Vision and Driving: A Summary of Research Findings

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To provide driver licensing adminstrators with heretofore unavailable information on which to establish effective vision-screening procedures for driver license applicants, a number of visual performance, personal, and driving habit characteristics of some 17,500 volunteer California driver license applicants were compared with their 3-year driving records (accidents and convictions). The vision tests included those for dynamic visual acuity, static visual acuity, field of vision, lateral phoria, low-illumination vision, glare recovery, and sighting dominance. Of these, dynamic visual acuity was most closely and consistently correlated with driving record, followed by static acuity, field of vision, and glare recovery. All relationships were in the "expected" direction, i.e., poor vision was associated with poor record. As expected, among all variables studied, age, sex, and average annual mileage play the largest role in influencing driving record. Accident and conviction frequencies increase with increasing mileage, are lower for females than for males, and are highest for the young age groups. Accident and conviction rates per 100,000 vehicle-miles decrease slightly with increasing mileage, are approximately the same for both sexes, and are highest for young drivers, followed by older drivers, with middle-age drivers having the lowest rates. The report gives recommendations for additional research and suggests practical applications of the present findings.

•IT HAS always been assumed, and logically so, that vision plays an important role in the driving task. While this assumption has been traditionally and universally accepted, and has been used by driver licensing agencies as the basis for incorporating one or more vision tests in their procedures for evaluating driver license applicants, there has been, in fact, no definitive experimental evidence relating visual ability to driving ability.

As was pointed out in a detailed survey (1), despite a reasonably large amount of published literature on vision in relation to driving, relatively little substantial research has been done and few, if any, basic relationships have been established. Attempts to determine such basic relationships have been largely unsuccessful for a variety of reasons, including the following:

1. Vision is only one of the many factors influencing driving performance, and thus it is extremely difficult to demonstrate a close relationship between a given vision characteristic and a measure of driving performance, such as number of accidents;
2. There may be a considerable disparity between the visual capabilities of the individual and the degree to which these capabilities are utilized in driving;
3. The tests used in the research may measure visual characteristics that are not closely related to the visual functions utilized in driving;

Paper sponsored by Committee on Road User Characteristics and presented at the 47th Annual Meeting.

4. The reliability of the specific vision test(s) and/or of the measure of driving performance (e.g., number of accidents) used may be low; and
5. The research study may have had methodological shortcomings, such as an unrepresentative sample of the driving population or lack of control over the many relevant variables (such as exposure).

Responsible officials have long felt the need for accurate and reliable information in this area, to permit establishing more effective procedures for screening driver license applicants on the basis of their visual abilities. Accordingly, early in 1962 the Institute of Transportation and Traffic Engineering, in conjunction with the California Department of Motor Vehicles, began a large-scale, long-range study of the relationship between visual ability as measured on several standard and nonstandard screening tests and driving performance as reflected in driving record.

The first phase of this study, comparing visual performance with 3-year driving records, has been completed, and the major findings are summarized in the present paper. The second phase, currently under way, involves:

1. Retesting a number of the original subjects, after a period of 2 to 3 years, to determine whether an appreciable change in visual performance occurs over this relatively short period of time;
2. Accumulating driver record information over a 6-year period, to provide a more valid and reliable measure of driving performance; and
3. In-depth analysis of the massive amount of data accumulated in the study, to evaluate such things as the relationship between specific types of accidents and specific types and degrees of visual degradation.

METHOD OF RESEARCH

The general sequence followed in the study was as follows:

1. Volunteers were solicited from among driver license applicants at DMV field offices throughout California.
2. Visual performance was measured, and personal and driving information (e.g., type and quantity of driving) obtained for these volunteer test subjects. (In addition, limited personal information was obtained about "non-test subjects," i.e., applicants who declined to volunteer for the study, to permit a check on the representativeness of the test subject sample.)
3. The information thus obtained was forwarded to DMV headquarters in Sacramento, where the immediately preceding 3-year driving record was examined for each test subject and non-test subject.
4. Whenever possible, each test subject's insurance record was located and examined, to provide a more complete picture of his driving record.
5. All accumulated information was coded and placed on IBM cards (and subsequently on magnetic tape) for computer analysis.

