STATE OF CALIFORNIA
DEPARTMENT OF MOTOR VEHICLES

AN EVALUATION OF THE IMPACT OF CALIFORNIA'S DRIVING PERFORMANCE EVALUATION ROAD TEST ON TRAFFIC ACCIDENT AND CITATION RATES

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Licensing Operations Division
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This evaluation is the final stage of a project to develop and evaluate the driving performance evaluation (DPE) drive test for possible statewide implementation in California. This study and earlier studies in the series are part of a more extensive effort by the department to increase the competency of California motorists by improving the driver licensing process. The DPE is currently being used in over 60 field offices in southern California.

The effect of the DPE on accident and citation rates was determined by comparing driving records for a sample of applicants taking the DPE with those of a sample of applicants taking the current drive test both before and after implementation of the DPE.

Logistic regression analysis was used to compare the crash and citation rates of the groups during the 2 years immediately following driver license application. The findings failed to substantiate any reduction in accident involvements or traffic law violations resulting from implementation of the program. However, there is no question that the DPE is a more reliable and content-valid test. Therefore, it is recommended that the DPE road test be expanded to all offices in the state.

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PREFACE

This report presents findings of an evaluation of the safety impact of a prototype drive test piloted in 30 California Department of Motor Vehicles (DMV) field offices. The study represents the final stage of a 5-stage project designed to develop an improved competency-based drive test for possible statewide implementation. The report is being issued as an internal monograph of the DMV's Research and Development Branch rather than an official report of the State of California. The findings and opinions may not represent the views and policies of the State of California.

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EXECUTIVE SUMMARY

Background

- This evaluation is the final stage of a project to develop and evaluate a new drive test, called the Driver Performance Evaluation (DPE), for possible statewide implementation in California. The DPE is currently being used in over 60 field offices in southern California.

- Romanowicz and Hagge (1995) found evidence that the DPE has construct validity. These authors reported that experienced drivers performed significantly better on the test than did inexperienced drivers or drivers with physical or mental abilities that may have affected their driving.

- An earlier study by Hagge (1994) evaluated the reliability of the DPE in six field offices used in a prior evaluation of the traditional drive test conducted by Shumaker (1994) and Williams and Shumaker (1994). Hagge reported the DPE to be a much more reliable test than the current drive test.

- The above studies and the current study are part of a more extensive effort by the department to increase the competency of California motorists by improving the driver licensing process.

- Previous evaluations of driving tests have measured the correlation between test scores and subsequent accident rates. In contrast to previous studies, the current evaluation was designed to determine whether applicants who are required to pass the DPE exhibit lower subsequent traffic accident and citation rates than do applicants who take the standard test. That is, the present evaluation attempted to measure a treatment effect (e.g., accident reduction) rather than a correlation between test performance and accident rates.

Study Objective

The objective of this study was to determine whether the DPE program resulted in a decrease or increase in the risk of traffic accident involvement and/or law violations subsequent to license application.

Methods

- Four independent groups of original driver license applicants were selected for this study:

  (1) 136,135 applicants who were administered the DPE in the 30 southern California field offices that had implemented the new test.

  (2) 110,412 applicants who were administered the standard drive test in the same 30 southern California field offices before implementation of the DPE.

  (3) 63,125 applicants who were administered the standard drive test in a comparable group of northern California field offices during the same time period before implementation of the DPE.

  (4) 84,429 applicants who were administered the standard drive test in the same northern California field offices during the same time period after implementation of the DPE.

- Logistic regression analysis was used to compare the study groups on traffic accidents, fatal/injury accidents, and total traffic citations during the 2 years immediately following driver license application. The driver license application date was selected as the reference date to capture any effect on the traffic safety measures due to delay of licensure attributed to the DPE program.

  The independent variables included a linear set of covariates, office region (northern vs. southern), field office within region (28 northern offices and 30 southern offices),

time of application (pre-DPE vs. post-DPE), region by time of application interaction, and time of application by office interaction within region. The primary effect of interest in the analyses was the interaction between region and time of application. This interaction effect addresses whether the change in accident risk for southern offices following implementation of the DPE differs from that for northern offices over the same time periods.

