and Traffic gave some 300 subjects this test, but sufficient time has not elapsed to make a thorough analysis of the data However, a hurried inspection indicates the following

1 The average reaction time under No 1-that is, the time elapsing from the instant the light goes on to the time the applicant takes his foot off the accelerator-1s about 01 per second Under No 2 , or the time elapsing from the instant the light goes on and the applicant takes his foot off the accelerator and starts to apply the brake it is about 02 of a second

2 Within certain limits (16 to 55) chronological age is not very closely related to reaction time. At the upper end of the age scale, however, Dr Walter R Miles, Professor of Psychology, Yale University, has made tests which seem to indicate that the reaction tume slows up considerably.

Unquestionably the reaction of the subject from the time he is given a signal to the time the brake is applied is a factor in an increase or reduction of motor vehicle accidents If a motor vehicle is going at a rate of 40 miles an hour and the reaction is 03 of a second longer than it should be a car will move approximately 20 feet during this period This may be sufficient to cause a serious accident

NOTES ON TRAFFIC SPEEDS<br>By A N Johnson<br>Dean, College of Engineering, Universily of Maryland<br>\section*{SYNOPSIS}

During the summer of 1933 the Maryland State Roads Commission in cooperation with the University of Maryland carried on a highway traffic speed survey to obtain comprehensive knowledge of the way traffic actually uses the state highways
The speed of traffic was observed at about 50 of the regular traffic census stations which the State Roads Commission has used for many years
At each point two observers counted and measured the speed of traffic from 9 AM untıl 4 PM This was done by the use of the Eno Foundation speed detector as devised by Professor C J Tilden of Yale University Ahout 500 vehicles were timed in each direction at each station
The average speed as observed from 41,000 vehicles was 355 mıles per hour, with 87 per cent of all the traffic within 45 miles per hour and 99 per cent within 55 miles per hour and with only an occasional vehicle moving over 65 miles per hour

The percentage of various rate of speeds was 8 per cent between 15-25 miles per hour
36 per cent between $25-35$ mles per hour
43 per cent between $35-45$ miles per hour
12 per cent between $45-55$ miles per hour
1 per cent between $55-65$ miles per hour

During the summer of 1933 , there was undertaken by the Maryland State Roads Commission, in cooperation with the University of Maryland, a traffic speed census. The object was to ascertan the speeds at which highway traffic moves over the state highways

For this purpose, traffic speeds were observed at 54 stations, as shown on the sketch in Figure 1 At each point selected, which corresponded to some regular traffic census station, two observers measured speeds from 9 AM untıl 4 P M One observer counted the traffic, divided as to direction, while the other observed the speed It was the plan to measure the speed of 1000 vehicles, 500 in each direction at each station At a number of stations, however, the traffic proved to be insufficient to make 1000 observations in the time avalable


Fig. 1
The method of measuring the speed was by the ard of an Eno Speed Detector, as developed by Professor C J Tilden of Yale University It is a very simple device which consists of a box with two sides open On the diagonal plane is placed a mirror The observer stands 176 feet from the mirror, which is placed so that objects moving along the road will be reflected to the observer's eye He notes the time on a stop watch as a vehicle goes by him and again as it is flashed in the murror Thus, if this time is two seconds, it indicates a speed of 60 miles per hour, three seconds, a speed of 40 mules, and so on

This method of determining the speed of vehicles was checked several times by comparing the speed thus recorded with that indicated by state police on their speedometers No practical difference was observed

It was possible to carry on this work without attracting undue attention of motorists, in fact, but few of the drivers noticed it at all, and those that did had slowed up after the speed had been observed

The highest average speed for any of the 54 stations was 47 mules per hour, with an average of 49 mules per hour for the east bound traffic, and 45 mules per hour for the west bound traffic This was on the Elk-ton-Glasgow Road, Route U S 40 There were six stations at which the average speed observed was over 40 miles per hour

The majority of the stations occupied for observing speed were in the zone where the legal limit is 40 miles per hour, the average speed in this zone being 37 miles per hour (See Figure 2, also Table I)
A few stations were occupied in more restricted zones In the 35mule zones, the average speed observed was 33 miles per hour

In the $25-\mathrm{mlle}$ zone, where traffic was observed at four stations, the average speed was 34 miles per hour


Figure 2 Range of Average Traffic Speed at Various Stations in 40 mph Zone on the Maryland State Highway System Each speed is the result of several hundred observations See Table 1.

