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E. H. Holmes

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CURRENT AND POSTWAR AUTOMOBILE SPEEDS

E. H. Holmes

(In the following article Mr. Holmes directs attention to a number of interesting findings relating to current and postwar automobile speeds. His interpretations are backed by years of study and research. He is a graduate of the Massachusetts Institute of Technology (year 1928, degree in Civil Engineering), and was awarded a fellowship in Harvard University's Albert Russell Erskine Bureau for Street Traffic Research for the annum 1929-30. Since then he has been in the continuous employment of the United States Public Roads Administration. Recently he was made Acting Chief of its Division of Highway Transport Research.—Editor.)

“Speed too fast for conditions” is perhaps the cause most commonly ascribed to automobile accidents. Speeds of very low order may be too fast on a city street; extremely high speeds may be relatively safe on the Bonneville salt flats. But our real problem of speed, at least as the highway designer views it, lies between these two extremes—the speeds found on our rural highways.

One of the unexpected items that we can enter on the credit side of the ledger of war cost is the greatly increased consciousness of motor vehicle speeds. Official requests from Washington that speeds be held first to 40 and then to 35 miles per hour met an immediate and almost unanimous response from public officials responsible for highway traffic throughout the country. Safety and conservation organizations pointed their educational guns toward the objective of reducing speeds, and the motor vehicle and allied industries through their advertising mediums directed public attention to the need for conserving motor vehicle transportation. And to measure the effectiveness of this concerted effort, studies of motor vehicle speeds are being conducted in unprecedented numbers.

At the request of the Highway Traffic Advisory Committee to the War Department and of the Public Roads Administration,

speeds of vehicles at representative points on rural highways the country over are being regularly reported. In one recent period reports were received from 41 states, whereas adequate records prior to Pearl Harbor could be found in only 17 states. It is to be hoped that this awareness of the speed problem can be maintained in the postwar period, for it is only by constant review of the problem and critical analysis of the effect of whatever measures are taken, that its solution may be found.

What, then, has been accomplished in reducing speeds to a level consistent with the need for motor vehicle conservation? Figure 1 shows the average rural speeds throughout the country calculated from figures submitted by the various States to the Public Roads Administration. Speeds prior to the war averaged about 47 miles per hour on the sections of highways over which

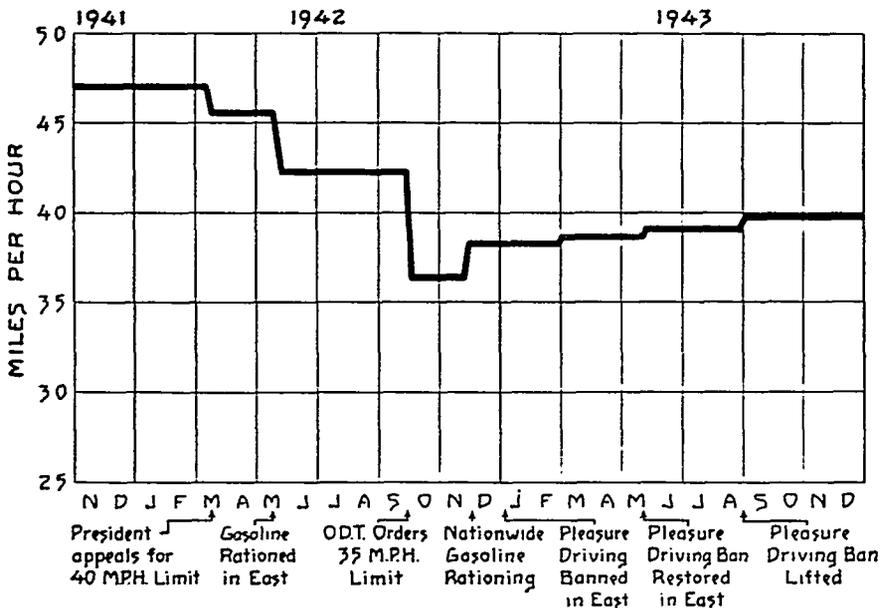


FIGURE 1.-AVERAGE WARTIME SPEEDS ON MAIN RURAL HIGHWAYS BY PERIODS

speeds were observed. In March 1942 the President appealed to the Nation to hold speeds to 40 miles per hour. A small reduction in speeds followed this appeal, but a more marked decrease occurred with the rationing of gasoline in the East in May of that year. The full amount of this reduction can not be attributed to the limitation in gasoline alone, however, because the speed reduction in the nonrationed areas paralleled almost exactly the reduction in the East. Probably the fact that rationing was necessary in one section had a sobering effect in the other parts

of the country as well, and efforts toward motor vehicle conservation were correspondingly stimulated.