The vision tests utilized in the study measured the following aspects of visual performance:

1. Dynamic visual acuity (DVA)—the ability to perceive details of an object when there is relative motion between the observer and the object;
2. Static visual acuity—the ability of the observer to perceive details of a stationary object;
3. Lateral visual field—the extent of the observer's side vision when he is looking straight ahead;
4. Lateral phoria—the "aim" of the eyes in the horizontal plane, i.e., the degree of crosseyedness (esophoria) or walleyedness (exophoria);
5. Low-illumination vision—the amount of illumination required to perceive an object (also referred to as glarimeter threshold);
6. Glare recovery—the length of time required to perceive an object after having been subjected to glare; and

7. Eyedness, or sighting dominance—the individual's preferred eye, similar in concept to his hand preference.

The driving record variables studied include accidents incurred over a 36-month period, and convictions for traffic citations incurred over a 36-month period.

In addition, three variables of known influence on vision and/or driving record were controlled for age, sex, and average annual mileage (quantitative exposure).

Because of time considerations, that is, because an unlimited amount of time was not available for testing each driver, selectivity had to be exercised in choosing vision tests for inclusion in the study. As a consequence, only those tests were selected which are easily and quickly administered, and which, based on previous studies, also showed promise for "payoff." For example, "depth perception" and color vision were among those tests not chosen, because a summary of previous research (1) indicated these tests to be least likely to be related to driving performance. On the other hand, because a major visual requirement of the driving task is the perception of objects that are moving, relative to the driver, it was hypothesized that a dynamic test of visual performance, such as DVA, would be more closely related to driving performance than any static test of visual capability. It was on the basis of this hypothesis that the present study was conceived.

Driving record (accidents and convictions) was the inevitable choice as an indicator of driving performance or "driving ability," not only because it is the only indicator readily available, but also because it is the indicator of greatest practical value to the driver licensing administrator. Although driving record is at best an imperfect estimate of driving performance, at present no practical means exist for obtaining a reliable measure of driving performance for the large number of drivers required by this study. A 3-year driving record was chosen for evaluation because this is the length of time that records normally are kept by the California DMV. The use of age, sex and (quantitative) exposure as control variables also was inevitable, since all three have consistently been shown to be related to accident and conviction experience.

Because of the number and complexity of the variables chosen for evaluation, the use of a large sample of drivers was necessary to permit sufficient data for detailed statistical analysis. Consequently, a total of nearly 17, 500 drivers were tested over a 32-month period. These drivers ranged in age from 16 to 92; 62. 8 percent were male and 37. 2 percent female. Static visual acuity ranged from 20/13 to 20/200, corrected (subjects were tested with corrected vision, if they so drove). In addition, some 11, 793 non-test subjects were processed. Analysis of the composition of the test subject group reveals it to be adequately representative of California drivers as described in the 1964 California Driver Record Study (9).

Some 3143 of the subjects were new or out-of-state drivers, and hence had not accumulated a 3-year California driving record at the time the major data analyses to be described were conducted. These "hold subjects" were kept on file, and by mid-1968, 3-year records will have been accumulated for the entire sample of drivers, and the next set of major analyses will be conducted. In addition, some 121 subjects were eliminated from the analysis because for various reasons such as illness or absence from the state they had done little or no driving in California during the 3-year period prior to their vision-testing.

The findings described, therefore, are based on the 14, 215 drivers for whom 3-year records were available at the time of analysis. Table 1 shows the age by sex breakdown of both the total test sample and the analysis sample.

METHOD OF ANALYSIS

The primary statistical technique used to analyze the data was multiple-regression analysis, which is a technique for determining that combination of factors (the "independent" or "predictor" variables) that will optimally predict another factor (the "dependent," "predicted" or "criterion" variable). While the multiple-regression technique is based on known interrelationships among variables, i. e., simple correlation coefficients, unlike the correlation coefficient it permits the assessment of each independent variable's unique contribution in the prediction of the criterion variable. This type of

TABLE 1

DESCRIPTION OF TEST SAMPLE BY AGE AND SEX

Age (years)	Total Test Sample						Test Sample With 3-Year Record					
	Males		Females		Total		Males		Females		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Under 20	1185	10.81	736	11.30	1921	10.99	457	5.13	286	5.39	743	5.23
20-24	1388	12.66	780	11.98	2168	12.41	974	10.93	526	9.91	1500	10.55
25-29	1164	10.62	668	10.26	1832	10.48	896	10.06	529	9.97	1425	10.02
30-34	1124	10.25	633	9.72	1757	10.05	937	10.52	527	9.93	1464	10.30
35-39	1120	10.22	700	10.75	1820	10.41	993	11.15	618	11.65	1611	11.33
40-44	1125	10.26	723	11.10	1848	10.57	1016	11.40	661	12.46	1677	11.80
45-49	941	8.58	646	9.92	1587	9.08	859	9.64	595	11.21	1454	10.23
50-54	861	7.85	582	8.94	1443	8.26	819	9.19	542	10.21	1361	9.57
55-59	641	5.85	381	5.85	1022	5.85	606	6.80	370	6.97	976	6.87
60-64	499	4.55	275	4.22	774	4.43	473	5.31	270	5.09	743	5.23
65-69	410	3.74	216	3.32	626	3.58	393	4.41	212	4.00	605	4.26
70-74	280	2.55	108	1.66	388	2.22	266	2.99	105	1.98	371	2.61
75-79	144	1.31	45	0.69	189	1.08	139	1.56	45	0.85	184	1.29
80 and over	81	0.74	20	0.31	101	0.58	81	0.91	20	0.38	101	0.71
Total	10963	99.99	6513	100.02	17476	99.99	8909	100.00	5306	100.00	14215	100.00