The following table shows the distribution of traffic according to speed in the 40 -mile zone

10 per cent of all the traffic was within $15-25$ miles per hour 32 per cent of all the traffic was within 25-35 miles per hour
45 per cent of all the traffic was within $35-45$ miles per hour
11 per cent of all the traffic was within 45-55 miles per hour
2 per cent of all the traffic was within $55-65$ miles per hour
It is seen that 87 per cent of the traffic was under 45 miles per hour, and but two per cent was over 55 miles per hour

Of the 52,704 cars timed, there were only 90 travelng faster than 60 miles per hour, divided as follows:

> 19 cars at 63 miles per hour
> 55 cars at 66 mıles per hour
> 5 cars at 70 miles per hour
> 10 cars at 75 miles per hour
> 1 car at 80 miles per hour
TABLE I
Mariland Traffic Speed Survey, 1933

| Road and Route | TrafficStafionNumber | Av No$\substack{\text { Vehcles } \\ \text { Hourly }}$ | $\begin{gathered} \text { Av Speed } \\ \text { vehicles } \\ \text { Sirocthons } \\ \text { Directions } \\ \text { M } \end{gathered}$ | Percentage of Trafic at Speeds Shown |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & \text { No of } \\ & \text { Veholes } \\ & \text { Timed } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Av Speed |  | 15-25 |  | 25-35 |  | 35-45 |  | 45-55 |  | 55-63 |  | $\begin{array}{\|c\|} \text { More than } \\ 65 \end{array}$ |  |  |
|  |  |  |  | N | E | N | E | N | E | N | E | N | E | N | E | N | E |  |
|  |  |  |  | s | w | s | w | s | w | s | W | s | w | s | w | s | w |  |
| 40 Male Zone |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cumberland-Frostburg, No 40 | A-2 | 200 | 32 \{ |  | 34 30 |  | 6 21 |  | 45 51 |  | 41 26 |  | 8 2 |  |  |  |  | 1,073 |
| Cumberland-McCool, No 220 | A-4 | 175 | 35 , | 34 36 |  | 6 5 |  | $\begin{aligned} & 43 \\ & 40 \end{aligned}$ |  | $\begin{aligned} & 46 \\ & 45 \end{aligned}$ |  | 5 |  | 1 |  |  |  | 1,030 |
| Cumberland-Hancock, No 40 | A-7 | 76 | 39 |  | $\begin{aligned} & 38 \\ & 40 \end{aligned}$ |  | $\begin{aligned} & 2 \\ & 5 \end{aligned}$ |  | $\begin{aligned} & 25 \\ & 21 \end{aligned}$ |  | $\begin{aligned} & 52 \\ & 43 \end{aligned}$ |  | $\begin{aligned} & 20 \\ & 23 \end{aligned}$ |  | 1 |  | 1 | 530 |
| Annapols Boulevard, No 2 | AA-1 | 345 | $36 \quad\{$ | 37 35 |  | 3 2 |  | 45 35 |  | $\begin{aligned} & 45 \\ & 31 \end{aligned}$ |  | 7 11 |  | 1 |  |  |  | 1,382 |
| Annapolis Boulevard, No 2 | AA-3 | 233 | $36 \quad\{$ | 35 37 |  | 6 4 |  | $\begin{aligned} & 33 \\ & 26 \end{aligned}$ |  | $\begin{aligned} & 49 \\ & 55 \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 14 \end{aligned}$ |  | 1 |  |  |  | 1,267 |
| Annapolis Boulevard, No 2 | AA-6 | 153 | $38\{$ | 36 40 |  | 5 <br> 2 |  | 28 18 |  | $\begin{aligned} & 54 \\ & 52 \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 25 \end{aligned}$ |  | 1 2 |  |  |  | 1,046 |
| Crain Highway, No 3 | AA-5 | 166 | $42\{$ | 40 44 |  | 3 2 |  | $\begin{aligned} & 15 \\ & 11 \end{aligned}$ |  | $\begin{aligned} & 52 \\ & 36 \end{aligned}$ |  | $\begin{aligned} & 27 \\ & 41 \end{aligned}$ |  | 3 9 |  | 1 | , | 1,134 |
| Defense Highway, No 50 | AA-8 | 152 | $36 \quad\{$ |  | $\begin{aligned} & 38 \\ & 34 \end{aligned}$ |  | 6 7 |  | 28 39 |  | 48 <br> 48 |  | 16 6 |  | 2 |  |  | 921 |