Results

Total accidents. For the total accident criterion, the region by time of application interaction was not statistically significant ($\chi^2 = 0.2493$, $p = .62$).

- The odds ratio computed for applicants in the northern region was 1.03, indicating that the odds of accident involvement for northern applicants was 1.03 times higher in the pre-DPE period than in the post-DPE period. Both groups of applicants within the northern region received the standard non-DPE drive test. The odds ratio for the southern region applicants was 1.04. This value indicates that the odds of accident involvement for southern applicants receiving the standard drive test during the pre-DPE period was 1.04 times higher than the odds of accident involvement for southern applicants receiving the DPE drive test during the post-DPE period. The adjusted accident involvement rates underlying these odds ratios are shown in the figure below.

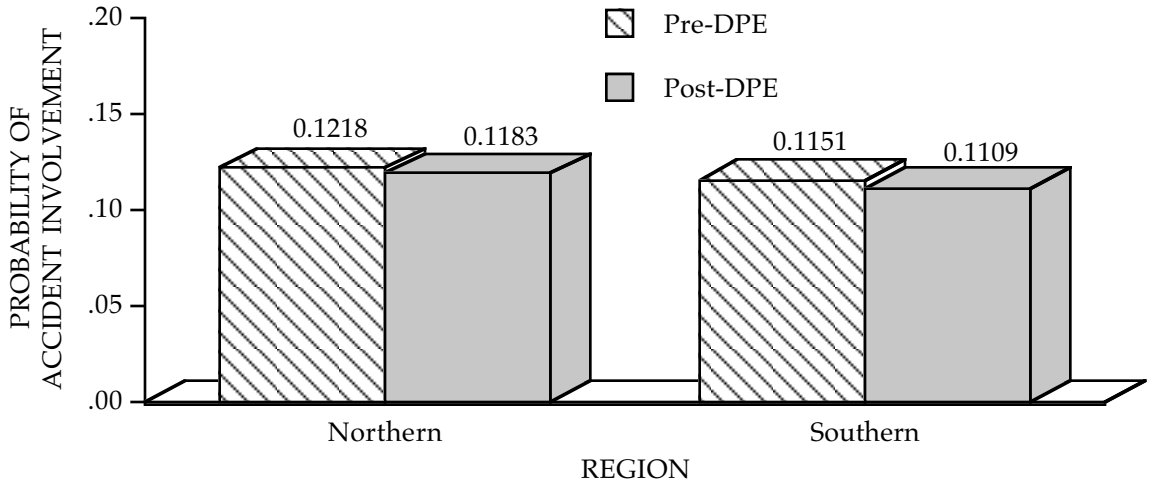

Figure. Adjusted 2-year total accident probability by region and time of application

- The similarity of the odds ratios over time for the two regions reflects the lack of a statistically significant interaction between time and region. However, the results are directionally supportive of a positive impact of the DPE with a greater risk reduction over time shown for southern offices exposed to the DPE.

Fatal/injury accidents. A second set of analyses focused on the fatal/injury accident criterion. As was the case for total accidents, the effect of interest was the region by time of application interaction. The results showed that the region by time of application interaction was not statistically significant ($\chi^2 = 0.0515$, $p = .82$).

- A comparison of the change of fatal/injury accident odds from pre to post within region yielded an odds ratios of 1.04 for each region, which reflects the absence of a significant period by area interaction.

- The lack of a statistically significant interaction between region and time for the fatal/injury accidents criterion is consistent with the findings for total accidents.

Total citations. The results from the logistic regression analysis for total citations showed that the region by time of application interaction was not statistically significant ($\chi^2 = 0.2997$, $p = .58$).