analysis permits utilizing the multiple-predictor approach to the prediction of driving record, an approach which is most practical from the standpoint of driver licensing agencies.

In order to keep the size and complexity of the multiple-regression analyses within reasonable limits, not all of the many study variables were included for evaluation. (These same considerations dictated the use of a linear regression model instead of a curvilinear model, which would probably have been more appropriate.) For example, of the three tests for static visual acuity used in the study, only one (Ortho-Rater) is included in the analyses; similarly, only one of the four dynamic visual acuity target velocities was chosen to represent DVA. The dependent variables used in the regression analyses were (a) binocular Ortho-Rater static visual acuity (O-R); (b) 90°/second dynamic visual acuity (DVA); (c) total lateral visual field (FIELD); (d) lateral phoria (PHORIA); (e) glarimeter threshold (THRESH.); (f) glare recovery (REC.); (g) Age (AGE); (h) average annual mileage (MILEAGE); and (i) sex (M,F).

Separate regression analyses were performed for males and for females for each of two dependent variables: (a) number of convictions in three years (CONV.), and (b) number of DMV accidents in three years (DMV ACC.). Finally, for each dependent variable, the regression analysis was conducted two ways, once with the other dependent variable included as a predictor variable and once without. Thus, eight separate regression equations are under consideration.

In performing these regression analyses, the 14, 215 analysis subjects (those with complete 3-year records) were randomly divided into two equal groups, one group for use in developing prediction (multiple-regression) equations, and the other group for use in validating these equations ("cross-validation"). An equation that indicates the relative contribution of each independent variable in predicting a given dependent variable was developed on the first half of the sample and then used to predict or estimate the magnitude of that dependent variable for the subjects in the second half of the sample. The degree to which these estimates correlate with the true values obtained for the second half of the sample is a measure of the predictive validity of the regression equations.

FINDINGS

Due to the massive number and variety of data analyses performed in the course of the study, only a brief summary of the findings can be given here. The reader is referred to the original report (5) for detailed results of the study.

Figures 1 through 12 graphically depict the simple interrelationships between several driving record variables and age and sex. The terms used in these figures are defined as follows:

Convictions—all convictions for traffic citations, regardless of type and regardless of whether connected with an accident, received by the DMV from the courts. A single

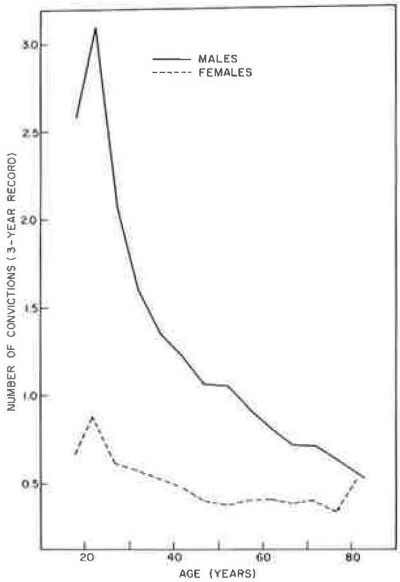

Figure 1. Conviction frequency by age and sex.

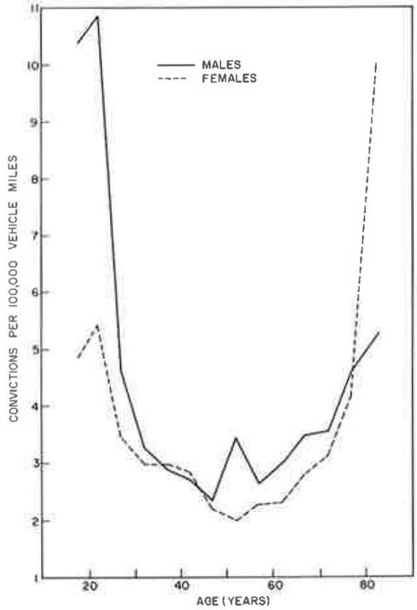

Figure 2. Conviction rate by age and sex.

