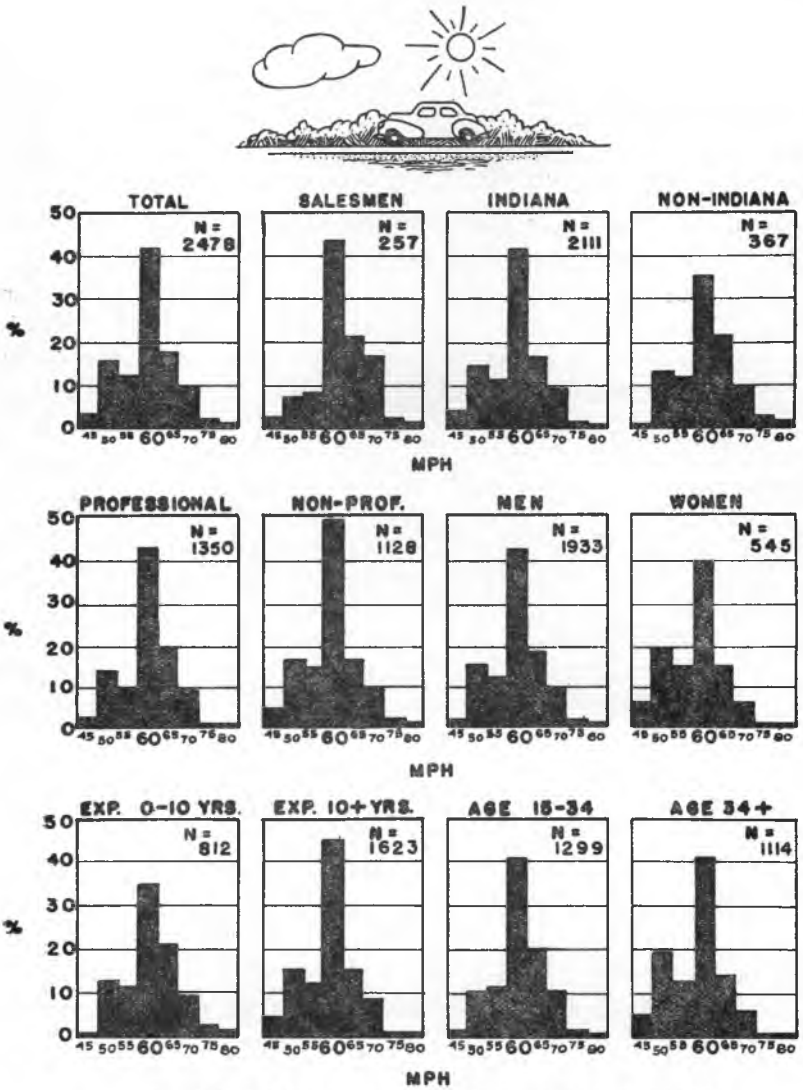


Fig. 8. Suggested maximum speed limit for passenger cars in daylight.

top speed for driving on a good open highway in this state, what would it be?" The following results were obtained:

"A third of the people (33 per cent) would set speed limit no higher than *45 miles an hour.*

"A total of two-thirds would set the maximum at *50 miles an hour* or under.

"Only 6 per cent of the people favor a speed limit about 60 miles an hour."

A median average speed of 48 MPH was suggested by the respondents (3).

Another nationwide survey was conducted early in 1950. "What do you, yourself, think the maximum (top) speed should be for automobiles on an open-country highway?" was the question asked. The results obtained indicated that:

The median average figure named was 50 miles per hour. Car owners as a group tended to favor a somewhat higher speed. About four out of ten owners suggested limits in excess of 50 miles per hour (4).

Here is the table:

	Total	Car Owners
Less than 35 m.p.h.	3%	2%
35-49 m.p.h.	24	20
50 m.p.h.	35	36
51-65 m.p.h.	28	33
Over 65	6	6
Don't know	4	3
	100%	100%

If you believe there should be a speed limit, what do you suggest as a maximum legal speed limit for passenger cars at night? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

The Indiana State Police recommendations appear to be further substantiated by this survey. A speed limit of 50 miles per hour for passenger cars was suggested by 41 per cent of those indicating a maximum speed for night driving (27 per cent of all respondents). The bar graphs in Figure 9 indicate the distribution for the various classes of drivers.