It remained for the ODT directive requiring speeds be held to 35 miles per hour to bring about the greatest actual reduction in vehicle speeds, and to reduce them to the lowest level that has prevailed for many years. This order, coupled with parallel action by many state governors and legislatures combined to reduce speeds to an average of 36 miles per hour.

Since this low in the late fall of 1942, speeds have been rising slowly but steadily throughout the country, until the most recent reports show substantially increased averages. In no state in that period was the average as low as 35, and in 12 of 21 reporting states average speeds equaled or exceeded 40 miles per hour.

The lines on this chart show marked breaks between the various reporting periods. Partly that is the result of continuing the lines to connect the speed levels in the various periods. Actually, however, speeds did respond to external influences almost as rapidly as shown here. As a demonstration of the sensitivity of this speed index, Figure 2 shows the average speeds month by month at four representative locations near the District of

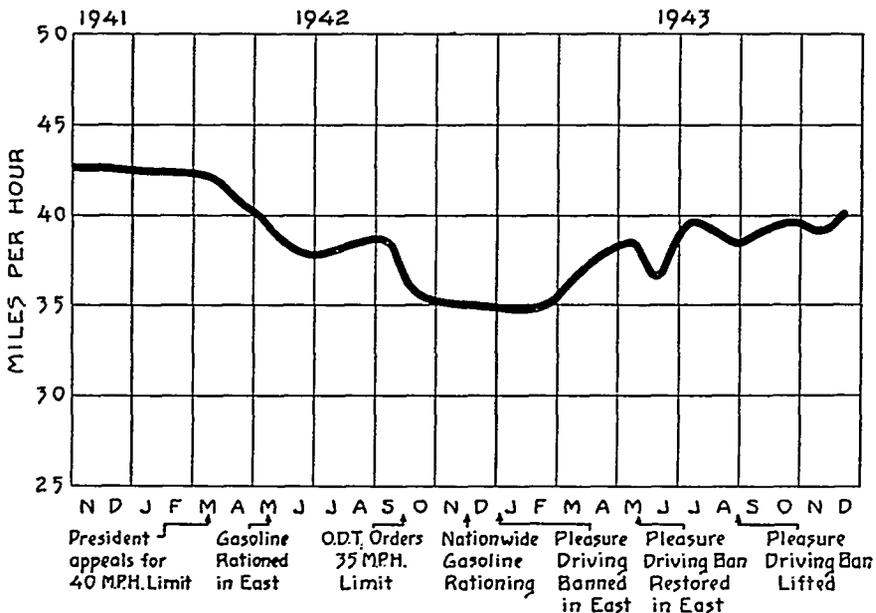


FIGURE 2.—AVERAGE WARTIME SPEEDS ON FOUR RURAL HIGHWAYS NEAR WASHINGTON, D.C., BY PERIODS

Columbia—two in Maryland and two in Virginia. Starting in 1941 below the national average shown in Figure 1, this curve fluctuates in almost exactly the same manner as the broken line

shown in that figure. The sharp dip in June 1943 followed the restoration of the pleasure driving ban in the Northeast and apparently indicates the most cautious of driving by those operators who did venture on the rural highway.

Average figures show the general picture. They are useful in assaying general trends and for rough gauges of the effectiveness of whatever measures may have been taken to influence speed. Any real analysis of the problem, however, requires that we go a good deal deeper than these average figures permit. If we are to forecast what may occur in the postwar period, we must examine in more detail how we arrived at our present situation.