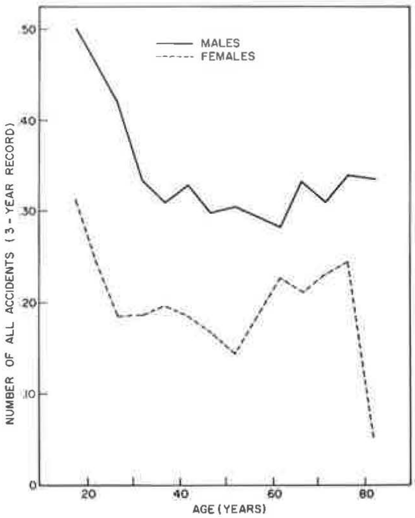

Figure 3. All accident frequency by age and sex.

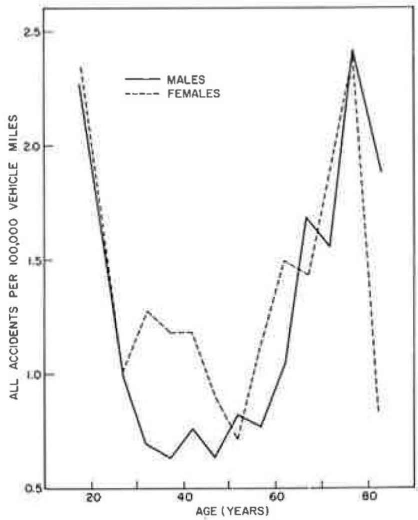

Figure 4. All accident rate by age and sex.

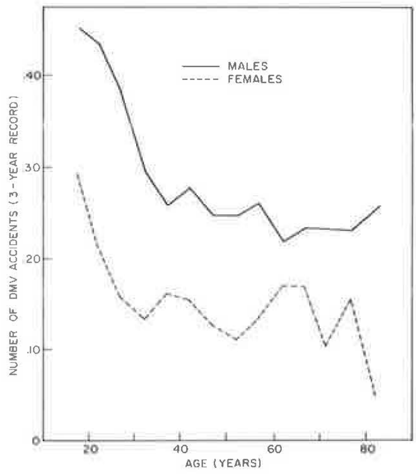

Figure 5. DMV accident frequency by age and sex.

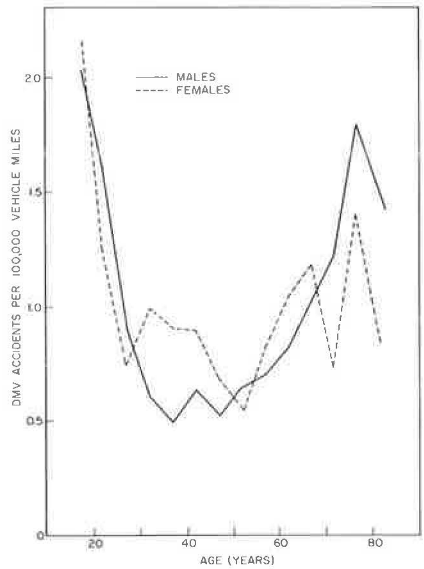

Figure 6. DMV accident rate by age and sex.

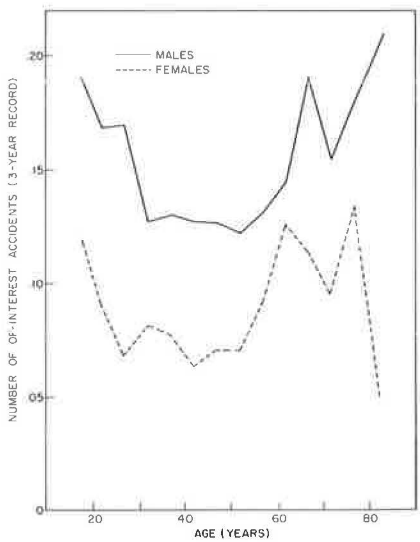

Figure 7. Of-interest accident frequency by age and sex.