If you believe there should be a speed limit, what do you suggest as a maximum legal speed limit for trucks in daylight? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

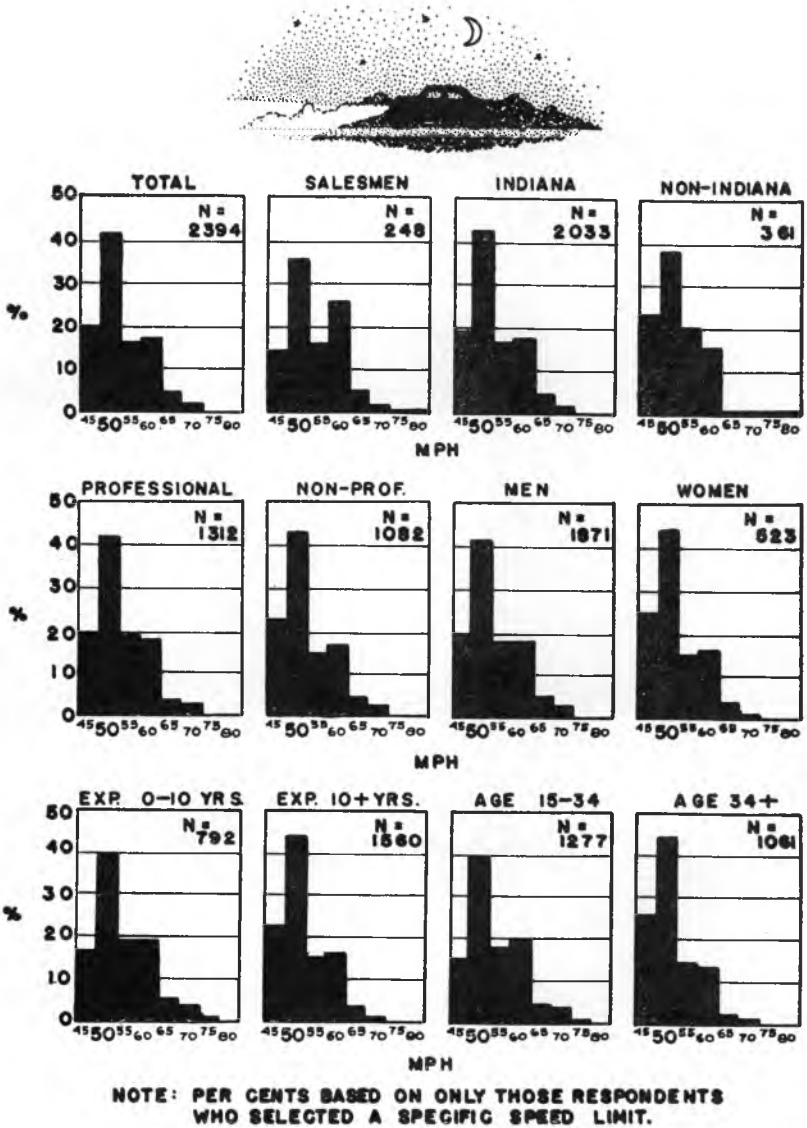
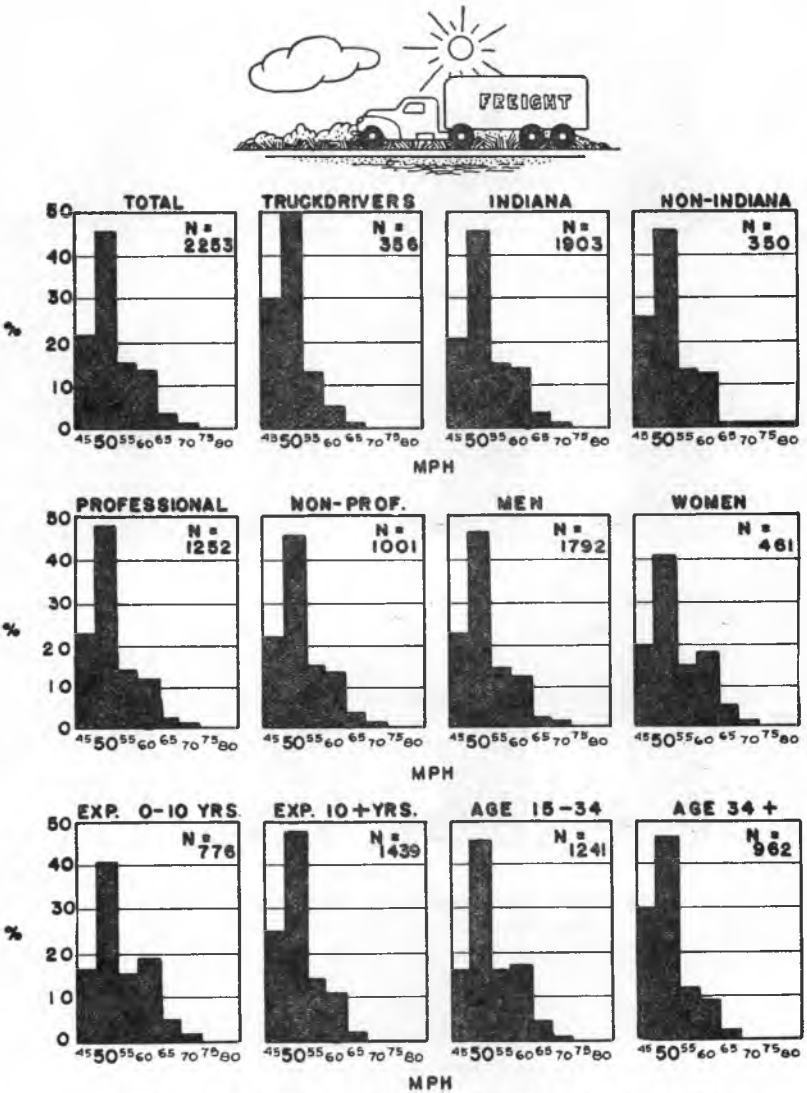