The thought that usually first comes to mind is the influence of enforcement practices. This element is difficult to evaluate statistically, at least from the information available to us in Washington. Strenuous enforcement efforts in an area where police forces are greatly undermanned may be relatively ineffective; on the other hand, the mere presence of patrolmen, even though limits are not strictly enforced, is bound to have a sobering effect on the driver. Recognizing these statistical limitations it is interesting, nevertheless, to compare in Figure 3 the trend of speeds in five states in which it was reported that efforts were made to enforce the prevailing nation-wide limits with the trends in five states in which the limits were reported to be non-enforceable because of the lack of appropriate legislative action

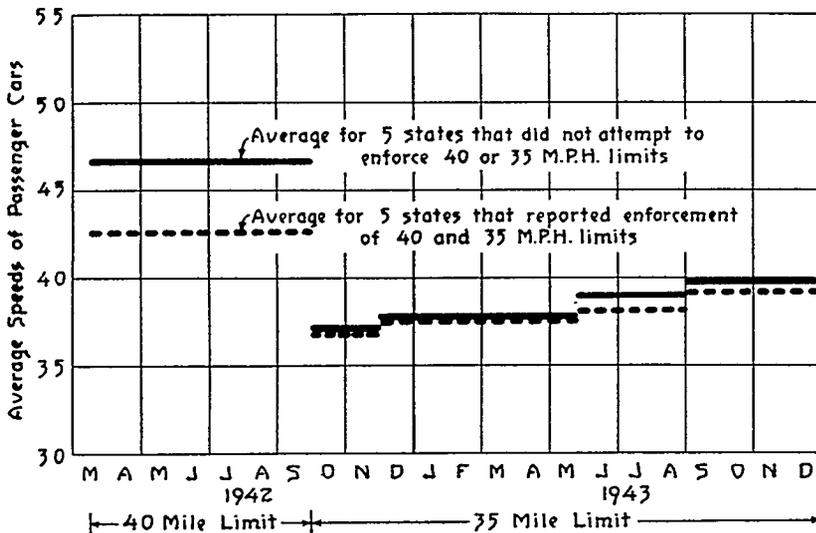


FIGURE 3.- COMPARISON OF AVERAGE PASSENGER CAR SPEEDS IN STATES THAT DID AND DID NOT ATTEMPT ENFORCEMENT OF PREVAILING NATIONWIDE SPEED LIMITS

or emergency powers. This figure shows a marked difference in observance of the 40-mile limit during the early stages of the war. It shows, however, an insignificant difference once speeds reached their lowest levels in the fall of 1942, since the 35-mile limit has been in effect. The conclusion, therefore, seems to be that enforcement activities have had less effect than voluntary conservation, engendered perhaps by the existence of enforceable limits in some cases, but probably more by the continuing publicity regarding vehicle, tire, and gasoline shortages.

Another comparison that may be made, and one which opens a wider range of speculation, is the comparison of war speeds with prewar speeds in groups of states having different prewar speed limits, as shown in Figure 4. Here on the left of the chart the top line shows the prewar speeds in 8 states in which there were no fixed limits. The average was just under 49 miles per hour. Then in order come lines showing the average prewar speeds in states having prewar limits of 60, 55, 50, and 40 miles per hour, respectively, the last line unfortunately representing only one state.

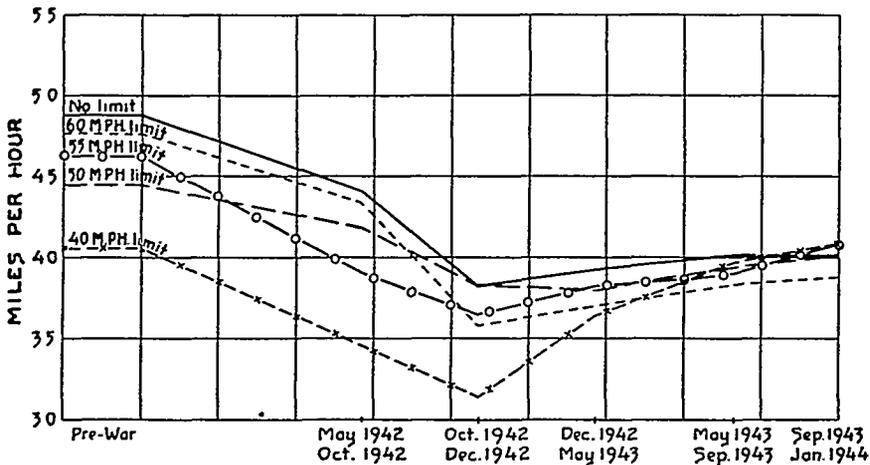


FIGURE 4.- AVERAGE SPEEDS OF VEHICLES BY PERIODS, CLASSIFIED BY STATES HAVING VARIOUS PRE-WAR SPEED LIMITS

It is significant that the average speeds varied directly with the speed limits and showed a wide range of more than 8 miles per hour between the highest and lowest average. Which is cause and which is effect is debatable. It seems likely, however, that a natural relation will always exist between desired and legal speeds, if only because a regulation inconsistent with the pronounced desires of the majority is difficult if not impossible to enforce.