- The odds ratio computed from the regression equation for the northern region was 1.11. The value implies that the odds of citations for northern applicants is 1.11 times higher in the pre-DPE period than in the post-DPE period. Both groups of applicants received the standard non-DPE drive test. The odds ratio computed for the southern region applicants was 1.10. This value indicates that the odds of citations for southern drivers were 1.10 times higher before DPE implementation than they were after.

- As was the case for the two accident criterion measures, the similarity in the odds ratios for the two regions reflects the absence of a significant interaction effect for total citations.

Conclusion

Because the DPE as evaluated in this study is longer in time than the standard road test and had additional maneuvers, such as a freeway driving component, it is a more costly program requiring a more extensive allocation of resources than is required for the standard road test.

The failure in this study to demonstrate any bottom-line benefits to offset program costs makes it difficult to recommend that the department reinstate the freeway maneuvers and expand the original DPE statewide. However, there is no question that the method of testing (route selection and scoring procedures) produces a more reliable and "content valid" test than does the current testing procedure. It is therefore recommended that the department expand the DPE scoring procedures to all offices of the state.

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INTRODUCTION

This evaluation constitutes the final stage (Stage 5) of a project to develop and evaluate a new drive test for possible statewide implementation in California. The study was conducted to assess the impact of the new test on traffic safety.

The Stage 4 study (Romanowicz & Hagge, 1995) found evidence that the new test, called the Driving Performance Evaluation (DPE), has construct validity. In that study, experienced drivers performed significantly better on the test than did inexperienced drivers or drivers with physical or mental abilities that may have affected their driving. The authors also reported that accident-involved drivers tended to receive lower test scores than did accident-free drivers, although the difference was not statistically significant ($p = .17$). The authors cautioned that the failure to find a significant relationship between test performance and accidents could be attributed to low statistical power resulting from the small number of subjects ($n = 42$) in the accident group and to the large stochastic component inherent in accident involvement.

The Stage 1 study (Shumaker, 1994) assessed the reliability of the department's current drive test in six field offices. The six offices were selected from a group of 30 pre-Stage 1 candidate study offices that were considered representative of field offices statewide (Williams & Shumaker, 1994). A prototype of the DPE was piloted in Bellflower, Laguna Hills, Sacramento, and South Sacramento field offices in Stage 2 (R. A. Hagge, internal memo, September 24, 1993). The Stage 3 study (Hagge, 1994) evaluated the reliability of the DPE in the six field offices used for the Stage 1 study and found it to be much more reliable than the current drive test. It also provided information for further improving the DPE prior to the pilot for the current study.

The above studies, and this one, are an integral part of a more extensive effort by the California Department of Motor Vehicles (DMV) to increase the competency of California drivers by improving the driver licensing process. As a first step, the department commissioned a study to evaluate the needs and requirements of the California driver licensing program (McKnight & Stewart, 1990). Following that study, DMV hosted the "Conference on Driver Competency," a seminar designed to obtain input from selected experts on driver licensing and driving behavior. The department's driver competency-enhancement plan, which calls for the development of a more reliable and valid drive test, is presented in the epilogue to the conference proceedings report (California Department of Motor Vehicles, 1990).

Description of the DPE

The DPE is based on the driver performance assessment model for commercial road tests described in a report by Mackie et al. (1989). It is currently being used in over 60 field offices in southern California. The following comparison of the characteristics of the DPE to those of the department's non-DPE drive test still being used in northern California is taken from the Stage 3 report (Hagge, 1994).

Characteristic	Current drive test	DPE
Content	Narrow in scope and insufficiently challenging.	Represents common traffic conditions, including freeway driving. Emphasizes proper search of the traffic environment.
Vehicle check list	Not printed on score sheet.	Printed on score sheet.
Mechanical knowledge	--	Expanded.
Skills test	Not standardized and may be conducted during on-road testing.	Standardized and conducted before on-road testing.
On-road test	Scored in seven error categories. Errors on the same type of maneuver are marked in different areas on the score sheet.	Scored in six maneuver categories. Errors on the same type of maneuver are marked in one area on the score sheet.
Scoring	Indefinite number of possible errors. Every observed error is marked no matter where it occurs.	Fixed number of possible errors. Maneuvers are scored only at predetermined locations. Disqualifying errors are scored anywhere.
Length	Typically too short (10-15 minutes) to adequately sample relevant driving conditions.	DPE is 5 - 10 minutes longer than the current test.
Training	Examiners taught to look for errors at all times. Does not teach a standard scoring strategy.	Examiners taught to observe specific maneuvers at specific places and times. Teaches standard scoring criteria.