Fig. 9. Suggested maximum speed limit for passenger cars at night.

When asked to suggest a suitable daylight speed limit for trucks, 51 per cent of the truck drivers favoring a speed limit selected a maximum of 50 miles per hour (42 per cent of all the truck drivers interviewed). It is interesting to note that present Indiana law limits trucks of over 5,000 pounds weight to speeds of 45 miles per hour.

The percentage (46 per cent) of all the respondents who designated 50 miles per hour for trucks in daylight was slightly lower than that of the truck drivers. This group, however, constitutes a much smaller part of the total sample (28 per cent). See Figure 10.



NOTE: PER CENTS BASED ON ONLY THOSE RESPONDENTS WHO SELECTED A SPECIFIC SPEED LIMIT.

Fig. 10. Suggested maximum speed limit for trucks in daylight.

If you believe there should be a speed limit, what do you suggest as a maximum legal speed limit for trucks at night? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

A 45 miles per hour maximum speed limit for trucks at night was favored by 71 out of every 100 truck drivers who suggested a limit (57 per cent of all truck drivers surveyed). This may be

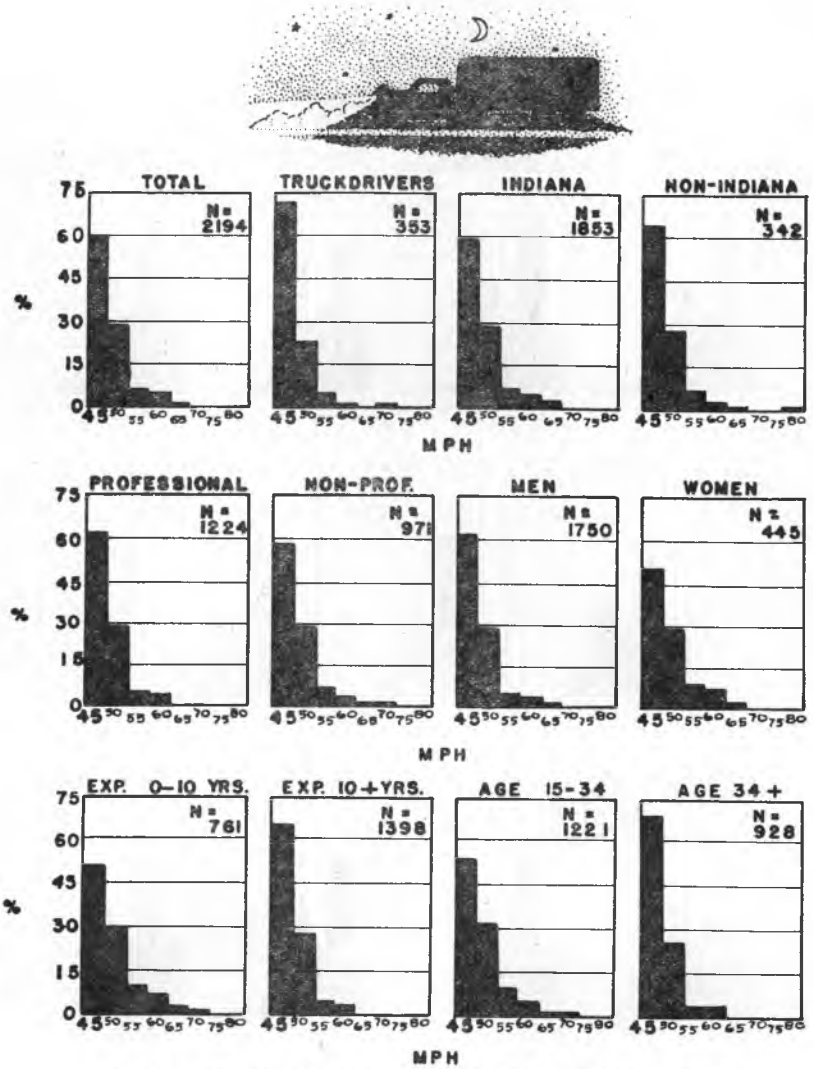
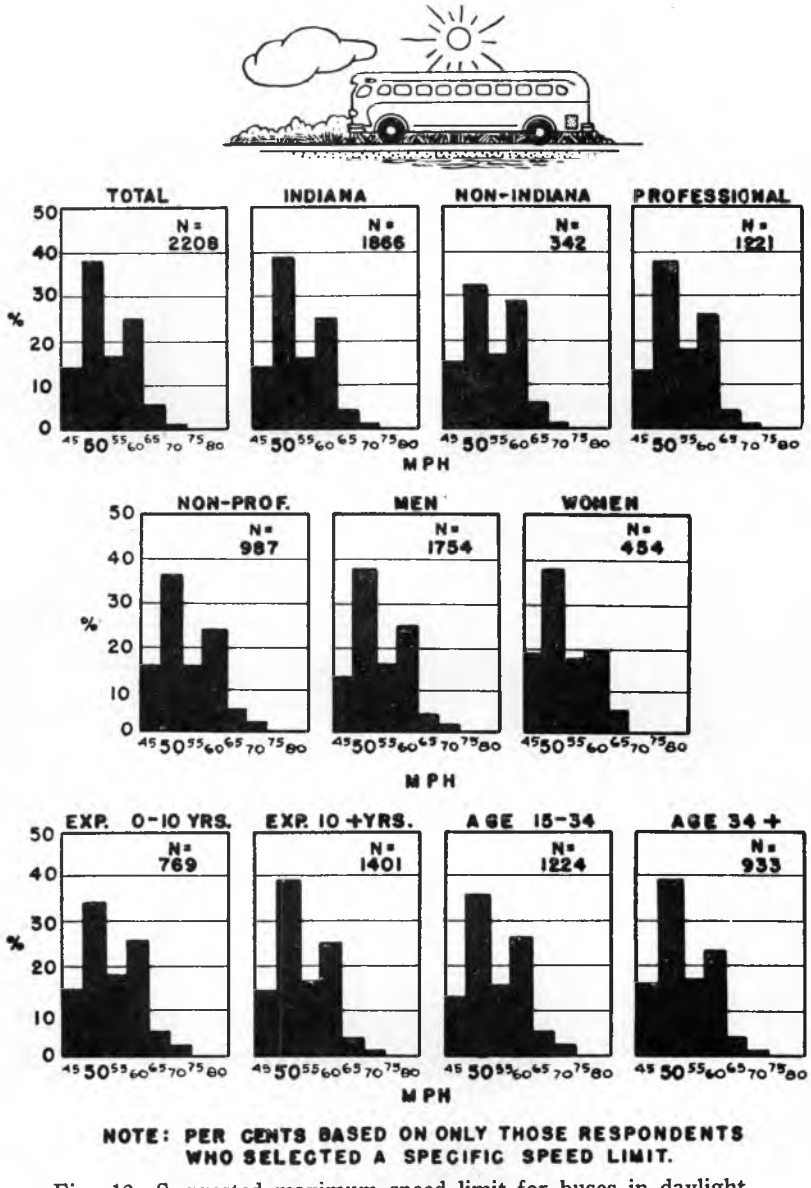