Now tracing each of these lines into the war period shows

how these originally divergent habits have been molded into a uniform pattern. Since the beginning of 1943 the range of speeds in the states that originally had widely differing speeds and speed limits now is almost negligible. Furthermore, within this narrow range the prewar order has become completely jumbled, with the lowest prewar group now being bracketed with the original middle group in top position, and the lowest present position being occupied by states that originally showed the second highest average. The explanation of this feature is probably that the differences are so small that the order has become insignificant, but as mentioned before, this figure offers interesting possibilities for speculation.

This curve seems to have particular value, however, as a basis for forecasting what may occur when the war is ended. Speeds are already rising slowly but perceptibly. There is every reason to believe that once wartime restrictions are lifted, speeds will rapidly return to their prewar levels. Unless there are powerful campaigns of education and enforcement, backed by effective legislation, prewar speeds will again prevail. And accompanying this increase will be a wave of accidents and fatalities as vehicles and drivers, figuratively rusty through disuse, and with every variety of prewar, recapped, and synthetic tires, find the strain too great. Furthermore, it is reasonable to believe that we can look to the states having the highest speed limits or no fixed limits at all to take the lead in the postwar accident toll.

Speed distributions as shown by figures that have been assembled at the many points on rural highways presumably might have been influenced by one or more of four principal factors: the road; the traffic; the vehicle; and finally the driver himself. Considering these factors in order, the road may limit speed because of its alinement or because of its surface condition. Certainly there are many sections of highway on which the curvature and superelevation are such as to require the reduction of speeds below those desired by the driver. Occasionally also, the road surface may be rough or have deteriorated sufficiently so as to require a reduction in speed. Neither of these conditions can have influenced the speeds on the sections included in the studies, however, for observation stations were invariably selected on level straightaway sections with smooth surfaces, with the specific objective of eliminating the highway itself as a factor influencing the driver's choice of speed. We may, therefore, count out the highway.

Traffic volume, the second item, has a significant influence on speed, even on level straightaways, although not so much here as on highways of poor alinement where insufficient sight distances make passing difficult. But again this factor may be

eliminated as a variable by considering only those vehicles so separated from vehicles traveling in the same or opposite direction that their speeds were unaffected by other traffic. A typical pattern of speed of such vehicles with the influence of the road and traffic eliminated is shown in Figure 5. Here, with just the "free-moving" vehicles included, only 6 per cent traveled faster than 60 miles per hour, and but 36 per cent exceeded 50 miles per hour. Under these conditions, with the large majority of vehicles confined to the low and moderate speed ranges, we must look for explanation to the vehicle or its driver.