TABLE I-Continued

| Road and Route | Traffic StationNumber , | $\begin{aligned} & \text { Av No } \\ & \text { Vehhcles } \\ & \text { Hourly } \end{aligned}$ | $\begin{array}{\|l\|} \hline \text { Av Speed } \\ \text { Vehtrles } \\ \text { Bothe } \\ \text { Direth } \\ \text { MP P } \end{array}$ | Percentage of Traffic at Speeds Shown |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{aligned} & \text { Vo of } \\ & \text { Vehinles } \\ & \text { Timed } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Av Speed |  | 15-25 |  | 25-35 |  | 35-45 |  | 45-55 |  | 55-65 |  |  |  |  |
|  |  |  |  | N | E | N | E | N | E | N | E | N | E | N | E | N | E |  |
|  |  |  |  | s | w | s | w | S | w | S | w | s | w | s | w | s | w |  |
| 40 Mile Zone-Continued |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Frederick-Baltımore, No 40 | F-10 | 137 | 35 |  | $\begin{aligned} & 35 \\ & 35 \end{aligned}$ |  | 8 9 |  | 38 38 |  | 44 43 |  | 9 9 |  | 1 1 |  |  | 903 |
| Frederick-Rockville, Nu 240 | F-13 | 145 | 38 \{ | 38 38 |  | 4 3 |  | $\begin{aligned} & 26 \\ & 30 \end{aligned}$ |  | $\begin{array}{\|l} 54 \\ 48 \end{array}$ |  | 14 16 |  | 1 |  | 1 |  | 857 |
| Frostburg-Grantsville, No 40 | G-8 | 69 | 42 \{ |  | $\begin{aligned} & 42 \\ & 42 \end{aligned}$ |  | $\begin{aligned} & 3 \\ & 5 \end{aligned}$ |  | $\begin{aligned} & 13 \\ & 15 \end{aligned}$ |  | $\begin{aligned} & 42 \\ & 40 \end{aligned}$ |  | 38 32 |  | 4 8 |  |  | 525 |
| Belair-Conowingo, No 1 | H-4 | 136 | 39 | 37 41 |  | 3 2 |  | $\begin{aligned} & 30 \\ & 16 \end{aligned}$ |  | $\begin{aligned} & 54 \\ & 59 \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 27 \end{aligned}$ |  | 1 |  |  |  | 891 |
| Belair-Baltımore, No 1 | H-9 | 266 | 37 \{ | $\begin{aligned} & 37 \\ & 37 \end{aligned}$ |  | 3 4 |  | $\begin{aligned} & 31 \\ & 29 \end{aligned}$ |  | $\begin{aligned} & 53 \\ & 55 \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 12 \end{aligned}$ |  | 1 |  |  |  | 1,282 |
| Philadelphia Road, No 40 | H-10 | 242 | $40\{$ | 42 38 |  | 1 |  | $\begin{aligned} & 13 \\ & 26 \end{aligned}$ |  | $\begin{array}{\|l\|} \hline 52 \\ 53 \\ \hline \end{array}$ |  | $\begin{aligned} & 29 \\ & 16 \end{aligned}$ |  | 5 1 |  |  |  | 1,076 |
| Frederick Road, No 40 | Ho-3 | 127 | 37 \{ | 38 <br> 36 |  | 6 5 |  | $\begin{aligned} & 33 \\ & 27 \end{aligned}$ |  | $\begin{aligned} & 48 \\ & 50 \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 16 \end{aligned}$ |  | 1 |  |  |  | 1,355 |
| Chestertown-Church Hill, No 213 | K-5 | 65 | $32\{$ | 33 <br> 31 |  | 15 20 |  | 43 42 |  | 32 34 |  | 10 5 |  |  |  |  |  | 507 |


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|  |  | Rockville－Washington，No 240 |  |  |  |  |  | $\begin{gathered} \infty \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \vdots \\ 0 \end{gathered}$ | $\begin{gathered} \infty \\ \circ \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ |  |  |