Subsequent to the completion of the data collection phase of this project, freeway driving and the turn-and-stop skill test were temporarily dropped from the DPE due to budgetary workload constraints. Therefore, the results presented in this report represent the DPE as originally designed. (The DPE test administration and scoring protocols are presented in Appendix I.) The policy implications of this distinction are discussed in a subsequent section of this report.

Study Objective and Evaluation Paradigm

The literature contains a large number of correlational studies on the validity of road tests as instruments for predicting driver accident rates or differentiating between accident-free and accident-involved drivers. These studies have invariably found little or no association between road test scores and accident rates per mile driven or per driver year. There are a large number of reasons for these negative findings. There is no need to discuss them here because the focus of this study is on the function of a test in enhancing driver competency rather than screening out drivers who are predicted to be at high risk of having accidents. As noted by McKnight and Stewart (1990) and Peck (1994), the objective of DMV road tests is to assure that a driver demonstrates an acceptable level of competency before being licensed. This, in turn, influences the amount of practice and training needed to pass the test. In addition, drivers who failed are not licensed until the road test is passed. To the extent that the road test exerts

these effects, any correlation between test performance and subsequent accident rates will be attenuated. The following quote from Peck (1994) illustrates this paradox:

> *Although it is frequently assumed that the ultimate criterion of the validity of a road test is the ability to correlate with the subsequent accident rates of drivers, this paradigm is flawed for several reasons, the most important of which is the fact that the test's existence and pass-fail threshold operate to motivate the acquisition of the requisite knowledge and skill before the test is taken. In addition, those failing the test often retake and pass the test after additional practice. The result of this process is both to elevate and homogenize the competency level of the licensed driving population.*
>
> *This does not mean that a licensing test should not be designed to achieve a safety impact, but rather that the method of establishing that impact cannot be done through traditional correlational analyses. What would be required to establish the tests' safety impact is an experimental design in which the test requirements were waived for a large random sample of the driving population, or conversely, imposing a road test as an additional licensing requirement in a jurisdiction which previously did not require passing a road test. If the road test has safety value, one would expect the tested group to have fewer accidents than the non tested group. This, of course, is an entirely different question than that of the correlation between the test scores of applicants with their subsequent accident rates.*

Recognition of the above has important implications on the type of research design that is required to demonstrate the ultimate validity of a road test or, in this instance, the comparative validities of two tests—the standard test versus the DPE. Rather than measuring the correlation between test scores and subsequent accident rates, the need is to determine whether drivers who are required to pass the more difficult and more reliable test (DPE) exhibit lower subsequent accident rates than do those who take the standard test. In other words, the study objective was to measure a program treatment effect (accident reduction) rather than a correlation between test performance and accident rates.

Very few studies have attempted to measure the "treatment effect" of a road test. In fact, only one such prior study has been documented—a California study by Ratz (1978). That study failed to demonstrate a significant effect, but the experimental test used was not comparable to the DPE, and the study had very low statistical power for detecting an effect on accident rates.

METHODS

Study Groups

Four independent groups of original driver license applicants were selected for this study:

(1) Applicants who were administered the DPE in the 30 southern California field offices that had implemented the new test.

(2) Applicants who were administered the standard drive test in the same southern California field offices before implementation of the DPE.

(3) Applicants who were administered the standard drive test in a comparable group of northern California field offices during the same time period before implementation of the DPE.

(4) Applicants who were administered the standard drive test in the same northern field offices during the same time period after implementation of the DPE.