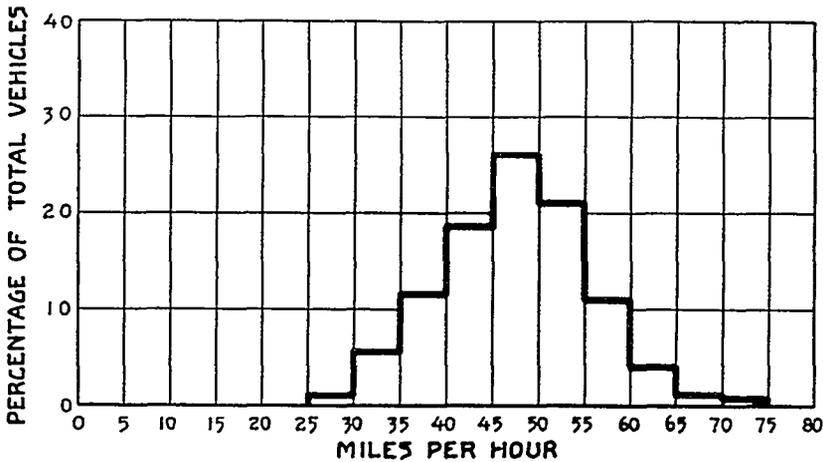


FIGURE 5.—FREQUENCY DISTRIBUTION OF SPEEDS OF FREE MOVING VEHICLES ON MODERN HIGH-SPEED HIGHWAYS

It is not so easy to eliminate unknowns in these categories. But considering now the vehicle, let us look back a little into the history of speed. First we have Figure 6, which shows motor vehicle speed records from about 1900 to date. These are one-mile records, established on straightaways and with a flying start. They show a rather gradual increase until about 1925, when the curve broke sharply, with speeds jumping from around 175 miles per hour to nearly 375 miles per hour in a 15-year period. The break in the trend probably coincided roughly with the beginning of the change in appearance and construction of the vehicle from something resembling an automobile to something more nearly resembling a projectile and which must be sighted, rather than steered.

This figure is included not because the vehicles are likely to become a highway problem, but to demonstrate the tremendous potentialities of the internal combustion engine. Turning next to something a little closer to our problem, we see in Figure 7 the average speeds of the winning cars in the 500-mile Memorial