Fig. 11. Suggested maximum speed limit for trucks at night.

compared with the fact that 60 out of every 100 people in the total sample (35 per cent of the total respondents) who designated a definite limit also selected 45 miles per hour as a maximum (Figure 11). Present Indiana law specifies a 45 miles per hour speed limit for trucks weighing over 5,000 pounds at all times.



NOTE: PER CENTS BASED ON ONLY THOSE RESPONDENTS WHO SELECTED A SPECIFIC SPEED LIMIT.

Fig. 12. Suggested maximum speed limit for buses in daylight.

In the revised questionnaire form, the lowest possible answer to this and the other maximum speed questions is 35 miles per hour.

If you believe there should be a speed limit, what do you suggest as a maximum legal speed limit for busses in daylight? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

Figure 12 shows that 38 per cent of the respondents who selected a speed limit for busses in daylight suggested a maximum of 50 miles per hour (22 per cent of the total sample); 25 per cent selected 60 miles per hour (15 per cent of the total). Present Indiana law specifies a speed limit of 50 miles per hour for busses at all times.

If you believe there should be a speed limit what do you suggest as a maximum legal speed limit for busses at night? 45, 50, 55, 60, 65, 70, 75, or 80 MPH?

The respondents in favor of a speed limit for busses at night were almost equally divided in their choice of a maximum speed. A limit of 45 miles per hour was suggested by 41 per cent of these respondents. A similar number (41 per cent) selected a maximum of 50 miles per hour. These groups each constituted 24 per cent of the total sample. See Figure 13.

Where hazardous conditions exist, do you believe that a maximum safe speed limit should be posted? Yes or no?

Approximately all (98 per cent) of the people interviewed believed that a "maximum safe speed limit should be posted" where "hazardous conditions exist."