TABLE I-Concluded

| Hoad and Route | Trafic StationNumber | $\begin{aligned} & \text { Av No No } \\ & \text { Vehicles } \\ & \text { Hourly } \end{aligned}$ | $\begin{gathered} \text { Av Speed } \\ \text { Vehcheles } \\ \text { Both } \\ \text { Directions } \\ \text { MPH } \end{gathered}$ | Percentage of Traffic at Speeds Shown |  |  |  |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} \text { Noo of } \\ \text { Vehicles } \\ \text { Timed } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Av Speed |  | 15-25 |  | ${ }^{25-35}$ |  | 35-45 |  | 45-55 |  | 65-65 |  | $\begin{gathered} \text { More than } \\ 65 \end{gathered}$ |  |  |
|  |  |  |  | N | E | N | E | N | E | N | E | N | E | N | E | N | E |  |
|  |  |  |  | s | w | s | w | S | w | S | w | s | W | s | W | S | w |  |
|  |  |  | 40 Mrle | Zon | -C | ncl | ded |  |  |  |  |  |  |  |  |  |  |  |
| Hagerstown-Hancock, No 40 | W-4 | 140 | 40 \{ |  | 42 38 |  | 1 3 |  | 18 25 |  | 49 49 |  | 26 21 |  | 4 2 |  | 2 | 1,031 |
| Hagerstown-Middleburg, No 11 | W-5 | 121 | 37 \{ | 37 38 |  | 5 4 |  | 31 26 |  | 46 46 |  | 17 |  | $\begin{aligned} & 1 \\ & 2 \end{aligned}$ |  | 1 |  | 1,008 |
| Hagerstown-Frederick, No 40 | W-9 | 190 | 34 \{ |  | $\begin{aligned} & 36 \\ & 32 \end{aligned}$ |  | 4 |  | $\begin{aligned} & 34 \\ & 51 \end{aligned}$ |  | $\begin{aligned} & 48 \\ & 38 \end{aligned}$ |  | $\begin{array}{r} 13 \\ 4 \end{array}$ |  | 1 |  |  | 1,087 |
| Delmar-Salısbury, No. 13 | Wi-4 | 162 | $35\{$ | 33 37 |  | 9 6 |  | $\begin{aligned} & 51 \\ & 32 \end{aligned}$ |  | $\begin{aligned} & 36 \\ & 48 \end{aligned}$ |  | 4 13 |  | 1 |  |  |  | 1,042 |
| Salisbury-Princess Anne, No 13 | W1-6 | 129 | $31$ | 31 31 |  | $\begin{aligned} & 17 \\ & 15 \end{aligned}$ |  | $\begin{aligned} & 57 \\ & 58 \end{aligned}$ |  | $\begin{aligned} & 25 \\ & 25 \end{aligned}$ |  | $\begin{aligned} & 1 \\ & 2 \end{aligned}$ |  |  |  |  |  | 1,312 |
| Sahsbury-Berlın, No 213 | W1-7 | 118 | $35^{\circ}$ \{ |  | $\begin{aligned} & 34 \\ & 36 \end{aligned}$ |  | $\begin{aligned} & 12 \\ & 10 \end{aligned}$ |  | $\begin{aligned} & 49 \\ & 37 \end{aligned}$ |  | $\begin{aligned} & 36 \\ & 41 \end{aligned}$ |  | $\begin{array}{r} 3 \\ 11 \end{array}$ |  | 1 |  |  | 918 |
| Berlin-Ocean Caty, No 213 | Wo-3 | 137 | $35\{$ |  | $\begin{aligned} & 34 \\ & 36 \end{aligned}$ |  | $\begin{array}{r} 11 \\ 5 \end{array}$ |  | $\begin{aligned} & 42 \\ & 39 \end{aligned}$ |  | $\begin{aligned} & 42 \\ & 41 \end{aligned}$ |  | $\begin{array}{r} 5 \\ 15 \end{array}$ |  |  |  |  | 961 |
| Average |  |  | 37 \{ |  |  |  | 10 |  | 32 |  | 45 |  | 11 |  | 2 |  |  | $\begin{gathered} \text { Total } \\ 45,348 \end{gathered}$ |



The car traveling at 80 miles per hour was on the Elkton-Glasgow Road, two miles east of Elkton

On three roads it happened that counts were taken on the same day as the county fars and the speed records show that the cars traveling towards these events were going at a much higher rate of speed than the cars going in the opposite direction

Thus, at station AA-5 on the Crain Hıghway, the average speed of the traffic during the rush to the races was 48 miles per hour, while the speed of traffic in the opposite durection was but 39 miles per hour

In all, of the 52,704 vehicles that were timed, 45,348 were at stations within the 40 -mile zone, and the remainder were in the lower speed zones

From the results obtaned, it appears that 40 to 45 miles per hour is a reasonable regulation, which is observed by the large majority of drivers in all parts of the state The driving public on our highways is content. for the most part to jog along at a moderate rate of speed


Figure 3. Relation Between Width of Pavement and Speed of Traffic
The relation that the width of pavement has upon speed of traffic was studied but without convincing results

For this purpose the data were assembled in Figure 3 showing the average speed at the different stations, arranged according to width of road