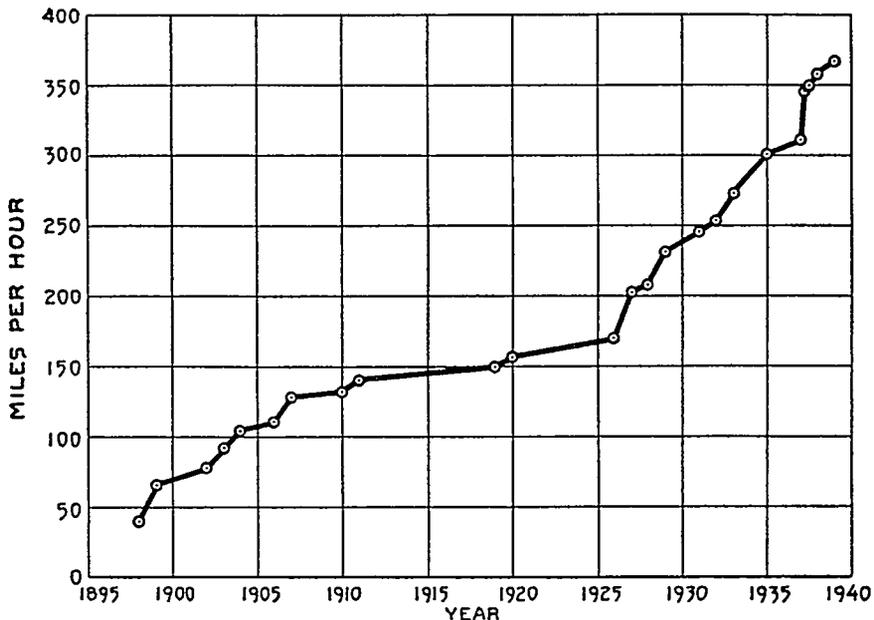


FIGURE 6.-ONE MILE MOTOR VEHICLE SPEED RECORDS

Source :- American Automobile Association

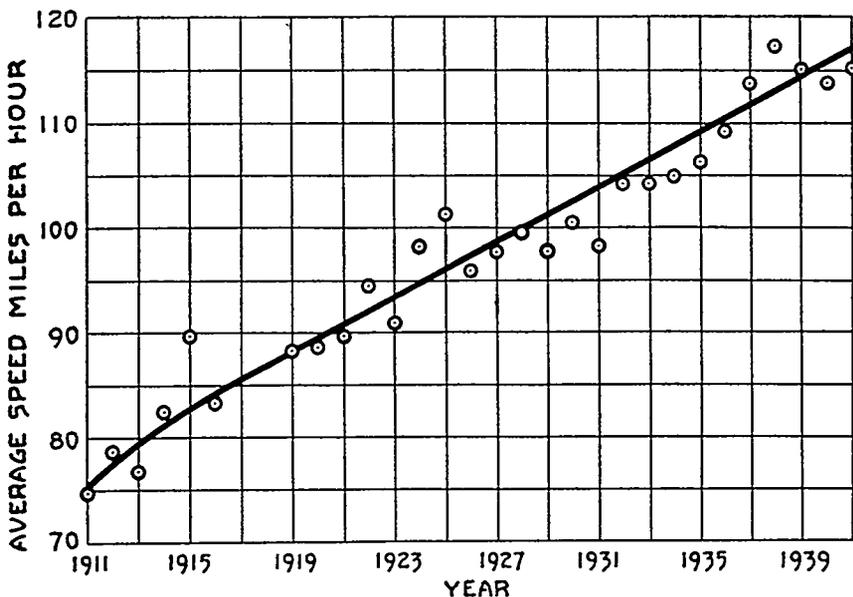


FIGURE 7.-AVERAGE SPEED OF WINNER IN MEMORIAL DAY RACES ON INDIANAPOLIS SPEEDWAY BY YEARS

Source :- American Automobile Association

Day races at Indianapolis. This curve shows on the average a steady increase, but closer inspection shows that it has risen in a series of plateaus. These figures are more closely related to our problem because they show steadily increasing speeds despite constantly tightening restrictions on such important elements as piston displacement and oil consumption. They show that the application of the results of technical progress and of the country's inventive genius will produce faster and faster cars despite increasing stringency in operating economy. Incidentally, the vehicles setting these records bore a considerable resemblance to automobiles, and were steered, not sighted.

Now coming to the core of our problems of the vehicle, we see in Figure 8 the trend in speed records set by American stock cars. These vehicles not only resemble, but actually are, the vehicles we see in our everyday traffic. They, too, have shown an increase in top speeds. From 1925, when only the high-priced cars could beat 60, we find that the average 1940 car in the low-priced field can exceed 80 miles per hour, and in the high-priced field it can top 90.

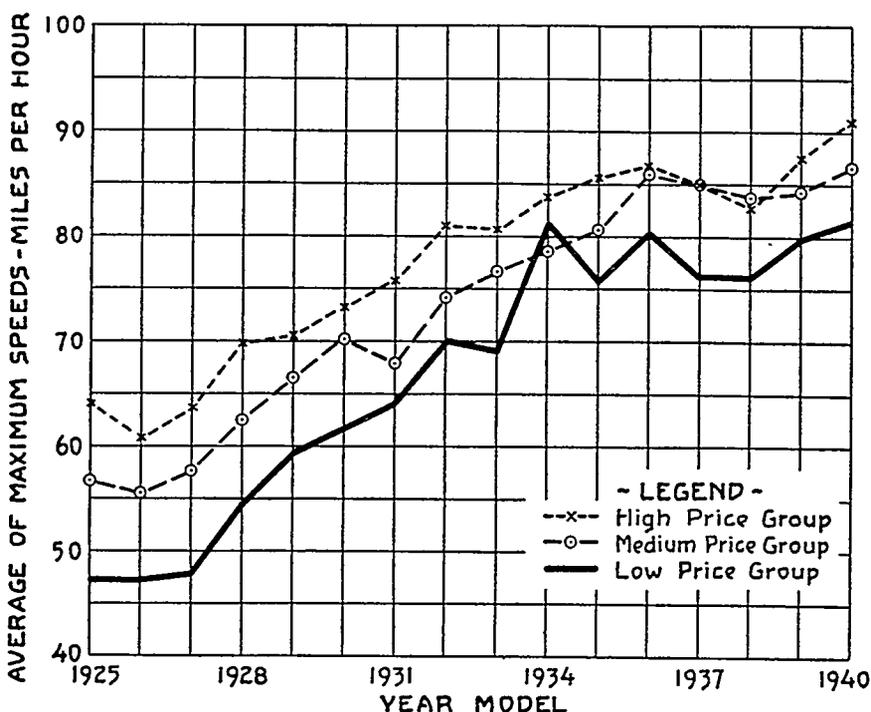


FIGURE 8.- AVERAGE TOP SPEEDS OF AMERICAN STOCK CARS IN HIGH, MEDIUM AND LOW PRICE RANGES BY YEAR MODELS

Source:- Proving Ground Records

Two items are outstanding in this figure. First, the spread between speed capabilities of high- and low-priced cars has narrowed from 18 miles per hour in 1925 to less than 10 in 1940. In 1938 models it was only 8 miles per hour. Second, and more significant, is the general shape of the curve, which shows a definite leveling after 1934. Contrast this with the two previous diagrams. The rise in the mile record since 1925 has been almost meteoric. The rise in the Indianapolis speeds has been steady despite the increasing limitations imposed by the Contest Board. But stock car speeds have leveled off.