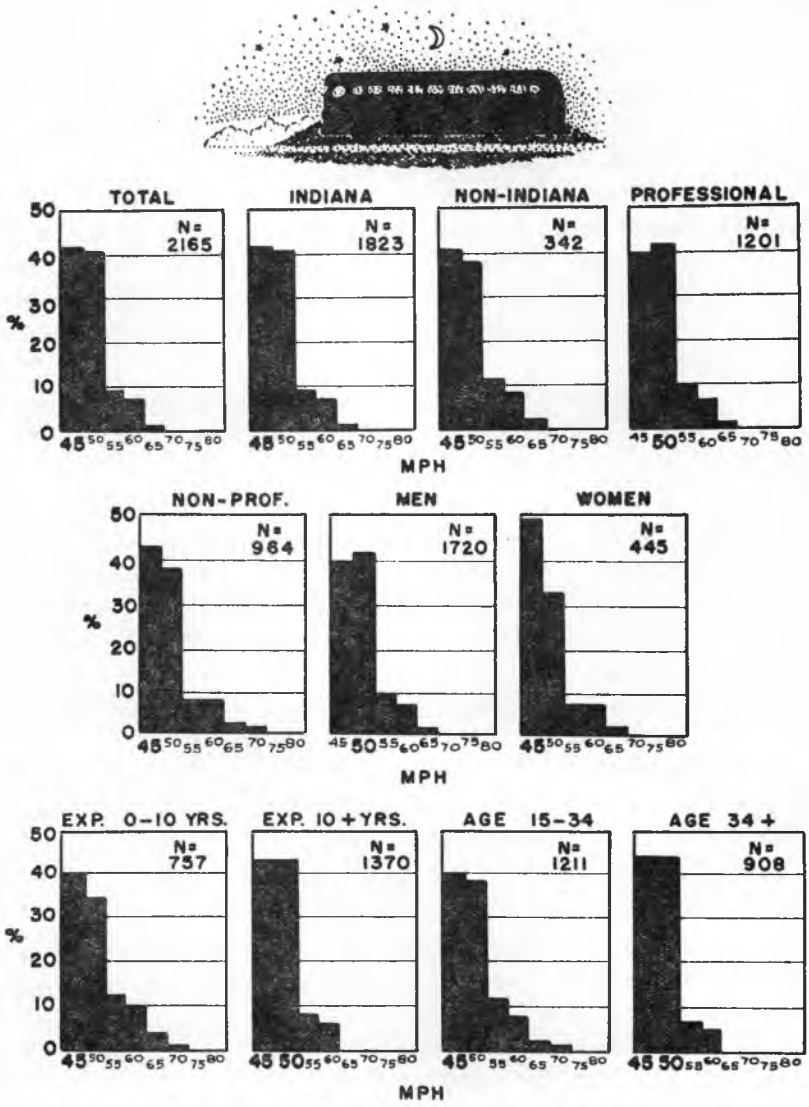
Do you believe that traffic laws should be made reasonably uniform throughout the U. S.? Yes or no?

When asked the above question, 97 out of every 100 drivers interviewed answered "yes", two said "no", and one made no comment.

SUMMARY

The survey results indicate that public opinion sampling methods may be applied as an aid in solving certain problems in traffic engineering such as roadway pavement markings, and that the respondents welcomed a chance to express opinions on specific highway practices.

Preference was given to a solid rather than a dashed centerline. Furthermore, the color of the centerline varied with the type of pavement. A black centerline on a concrete surface and a white



NOTE: PER CENTS BASED ON ONLY THOSE RESPONDENTS WHO SELECTED A SPECIFIC SPEED LIMIT.

Fig. 13. Suggested maximum speed limit for buses at night.

centerline on a blacktop surface were recommended by the greatest number of the 3,683 respondents.

Yellow on a concrete surface and white on a blacktop surface were considered the most visible colors for the respective surface types in bad weather conditions.

Over half of the respondents who favored a color difference between the no-passing line and the centerline thought yellow was the best color for the no-passing line.

While there was divided opinion on the preferred location for signal lights, almost half of the respondents thought the "poorest" location was the overhead signal light in the center of the intersection.

The largest number of respondents who favored establishing maximum speed limits in Indiana or in their home state recommended the following:

	MPH in Daylight	MPH at Night
Passenger Cars	60	50
Trucks	50	50
Busses	50	50 or 45

The majority of the respondents thought that a "maximum safe speed limit should be posted" where "hazardous conditions exist."