In this figure, each of the ordinates represents the mean of observations taken at a single station, averaging about one thousand vehicles per station It will be noted that the average for each of the different widths is not far from the same value, about 35 or 36 miles per hour

One thing that is notable is that the 18,17 and 16 -foot widths, while maintanning the same average speed as the wider widths of roadway, do not show as great a variation It is evident that more data than are here presented will be required to determine definitely what effect the width of the roadway has upon the speed of traffic

## DISCUSSION

ON

## HIGHWAY TRAFFIC SPEEDS

Captain L. A. Lyon, Deputy Superintendent, Uniform Division, Department of Public Safety, Michigan: This Department has recently completed a survey of the speeds at which motor vehicles are being driven on the Michigan highways. This survey was made by all of the officers of the Department while on their regular patrols, either with motorcycle or patrol car. The checks were made on all types of highways and under various weather conditions, from the congested area around Detroit to the lonesome trails of the far north.

The officers were instructed to pace the first ten vehicles they could on the various types of roads each day for two weeks. Thus, they did not pick out passenger cars or high speed vehicles. They were also instructed to make the check without the knowledge of the driver of the vehicle, if possible.

Cars were checked under the following conditions:

> 47 per cent during daylight.
> 53 per cent during darkness.
> 16 per cent during rain or on wet roads.
> 10 per cent on gravel roads, and the balance on various types of hard surfaced roads, mostly concrete.

The percentages of the vehicles traveling at the various speeds were as follows:
25 miles per hour and under ..... 5
30 miles per hour ..... 9.7
35 miles per hour ..... 12.6
40 miles per hour ..... 20
45 miles per hour ..... 17.9
50 miles per hour ..... 16.6
55 miles per hour ..... 8.6
60 miles per hour and over ..... 9.6

Little difference in average speed can be noted as between wet and dry roads.

On paved highways the average speeds were: during daylight, 43.3 miles per hour; during darkness, 41.5 miles per hour.

Two per cent of all vehicles checked on pavements in daylight hours were trucks; 1.5 per cent during night hours were trucks.

On gravel highways the average speeds were: during daylight 39.8 miles per hour; during darkness 34.0 miles per hour.

On gravel roads 4.5 per cent of all vehicles checked in daylight hours were trucks; during darkness 3.7 per cent were trucks.

Sixteen per cent of all cars checked were of foreign registration and were probably through traffic, and nearly all on pavement. The aver-
age speeds were during daylight, 481 miles per hour, during darkness, 472 miles per hour.

The cars that were apparently from some other part of the state and could be classed as through traffic constituted 227 per cent The average speeds were: during daylight, 483 miles per hour; during darkness, 48 miles per hour.

We find that the average speed of all vehicles checked on all types of highways and under all weather conditions is 437 mules per hour

The above data are all we can obtain from the reports as submitted With this experience we expect to make a more detaled survey in the coming year, and would like suggestions as to data that should be included

The results of the survey seem to indicate that 45 miles per hour is a good average speed, and that a regulation declaring speeds in excess of that figure to be prima facie evidence of unreasonable speed would be in order

# ALCOHOL AND MOTOR VEHICLE DRIVERS 

By Dr W R Miles<br>Yale Instrtute of Human Relatzons<br>\section*{SYNOPSIS}


#### Abstract

A man may keep his car right side up and on the road when he is too intoxicated to walk but this fact is not reassuring to others on the highway Although beverage alcohol appears to give subjective stimulant action to a person, its real effect is a depressant action on most of the functions of body and mind The alcohol effect which interferes with driving ability is fourfold. (1) A poorer grade of attention to external signals and environment, (2) Slower responses of eyes, hands and feet, (3) Less dependable, that is more variable, muscular responses, (4) Increased self assurance which prompts to the assumption of right-of-way and willingness to take a chance Although alcohol is directly mentioned in only $\mathbf{7}$ to 10 per cent of fatal highway traffic accidents, it is the belief of informed traffic officials that one-third of such accidents are at least partly chargeable to use of alcohol by the driver Officials need a method to definitely determine whether a driver is intoxicated as a basis for court action Determination of percentage of alcohol in the blood or urine by biochemical means is a feasible undertaking This method should be tried out in some representative areas to secure scientific data in this controversial field


The motor car of today is a splendid mechanism, comfortable, responsive and powerful, a truly marvelous extension of the human personality but it can not drive itself, society counts on its being used by responsible people who have reached and are maintaming the human adult level of understanding and emotional balance A large army of engineers is continually at work improving the automobile in all possible ways