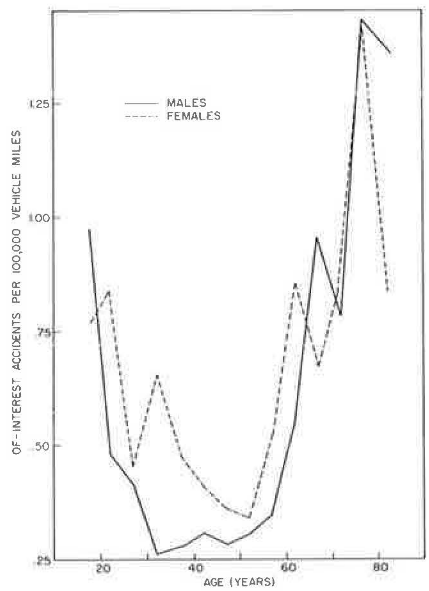

Figure 8. Of-interest accident rate by age and sex.

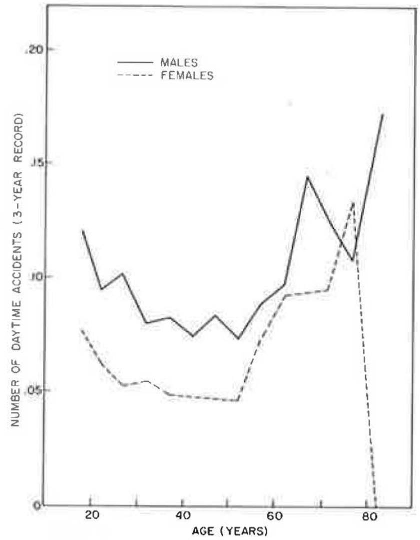

Figure 9. Daytime accident frequency by age and sex.

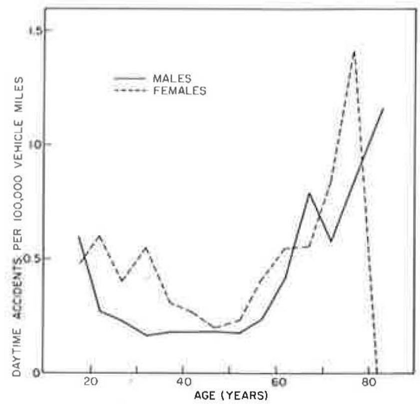

Figure 10. Daytime accident rate by age and sex.

conviction (or citation) may involve more than one violation of the Calfornia Vehicle Code. (No data analysis by type of violation has yet been conducted, although this information is available for each subject.)

All Accidents—all accidents, regardless of type or culpability, on record in DMV and/or insurance files.

DMV Accidents—all accidents, regardless of type or culpability, on record in the DMV files. (This measure includes approximately 85 percent of All Accidents, and is the better measure to use when comparing subject groups since insurance information, which is included in the All Accidents measure, was available for only some 38.4 percent of the analysis sample of 14,215.)

Of-Interest Accidents—all accidents (regardless of culpability and from whatever source) except those types in which vision in all likelihood did not play a part, or those accidents whose type was undeterminable.

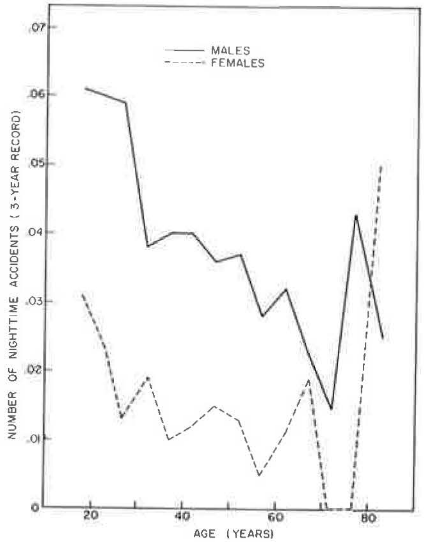

Figure 11. Nighttime accident frequency by age and sex.

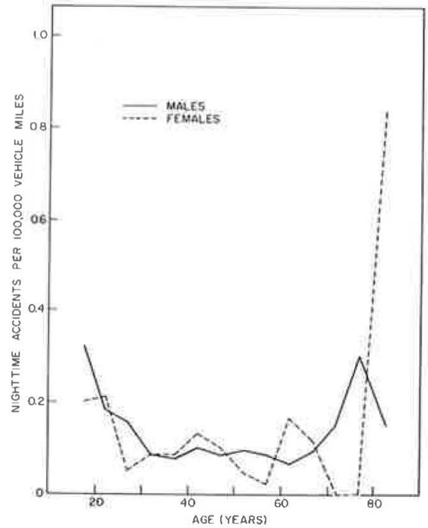

Figure 12. Nighttime accident rate by age and sex.

Daytime Accidents—all of-interest accidents that definitely occurred during daylight hours. (Dawn and dusk accidents are eliminated, and will be studied separately in future analyses.)

Nighttime Accidents—all of-interest accidents that definitely occurred during hours of darkness.