CONCLUSIONS

The following conclusions may be drawn on the basis of the information obtained in this study:

1. Public opinion sampling procedures appear to be applicable to certain phases of traffic engineering. It should be understood that the survey returns are not recommended as a panacea but, when applicable, may supplement technical information and serve as a guide and tool for the traffic engineer.
2. The motor vehicle operator is willing to give time to express opinions on certain highway traffic practices. This is evidenced by the ready cooperation obtained wherever the survey forms were distributed to the respondents, the oral and written comments of the respondents, and the very small number of respondents who failed to answer the questions seriously.
3. The survey results indicate that further investigations may be warranted for such questions as:
   a. Is the information in this type of survey of such quality as to be acceptable as an aid in establishing uniform roadway pavement markings?
   b. Is the "closed type" question, used in this survey, the most effective for obtaining roadway marking information, or is

some other survey sampling technique more reliable and economical?

c. Is the American driver aware of his definite likes and dislikes as related to roadway pavement markings?

d. Are the findings of this survey representative of local, regional, or national thought concerning pavement markings?

It is generally conceded that the average driver not only considers himself as a highway expert, he is also a traffic expert and a very well qualified one at that. Thus it is very important that all classes of drivers be given an opportunity to answer any survey questions for their answers are naturally influenced by their particular activities. How each class of driver can be adequately sampled is a problem that must be solved before the traffic engineer can begin to apply opinion polling techniques as one of his tools.

Another problem that must be considered is that of the "non-returns". For example, suppose the driving public is sampled by means of mailing a questionnaire to every *nth* applicant for a driver's license renewal. If 68 per cent of the truck driver's return their completed questionnaires while only 32 per cent of the traveling salesmen and 14 per cent of the pleasure drivers reply, what assumptions can be made concerning those truck drivers, traveling salesmen, and pleasure drivers who did not reply? One assumption would be to assume that the non-replies would be in the same proportions as the replies received and thus the non-replies could be ignored and the replies could be considered to be representative of the feelings of the truck drivers, traveling salesmen, and pleasure drivers.

Another approach could be to attempt to requestion the non-replies until answers are received. This method naturally becomes increasingly costly the greater the number of non-replies and the more times the questions must be repeated.

While questions in this study were designed to test the method rather than to obtain specific information, any future surveys might contain questions which cover subjects the driver is qualified to answer. Very few drivers are aware of how long it takes them to stop their vehicles under varied human, vehicle, and road conditions, thus the general public may not be considered qualified to answer questions dealing with sight distance or how far warning signs should be placed in front of any obstacle.

Many authorities in the fields of highway and traffic engineering have very kindly commented on this study in the past two years.

Many of these gentlemen agreed that there might at least be limited applications of public opinion surveying techniques to traffic engineering. However a few appeared to be of the opinion that the public doesn't know what they want nor what is good for them so why bother with them.

It is granted the majority of the replies to a specific traffic question may be diametrically opposite to sound engineering principles. For example, 82 per cent of the respondents in a local survey may reply that a speed limit of 25 miles per hour is too low for a given section of road in the area. Two main possibilities are then open to the traffic engineer. First, he can just ignore the question replies and second, he can review his basis for setting the 25 mile per hour speed limit. After reviewing his conclusions he may find that either he or the public is wrong. If his earlier conclusions are in error, he can act to change the limit. But, if the public is wrong, then he has a definite mandate to utilize one and possibly two of the 3 E's of traffic engineering. He should begin at once to educate the public as to why speeds above 25 miles per hour are unsafe for existing conditions and if necessary utilize enforcement agencies to augment the educational program. In either event, the views of the public have enabled that traffic engineer to better perform his duties. To him a public opinion poll that correctly presents the public's opinion would not only be a valuable tool but perhaps a necessary tool.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to the following faculty members of Purdue University: K. B. Woods, Associate Director of the Joint Highway Research Project, for his counsel and encouragement; A. K. Branham, Research Associate, who guided the most important stages of the investigation; the late K. S. Davenport, Assistant Professor of Psychology, for his helpful consultations; S. E. Wirt, Supervisor of Tabulating Division, who facilitated the tabulation of the data; and F. H. Green, Associate Professor of Highway Engineering, for his advice in the initial phases of the study. The author is also indebted to members of the Highway Research Board Committee on Roadway Pavement Markings and to N. F. Schafer, Director of Traffic, and W. F. Milner, Traffic Engineer, of the Indiana State Highway Commission, for their helpful suggestions. The kind assistance of the several cooperating agencies and their representatives, and the patience and

understanding of the men and women on the Joint Highway Research Project staff in the preparation and coding of the survey questionnaires and data are greatly appreciated.