Clearly the manufacturer could have built in more speed if the speed capacity was not already equal to or in excess of the public's desires. Keeping this figure in mind, let us consider again the speed distribution of Figure 5, which showed that the greatest number of drivers moving without interference of road or traffic wish to travel between 45 and 50 miles per hour, and that only a scattered few wish to drive at speeds above 60, a speed at least 20 miles per hour below the speed capacities of their vehicles.

It is logical to conclude therefore that the vehicle also may be eliminated as a factor influencing the speed data we are considering. Of the four original factors only the driver himself remains as a variable, and that variable is by far the most obscure and unpredictable in its behavior.

Drivers control their speed in accordance with their own idiosyncrasies and inhibitions. Diagnosing these idiosyncrasies is a job for a psychologist, not an engineer. Perhaps a psychiatrist would be more appropriate. But the engineer can point out a few symptoms to aid the psychologist in his diagnosis, and thereby perhaps can perform a useful service.

Several years ago the Public Roads Administration undertook an investigation of the characteristics of individual drivers, working in collaboration with the Institute of Human Relations at Yale University, and the American Association of Motor Vehicle Administrators. In these investigations vehicle speeds were determined on sections of highway and under conditions of traffic that would not constitute retarding influences. Beyond the points where the speeds were observed the vehicles were stopped and their drivers questioned regarding a number of their personal characteristics such as age, sex, occupation, place of residence, and driving experience, and regarding features of their trip such as its length, and purpose. This investigation, both in the field and analytical phases, has been stopped by the war, but the results give promise of a fertile ground for further study once work can be resumed.

These studies revealed, among other factors, that, on the

average, out-of-state drivers traveled faster and drove newer cars than drivers residing in the state of the study; young persons drove somewhat faster than older persons; men drove slightly faster than women; drivers on long trips traveled faster than those on short trips; non-owners drove faster than those who owned their vehicles; and newer vehicles were driven faster than older vehicles.

In our consideration of speed there has always been an assumption, perhaps almost subconscious, that speed and safety are closely related. It is probable that this belief persists in the minds of most of us even though there has never been any very clear evidence developed of the character of this relationship if it exists. Even now a joint committee is renewing the search for such a decisive relationship.

Without attempting or wishing to venture far into this field in this discussion, it is believed, nevertheless, that the comparisons shown in Figure 9 are of interest. This figure simply shows that high-speed drivers from the States of Connecticut, New York, and New Jersey, as shown by the records of those States, are guilty of more speed violations (which, of course, is

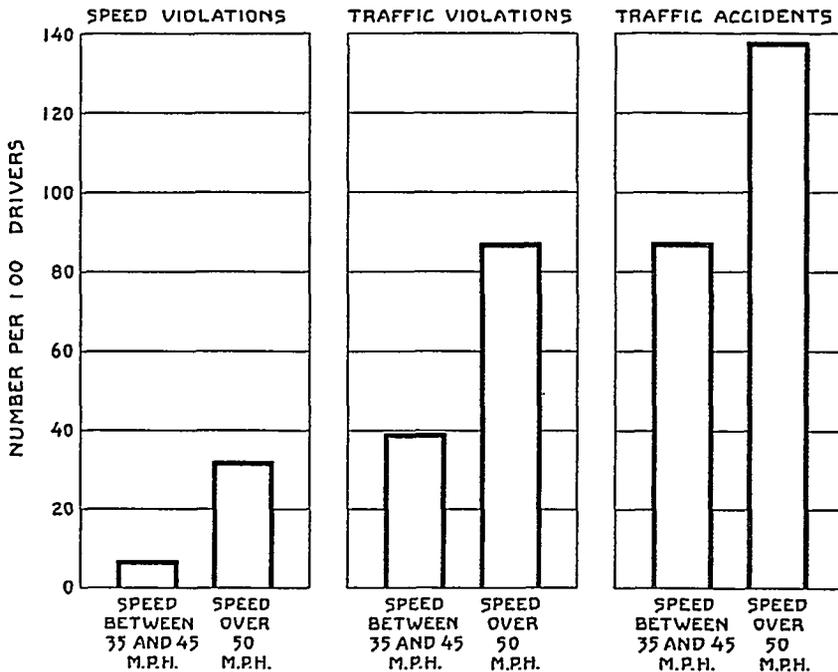


FIGURE 9.-COMPARISON OF NUMBER OF SPEED VIOLATIONS, TRAFFIC VIOLATIONS, AND TRAFFIC ACCIDENTS FOR MODERATE AND HIGH-SPEED DRIVERS

to be expected), are guilty of more traffic violations, and are involved in more accidents than are those drivers who hold to a more moderate speed.