From inspection of the graphs it is obvious that, in general:

1. Young drivers tend to have poor driving records, whether frequency or rate is considered. Older drivers have poor driving records when rate is the consideration, but when frequency alone is considered, older drivers are generally only slightly worse than middle-aged drivers.

2. With regard to sex differences, males have poorer driving records than females in terms of frequency, but not in terms of rate (with the sole exception of conviction rate, for which the female record is slightly, but statistically significantly, better*). As a matter of fact, for all but nighttime accidents, accident rates for females in the middle age groups are significantly worse than those for the corresponding male age groups.

3. The graphs reflect the findings of other data analyses which show that older drivers drive proportionately less at night than do younger drivers, and women drive proportionately less at night than do men.

In addition, among the large number of product-moment correlations computed as part of the regression analyses, the following relationships are of interest (all statistically significant at the 0.05 level or better):

1. DMV accident frequency increases with increasing conviction frequency ($r = 0.292$).

2. DMV accident rate increases with increasing conviction rate ($r = 0.646$).

3. Both DMV accident and conviction frequencies increase with increased average annual mileage ($r = 0.154$ and 0.302, respectively).

4. Both DMV accident and conviction rates decrease slightly with increased average annual mileage ($r = -0.074$ and -0.057, respectively).

With regard to the multiple-regression analyses, space does not permit presenting and discussing the actual regression equations that were developed; however, it is possible to assess the relative contribution of the significant independent variables (i.e., those independent variables whose contributions to the prediction are statistically significant at the 0.10 level) to prediction of the dependent variable by comparing the squared beta coefficients of each variable in each equation. Table 2 presents this information for the eight half-sample equations developed.

Table 3 is a summary that presents, for each of the eight prediction equations, the multiple correlation coefficient (R), the "index of determination" (R^2)**, and the cross-validity coefficient (r). For purposes of comparison, Table 3 also includes the "terminal" multiple correlation coefficient (R_T), which is the R obtained when all of the independent variables listed earlier, regardless of the level of significance of their contributions, are left in the multiple regression equation. All correlation coefficients in Table 3 are significant at the 0.01 level.

Once the prediction equations had been generated on the first half of the subject sample, and validated on the second half, the same regression analyses were performed on the full analysis sample of 14,215 test subjects as a check on the consistency of the data. To provide a comparison with the half-sample data in Table 2, Table 4 shows the

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*It has been suggested that this finding may be the consequence of differential enforcement as a function of sex. No definitive information on this point is readily available.

**This represents the amount of variation in the predicted (dependent) variable associated with variation in the predictor (independent) variables.

TABLE 2

RELATIVE CONTRIBUTION OF SIGNIFICANT VARIABLES IN MULTIPLE-REGRESSION PREDICTION EQUATIONS (HALF-SAMPLE)
(Cell entry is beta coefficient squared × 100)

Significant Independent Variable	Predicting No. of DMV Accidents				Predicting No. of Convictions			
	Without No. of Conv.		With No. of Conv.		Without No. of DMV Acc.		With No. of DMV Acc.	
	M	F	M	F	M	F	M	F
CONV.			6.686	4.640				
DMV ACC.							4.964	4.440
MILEAGE	1.818	1.086	.604	.442	4.702	2.994	3.489	2.300
AGE	1.346	.785	—	.363	11.835	1.569	10.123	2.781
DVA	.332	—	—	—	1.010	.169	.768	—
O-R	—	.356	—	.312	—	—	—	—
REC.	—	.125	—	—	—	—	—	—

TABLE 3

MULTIPLE CORRELATION AND VALIDITY COEFFICIENTS FOR PREDICTION EQUATIONS (HALF-SAMPLE)

Coefficient	Predicting No. of DMV Accidents				Predicting No. of Convictions			
	Without No. of Conv.		With No. of Conv.		Without No. of DMV Acc.		With No. of DMV Acc.	
	M	F	M	F	M	F	M	F
R	.169	.144	.287	.253	.381	.210	.440	.294
R^2	.028	.021	.082	.064	.145	.044	.193	.087
r	.144	.087	.276	.234	.358	.280	.422	.347
R_T	.171	.148	.290	.256	.382	.214	.441	.297

TABLE 4

RELATIVE CONTRIBUTION OF SIGNIFICANT VARIABLES IN MULTIPLE-REGRESSION EQUATIONS (FULL-SAMPLE)
(Cell entry is beta coefficient squared × 100)