BIBLIOGRAPHY

1. Gallup, George, "Public Opinion-Surveys Apply Lessons of 1948 to Call Shots in Off-Year Election," *Indianapolis Star,* April 3, 1950.
2. Parten, Mildred B., *Surveys, Polls, and Samples,* Harper and Brothers, New York, 1950.
3. *The Public's Attitudes on Traffic Safety,* A Public Opinion Survey Conducted for the National Committee for Traffic Safety by the Opinion Research Corporation, Princeton, New Jersey, January 29, 1946.
4. Gallup, George, "Public Opinion—Physicals for Drivers, 50 MPH Top Favored," *Indianapolis Star,* April 1, 1950.
5. Corder, Leon W., "We Asked Highway Users," *Better Roads,* Vol. 19, No. 4, April, 1949, pp. 21-23, 44.
6. *Traffic Survey and Study Proposed Bypass Route, Lowell, Massachusetts,* prepared by Charles A. Maguire and Associates and De Leuw, Cather and Company, October, 1948, p. 3.
7. Vickery, C. W., "Improvement of Methods Used in the Highway Planning Surveys," *Highway Research Board Proceedings,* Vol. 21, pp. 88-109, (1941).
8. Evans, Henry K., "How Good is Your Traffic Sample?" *Traffic Engineering,* Vol. 15, No. 8, May, 1944, pp. 182-186.
9. MacDonald, Thomas H., "Analysis of Urban Travel by Survey Technique," New York, American Transit Association, 1944, 17 p.
10. Lynch, John T., "Origin and Destination Surveys in Urban Areas," *Highway Research Board Proceedings,* Vol. 24, pp. 239-255, (1944).
11. "Origin and Destination Surveys in Urban Areas," *Traffic Engineering,* Vol. 15, No. 12, Sept. 1945, pp. 478-482.
12. "New Type Origin-Destination Surveys Conducted," *American City,* Vol. 50, No. 6, June, 1945, pp. 133, 135.
13. Lynch, John T., "Traffic Planning Studies in American Cities," *Public Roads,* Vol. 24, No. 6, Oct.-Nov.-Dec., 1945, pp. 161-178.

14. Trueblood, D. L., "Metropolitan Traffic Surveys Improved by Home-Interview Method," *Engineering News-Record,* Vol. 136, No. 2, Jan. 10, 1946, pp. 146-150.
15. Mickle, D. Grant and Lynch, John T., "Report of Committee on Origin and Destination Survey Techniques," *Highway Research Board Proceedings,* Vol. 25, pp. 298-301. Discussion pp. 301-329, (1945).
16. O'Flaherty, Daniel, "Simplified Methods for Travel Studies in Smaller Cities," *Highway Research Board Proceedings,* Vol. 27, pp. 297-311, (1947).
17. "What Others Think of Virginia," *Virginia Highway Bulletin,* Vol. 16, No. 10, pp. 11, 25.
18. "Notes on the Design of 'Dashed' Pavement Striping," Highway Research Correlation Service, Circular No. 108, June, 1950.
19. *Manual on Uniform Traffic Control Devices for Streets and Highways,* Public Roads Administration, Washington, D. C., August 1948, p. 78.
20. "Speed . . . The Greatest Contributing Cause to Traffic Accident Severity in Indiana," A Compilation of Accident Statistics, Speed Studies, and Corrective Measures Recommended by the Indiana State Police, mimeo, August 15, 1950.
21. "State Police to Ask Speed Limit," *Indianapolis Star,* January 24, 1950.
22. "Indiana Needs a Speed Limit," editorial in *Indianapolis Star,* January 25, 1950.
23. "60-50 Speed Law Favored," *Indianapolis Star,* January 26, 1950.
24. "Indiana Asked to Curb Deaths by Speed Limit," *Chicago Daily Tribune,* February 6, 1950.