It is believed that this is the only analysis ever made of the accident experience of drivers as related to their *normal* driving habits, if we may assume that their speeds at the time they were observed in these studies, at points where they were uninhibited by unusual road or traffic conditions, represent their normal habits. It does not mean that the drivers were necessarily driving at high speed when they were involved in accidents nor when violating traffic regulations.

Thus this comparison does not in any way show the driver's performance at the time of violation or accident. It does show, however, that whatever individual characteristics inspire a driver to travel at high speed also caused him to be involved in more than his share of trouble on the highway, and confirms the many other reasons that make us feel that the fast driver is the core of our safety problem.

Now in conclusion, a word on postwar speeds, not so much a year or two postwar, as somewhat further in the future. What will these speeds be? If the trends shown in this discussion are accurately interpreted, we have in recent years provided highways and vehicles with speed capacities in excess of those possessed or desired by most of the drivers. Driving in new vehicles on smooth, straight roads unobstructed by traffic and uninhibited by speed limits, few drivers even approximate the speeds available to them.

If the vehicle and the roadway have caught or passed the driver in speed capacity, we must look to the drivers themselves with their human strengths and weaknesses as the index of our future speeds. In normal times we buy new cars every two or three years. We buy new highways every 20 or 30 years. But our physical and mental equipment is born with us and it must last a lifetime, even depreciating somewhat as life wears on, and psychological changes come about slowly if at all. To the extent we can relate speed to driver characteristics, we can, therefore, forecast future speed trends.

If as a nation our living standard improves, as indeed it must, if, on the average, we drive newer cars, if our highways are designed in accordance with the functions they should serve, if travel is encouraged, if roadside hazards are reduced by limited or controlled access, then we must certainly anticipate higher average speeds. But these higher speeds will be attained not so much by a general increase throughout the range of present speeds as by a reduction in the proportion of low-speed driving.

On typical prewar main highways only an insignificant num-

ber of vehicles exceeded 65 miles per hour, the greatest concentration of speeds lay in the range between 40 and 45 miles per hour, and a significant number traveled at less than 35. On the best of highways constructed shortly before the war, speeds were higher, both average and maximum. But there still were many vehicles moving below 35 to hold the average to a figure of 48.5 miles per hour. It is doubtful whether on rural roads where access is unlimited, along which roadside developments flourish, and on which short trips are frequent or may even be predominant, that the average in the postwar period will show much increase above this figure.

If, however, we build highways to the standards recommended by the National Interregional Highway Committee in its report recently transmitted to Congress by the President, we may expect considerably higher speeds. On such highways the location and design would discourage most short-trip travel, access would be permitted only where it can be provided safely, and we should expect a definite concentration of driving in the higher speed brackets. Here in the top diagram is shown a possible speed distribution on such rural roads. No vehicles are shown to exceed 80 miles per hour but the elimination of all vehicles moving under 40 gives an average of 56 miles per hour.

These roads and these speeds will be evidences of the higher living standard America can have if we can apply to constructive ends the energies we now are devoting almost entirely to the destructive purposes of war. And one item that must accompany this improved living standard is a greater appreciation of the principles of highway safety, that the more of us may live.

TWO-INCH REVOLVER NOW AVAILABLE

The 2-inch detective model revolver, which has not been manufactured since the outbreak of the war, is now available to public law enforcement agencies and guard forces of industrial plants. Because of the demand for this type of revolver, the *Defense Supplies Corporation*, subsidiary of the *Reconstruction Finance Corporation* has arranged with Smith and Wesson and Colt's Patent Fire Arms Manufacturing Company to produce limited supply primarily for police use. Application and order forms may be secured from the *Defense Supplies Corporation*, 811 Vermont Avenue, N. W., Washington, D. C., or from the *International Association of Chiefs of Police*, 918 F. Street, N. W., Washington, D. C.—Noted from the *Police Chiefs' News Letter*.