Significant Independent Variable	Predicting No. of DMV Accidents				Predicting No. of Convictions			
	Without No. of Conv.		With No. of Conv.		Without No. of DMV Acc.		With No. of DMV Acc.	
	M	F	M	F	M	F	M	F
CONV.			6.462	4.977				
DMV ACC.							5.059	4.511
MILEAGE	1.382	.952	.414	.267	4.411	4.197	3.369	3.385
AGE	1.361	.602	.109	.115	10.887	2.284	9.222	1.776
DVA	.234	.094	.070	—	.535	.109	.395	.070
O-R	—	—	—	—	.055	—	.050	—
REC.	—	.088	—	.069	—	—	—	—
FIELD	—	—	—	—	—	.102	—	.071
R =	.157	.121	.284	.247	.370	.244	.432	.322

squared beta coefficients of each significant variable (as defined in connection with Table 2) in the eight full-sample equations. Table 4 also includes the multiple correlation coefficients (R) attained with inclusion of these significant variables, for comparison with the half-sample R's given in Table 3.

All of the significant relationships expressed by the beta coefficients in Tables 2 and 4 are in the "expected" direction. That is, in every equation, driving record worsens with increasing mileage, decreasing age, and worsening vision.

From Tables 2 and 4 it is clear that, in general, the results of the half-sample and full-sample analyses are remarkably similar, indicating a relatively high degree of consistency in the data and thereby increasing confidence in the validity of the results. Also, as shown in Table 3, the cross-validity coefficients obtained in the half-sample analyses correspond quite well to the multiple correlation coefficients, again suggesting adequate consistency in the data and the lack of any major spurious elements. The small differences between the multiple correlations (R) and the "terminal" multiple correlations (R_T) demonstrate how little the non-significant variables contribute to prediction. It should be pointed out, of course, that no attempt was made to maximize prediction by utilizing all of the many variables involved in the study. The regression analyses performed were intentionally confined to specific vision variables plus the

control variables of age, sex, and mileage. Based on the data summarized in all three tables, it may be said that:

1. Convictions are more predictable than accidents (due, no doubt, to their less complex causative structure).
2. Inclusion of a driving record variable in the equation for predicting another driving record variable substantially increases the validity of that prediction and, generally speaking, the driving record variable is the predictor contributing the most to the overall prediction.
3. Among non-driving record predictor variables, mileage, and then age, contribute the next most significant amounts to the prediction.
4. Among vision variables, the results support the original research hypothesis by showing that dynamic visual acuity is by far the most consistent contributor to prediction, followed (at some distance) by static acuity, glare recovery, and visual field. The two remaining vision variables (glarimeter threshold and phoria) do not appear to make a significant contribution to prediction of a driving record variable; this does not imply that they might not contribute significantly in prediction of specific accident types, a possibility that future analyses will examine. The relationship between sighting dominance and driving record has not yet been evaluated.
5. Major differences between males and females are noted; driving record variables are much more "predictable" for males than for females and, with rare exception, individual variables contribute less to prediction for females than for males.

Finally, it should be mentioned that exploratory regression analyses of different age groups strongly suggest the existence of major differences in the predictability of driving record variables as a function of age. Future analyses will investigate this in detail.

RECOMMENDATIONS

Need for Continued Analyses of These Data

While it is not expected that the major conclusions of the present study will be altered to any significant extent, important supplemental information will be gained when the following additional research is carried out utilizing data accumulated in the study:

1. Conduct detailed analyses of the total test sample (including the 3143 "hold" subjects) to determine more precisely the effects of age and qualitative exposure on driving record variables.
2. Conduct detailed analyses to determine the relationships between both vision and non-vision variables and specific accident types, as well as specific types of convictions.
3. Conduct detailed analyses of the relationships between driving record and the many variables which were not included in the analyses presented in this report, including such things as smoking habits, occupation, hours of sleep (in relation to vision performance), and so on.
4. Continue accumulating driving record information for all 17, 500 test subjects to provide a broader and more reliable indication of driving performance, repeating the analyses already conducted and adding new ones to ascertain such things as predictability of non-concurrent driving record, relationships between different 3-year driving record periods, relationship (if any) between driving records before and after testing, changes in driving record with age, and suggested criteria (e. g., cut-off scores for vision tests) for acceptance or rejection of driver license applicants.

Need for Additional Research

1. Efforts should be directed toward developing a more compact, less expensive and equally reliable test of dynamic visual acuity, in order to permit the use of DVA as a supplement to or replacement for static acuity testing for driver license applicants. Such a test should be designed to permit measurements under a range of illumination levels.

2. In conjunction with the preceding, basic research should be conducted to determine the primary components of DVA, to ascertain whether performance on a battery of simple, reliable, inexpensive and already standardized tests can be used as an adequate substitute for performance on a DVA test.