The four applicant groups were obtained through a two-step selection process. The first step involved the selection of all original driver license applicants throughout the state during specific time periods before and after DPE implementation. The second step involved the selection of a sample of northern (non-DPE) field offices that would provide a similar group of applicants for comparison to the applicants receiving their drive tests in the 30 southern DPE offices. The following sections describe the selection process in more detail.

Subject Selection and Data Collection

The available subject pool for the study consisted of 817,556 individuals who applied for an original driver license during one of two time periods. The first time period was January through June of 1993. During this pre-DPE time period, 362,680 applicants applied for a California driver license. The second time period was January through June of 1995. During this post-DPE time period, 454,876 applicants applied for a driver license.

All potential study subjects were identified from a search of the department's automated driver license (DL) master file. Applicants whose records indicated that they received a drive test waiver (usually because they were already licensed in another state) were excluded as study subjects. Although it was desirable to limit the subject pool to drivers who were on the first drive test attempt of their first application for a license, a small, indeterminate number of applicants in each study group may actually have been on their second or subsequent application as of the driver record extract date. It was not possible to identify and remove these latter applicants from the analyses. However, any bias that may have resulted from including them is believed to be slight.

It should be noted that the number of applicants in the pre-DPE time period may be slightly underrepresented. It is estimated that fewer than 5% of the drivers who applied during this period were not captured because they had renewed their license prior to the extract date and therefore were not identified as original applicants. However, any bias attributed to the underrepresentation is probably slight because the loss of subjects would have occurred in the northern and southern regions equally.

Data on demographics and subsequent driving incidents were gathered for all applicants. The data are of two types. The first type is subject-specific (driver age,

gender, etc.). These data were gathered from the DL master file. The license application date served as the reference or "zero date" for counting driver-record entries. The driver license application date was selected as the reference date to ensure that any effect on the traffic safety measures due to delay of licensure attributed to the DPE program would be captured. The driver records for the analyses cover 2 years after the application date. In order to accumulate complete 2-year driver records for both the pre- and post-DPE time periods, a final data extraction was made on October 9, 1997.

The second type is aggregate- or ecological-level data. These data provide information about the driving localities and social context in which the drivers live and presumably do most of their driving. It is important to note that the aggregate-level data do not provide information about the individual driver because each driver residing in the same area or ecological unit receives the same value—i.e., the mean value for the unit. The aggregate-level data are grouped by ZIP Code. Some of these data were gathered from the 1990 U.S. Census. Examples of the census-based data include percentage of drivers aged 55 years and older, median family income, and average level of education. Other aggregate-level data were derived from individual driver record data gathered from the DL master file (grouped by ZIP Code of residence). Examples of these data include the 3-year total accident rate and the 3-year total traffic citation rate for each ZIP Code area, averaged over a 3-year period surrounding the license application date. The aggregate-level variables used in this study were identified through a factor analysis of ecological accident risk predictors (D. DeYoung, internal memo, December 3, 1993).

The demographic and aggregate-level variables were used as potential covariates in the analyses. A list of these variables is provided in Appendix II.

Subsequent driving incidents involving individual subjects were used as outcome or criterion measures to evaluate the effect of the DPE program. The outcome variables included total accidents, fatal/injury accidents, and total citations that occurred within the 2 years immediately following the license application date.

Office Selection

Following the identification and selection of applicants in the two time periods, a sample of "control" field offices was selected. The criterion measures for subjects in these offices served as a comparison baseline of any changes in the criterion measures occurring for subjects in the 30 southern offices after implementation of the DPE. The analysis of driving records for applicants in non-DPE offices during the same time periods of testing in the DPE offices was designed to directly control for any biases arising from exogenous factors unrelated to the DPE program.

Figure 1 displays a map of California showing the location of field offices. Offices in Regions V–VIII are defined as residing in the southern region for purpose of this study. Those in Regions I–IV are defined as residing in the northern region. Using non-DPE offices in southern California as comparison offices was considered problematic because an unknown number of applicants who applied for a license in one of these offices may have actually taken their drive test at a DPE office. Therefore, it was decided to use only field offices in northern California as candidate control offices.