3. An attempt should be made to develop an accurate, reliable, and easily administered test of "night vision," for possible inclusion in the vision-screening procedure. Such a test should include threshold and glare recovery measurements as a minimum and, if possible, both form-recognition and acuity testing under both static and dynamic conditions.

Practical Applications of the Results of the Study

Based on information generated thus far, and until future research dictates otherwise,

1. The currently universal use of static acuity vision testing as a prime aspect of the driver licensing procedure is justified, and should continue at least until a DVA test is commercially available.
2. Consideration should be given toward more comprehensive visual evaluation for driver license applicants. Included in this visual evaluation should be tests of static and/or dynamic acuity, lateral visual field and, possibly, night vision as well. Well-standardized acuity and visual field tests are already available. Utilization of a DVA and night vision test must await development of the apparatus suggested earlier. Planned analyses of study data to be performed within several months will permit suggesting required performance levels on these tests to be included in driver licensing standards. (It must be emphasized that these suggestions are based solely on the research results; any decision to increase the scope of present vision evaluation procedures must, of course, be heavily influence by time and budget considerations that fall outside the province of this report.)
3. Based on the results of these comprehensive visual tests, issue appropriately restricted driver licenses. For example, applicants with very poor glare recovery and/or low-illumination vision could have their night driving restricted to the relatively better lighted urban areas.
4. Because of the rapid deterioration of visual capabilities with increasing age, a finding discussed in separate publications (3, 6, 7), consideration should be given to the institution of more frequent licensing (i. e., vision testing) and consequently, shorter term licenses, for older drivers. (Future analyses will permit more accurate recommendations as to whether this more frequent testing should begin at a certain age, or at the point where the individual driver's vision has deteriorated to a specified level.)
5. Based on the criterion of driving record (rather than visual performances), younger drivers (e. g., under 25) should be given shorter term licenses.
6. Based on the present results, as well as on the results of future analyses, consideration should be given to the feasibility of establishing differential renewal periods and degrees of license restriction based on predictive equations. Variables to be included in such predictions include those shown to be significant in the present study, as well as those that may be revealed as significant in future analyses.

In conclusion, it should be said that experience gained in conducting the study has made abundantly clear the strong desirability of having a complete, detailed and centrally located source of information on driver record. That is, it is felt that a central (state or, preferably, national) record file should be established containing basic details for every conviction, and every accident for which a report has been made (to whatever governmental or private organization or agency). This file should be maintained in such a fashion that ready access to driver record information can be provided for operational and research purposes.

ACKNOWLEDGMENT

This paper is a condensed version of a detailed, limited-distribution report published earlier (5); for more information concerning specific aspects of the study, the reader is

referred to the original report as well as to the other publications listed in the References. Data collection and analysis costs for the study herein described were partially borne by the U. S. Public Health Service and by the State of California and U. S. Bureau of Public Roads. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of either the sponsoring agencies or the California Department of Motor Vehicles.

REFERENCES

1. Burg, A. An Investigation of Some Relationships Between Dynamic Visual Acuity, Static Visual Acuity and Driving Record. Department of Engineering Report No. 64-18, University of California, Los Angeles, April 1964.
2. Burg, A. Apparatus for Measurement of Dynamic Visual Acuity. Perceptual and Motor Skills, Vol. 20, pp. 231-234, 1965.
3. Burg, A. Visual Acuity as Measured by Dynamic and Static Tests: A Comparative Evaluation. Jour. Applied Psychology, Vol. 50, No. 6, pp. 460-466, 1966.
4. Burg, A. Some Preliminary Findings Concerning the Relation Between Vision and Driving Performance. Jour. American Optometric Assn., Vol. 38, No. 5, pp. 372-377, 1967.
5. Burg, A. The Relationship Between Vision Test Scores and Driving Record: General Findings. Department of Engineering Report No. 67-24, University of California, Los Angeles, June 1967.
6. Burg, A. Light Sensitivity as Related to Age and Sex. Perceptual and Motor Skills, Vol. 24, pp. 1279-1288, 1967.
7. Burg, A. Lateral Visual Field as Related to Age and Sex. Jour. Applied Psychology, Vol. 52, No. 1, pp 10-15, 1968.
8. Burg, A., and Coppin, R. S. Visual Acuity and Driving Record. Highway Research Record 122, pp. 1-6, 1966.
9. The 1964 California Driver Record Study. California Dept. of Motor Vehicles, Div. of Administration, Parts 1-8, Dec. 1964-March 1967.