Figure 1. California Department of Motor Vehicles Regional Field Offices.

The specific offices under consideration as control offices were all Level 3, 4, or 5. (Office levels range from 1 through 5—the higher the level, generally the more driver license applicants in the office.) These offices include those in San Francisco, San Jose, and Sacramento. The geographical area in which these offices are located is similar to that for DPE offices in the sense that both are large metropolitan areas with diverse populations. Although the two regions do not each contain the same number of offices in each level, both regions include the vast majority of Level 4 and 5 offices.

An attempt was made to further reduce any pre-existing differences between subjects in the two regions by maximizing the similarity of the two groups with respect to expected accident rates. This was done through a combination of ordinary least squares (OLS) regression and the confounder score techniques of Miettinen (1976). The predicted accident score obtained for a given office can be thought of as the accident-likelihood for that office, as discussed below.

SAS statistical software (SAS Institute, 1990) was used to estimate the OLS regression equation used to compute the accident-likelihood scores for the candidate control offices. For this application, office rather than subject was the unit of analysis. The criterion variable was the office accident rate—i.e., the average rate for subjects within the given office—for the 2-year period after the license application date for subjects in the post-DPE period. The independent (predictor) variables in the equation consisted of the average age of subjects within office, the proportion of men subjects within office, and the total accident and citation rates for the 2-year period before application date for subjects within office in the pre-DPE period. A predicted total accident score derived from the equation was obtained for each potential control office.

The next step involved applying the same regression equation to obtain a predicted accident-likelihood score for each DPE office. Any candidate control office with a score that fell within the range of predicted scores obtained for the DPE offices was included in the control group. As it turned out, the ranges of mean values for the northern and southern offices were very similar, and therefore no northern offices were deleted in order to increase similarity.

The final DPE and non-DPE offices selected and used for the analyses are listed in Appendix II. The four study groups that emerged were: (1) 110,412 southern applicants who took the standard non-DPE drive test during the 1993 pre-DPE time period, (2) 136,135 southern applicants who took the new DPE drive test during the 1995 post-DPE time period, (3) 63,125 northern applicants who took the standard non-DPE drive test during the 1993 pre-DPE time period, and (4) 84,429 northern applicants who took the standard DPE drive test during the 1995 post-DPE time period. The composition of these independent groups is shown more concisely in Table 1.

Table 1

Number of Subjects by Office Region and Time Period of Application

	Time period of application	
Office region	Pre-DPE	Post-DPE
Southern (DPE)	110,412	136,135
Northern (non-DPE)	63,125	84,429

Design

This study was designed to evaluate the effects of the DPE program on subjects' subsequent driving records. Ideally, subjects would have been randomly assigned to either the DPE or standard drive test program. Theoretically, random assignment would have ensured that any treatment effect found in the analysis was caused by the DPE program and not some other variable.

Unfortunately, the use of random assignment was not possible in this study because of the way the program was implemented. Because of the quasi-experimental nature of this study, statistical adjustments of the criterion measures were made in an effort to control potential biases resulting from any such pre-existing differences between subjects and regions. The definition, selection, and use of covariates in the statistical analyses are discussed below.

Covariates are variables that are related to the outcome of interest and on which the comparison groups may differ. For example, if one group has a higher proportion of men than does another group, then the former group would be expected to have a higher subsequent accident rate, all else being equal, because men tend to have more accidents than do women. Using covariates such as gender, age, and prior driver record in the analysis accounts for the linear relationship between the covariates and the outcome measure. This, in a statistical sense, removes the effects of the covariates by equating the two groups on these measures. Although the use of covariates aids in statistically removing some of the pre-existing differences between subjects, it does not guarantee that all sources of extraneous variance have been controlled. However, the availability of accident rate data for applicants and offices in the year prior to the identification of study subjects provided an additional control for bias.

The reader should note the distinction in this study between the use of office-level measures and subject-level measures. As noted above, the selection of the comparison offices is based on office-level measures. The analysis of the effectiveness of the DPE on

traffic safety measures, on the other hand, is based on individual driving records with subjects being the unit of analysis.

Analysis

Multiple logistic regression analysis was used to compare the study groups on the accident and citation criterion measures. The logistic regression model expresses the probability that the outcome variable Y is equal to 1 (indicating the occurrence of an event such as an accident):

$$P\,(Y = 1) = \pi = e^{u}/1 + e^{u}$$

In this equation e is the base of the natural logarithms (approximately equal to 2.718) and the term u (often called the "logit") represents a linear combination of variables:

$$u = A + B_1X_1 + B_2X_2 + \ldots + B_KX_K$$

with constant A and coefficients B_j being estimated from the data and X_j being the k independent variables or predictors.

The logistic model can be rewritten in terms of the odds (rather than the probability) of the event occurring. The odds are defined as the probability that the event will occur (π) divided by the probability that it will not occur ($1 - \pi$). The equation then becomes:

$$\log\,(\pi/1 - \pi) = u = A + B_1X_1 + B_2X_2 + \ldots + B_K\,X_K$$

The above model is now similar to a linear regression model, except that the dependent variable is the natural log of the odds (i.e., the "log odds"). The estimation of the model uses the maximum likelihood technique. For a detailed discussion of maximum likelihood estimation, the reader is referred to Hosmer and Lemeshow (1989). Maximum likelihood estimates have many desirable properties, one of which is that with large samples the regression coefficients are approximately normally distributed.

Another useful measure is called the odds ratio. It represents the increase (or decrease if the value is less than 1) in the odds of an event (e.g., accident) occurring when the value of a given independent (predictor) variable increases by one unit. (The odds ratio associated with X_j is equal to e^{Bj}). For example, in the case of a treatment designed to reduce accidents, an odds ratio of 1.12 for the independent variable representing group membership (treatment vs. control) would mean that the odds of accident involvement for the untreated control group is 1.12 times (or 12%) higher than the odds of accident involvement for the treated group (assuming the group variable was coded "0" for the treatment group and "1" for the control group).

Predicted probabilities are perhaps most useful when the purpose of the analysis is to forecast the likelihood of an event, given a set of subject characteristics. If, as in the case of the present study, interest is in the impact of a treatment or independent variable(s) when controlling for the effects of other variables in the model, the odds ratio is the preferred measure. Therefore, in the following sections, the impact of the DPE on traffic accidents and citations is discussed primarily in terms of odds ratios.

For a detailed description of logistic regression analysis, the interested reader is referred to Hosmer and Lemeshow (1989) and Tabachnick and Fidell (1996).

Before developing the final logistic regression models, steps were taken to screen the data and to select the covariates to be used in the models. All data were screened to check for missing values, out-of-range values, and for skewness and kurtosis patterns. SAS statistical software programs were used to conduct the analyses (SAS Institute, 1990; SAS Institute, 1996).

There were 17 covariates available for inclusion in the logistic regression models. A multiple-step process was followed to select an optimal subset of covariates. In the first step, SAS Proc Logistic was used to conduct a number of bivariate regression analyses in which each of the three criterion variables (total accidents, total citations, and fatal/injury accidents) was regressed against each of the 17 potential covariates. An alpha level of .10 was used to assess the statistical significance of each simple correlation. Alpha level is defined as the acceptable level of risk or probability of making a Type 1 error (p), or rejecting the null hypothesis (i.e., the hypothesis of no effect) when it is true. In this study, covariates with a p value greater than .10 (indicating a greater than 10% probability that the correlation obtained was due to chance variation rather than being real) were dropped from the candidate pool.

After a reduced set of potential covariates was identified for each criterion variable, SAS Proc Logistic was used to obtain a final subset of covariates to use in each logistic regression model. Each criterion variable was regressed against its reduced set of covariates. The backward elimination process was used to evaluate the predictive power of the individual covariates. In this method, all covariates are entered in the model at the initial step. At succeeding steps, covariates were removed from the equation if their unique value in accounting for variation in the outcome measure did not meet the specified level of statistical significance ($p < .10$). At the final step, only covariates that significantly contributed to prediction remained in the final covariate set.

As stated above, multiple logistic regression analysis was used to evaluate three criterion measures reflecting driving during the 2-year period after license application date: (1) total accidents, (2) fatal/injury accidents, and (3) total citations. The question addressed in the analyses was the following: Does the change in the odds of traffic accidents or convictions over the pre- and post-DPE periods for southern applicants

following implementation of the DPE differ from that for northern applicants over the same time periods?

The logistic regression analysis for each criterion had a partial-hierarchical design, which included both crossed and nested factors. A crossed factor is one in which all levels or categories of that variable can be found within each level of all other independent variables. A nested factor, on the other hand, has its levels confined within specific levels of another independent variable. For example, in assessing the efficacy of different teaching methods, classrooms are often assigned to (nested in) one of an array of teaching methods. Since each classroom appears under only one teaching method, classroom is considered in this example as a nested rather than crossed factor. The interested reader is referred to Kirk (1968) and Winer (1971) for a detailed discussion of designs containing both crossed and nested factors.

The analyses included an assessment of the independent effects of the following factors:

- Covariates.
- Office region (northern vs. southern).
- Field office within region (28 northern offices and 30 southern offices).
- Time of application (pre-DPE vs. post-DPE).
- Region by time of application interaction.
- Time of application by office interaction within region.

In the logistic regression analyses, the effect of each factor was evaluated after adjusting for (or removing) the effects of all other factors in the model. For example, each interaction effect was assessed after adjusting for all main effects, all other interaction effects, and the effects of all covariates. Thus, each logistic regression coefficient (B_j) provides an estimate of the log odds after adjusting for (i.e., at fixed levels of) all other factors or variables.

The effect of primary interest in the study is the region by time of application interaction. At first glance, this may seem unusual because in most treatment or program evaluations, the main effect of treatment is the primary interest. Recall, however, that the inability to randomly assign applicants to test conditions resulted in a design that confounded treatment (type of test) with region (north vs. south). The existence of a program effect must therefore be inferred from regional differences in the pre-DPE versus post-DPE odds ratios. This change is tested by the region by time interaction component of the logistic regression model.

The use of field office as a fixed-effects independent variable also warrants some explanation because it bears on the external validity of the study results. External validity represents the extent to which a researcher can generalize the findings of a study and is related to the way in which the levels of the independent variable are

selected from the population. According to Keppel (1991), a fixed-effects factor is one in which the levels of an independent variable are selected arbitrarily and systematically. A factor of this type is assumed to represent the complete population of the relevant treatment levels. The statistical generalizations for a fixed-effects factor are limited to the treatment effects observed for the particular conditions. Alternatively, a random-effects factor is one in which the levels of a factor are selected either randomly or unsystematically from a larger pool of possible levels. This type of factor represents a random sample obtained from the larger population of treatment conditions.

When interpreting the results in the following section, it is important for the reader to keep in mind that the DPE offices were not selected at random. At the time of the study's implementation, the DPE was being piloted in 30 field offices residing in southern California. All of these offices were used in the study. As mentioned above, the control group of field offices was selected from northern California in a manner that would make the control group applicants as similar as possible to applicants in the 30 DPE offices on a number of covariates. Therefore, the office component was treated as a fixed-effects factor in the statistical analyses. The estimated effect sizes and p values for the hypothesis tests can only be generalized to the offices used in the study unless one can demonstrate or justify the assumption that the non sampled field offices would have yielded identical estimates.

The statistical power for the logistic regression model was estimated for each criterion measure. The power of a statistical test is the probability of rejecting the null hypothesis of no treatment effect for a given criterion when an effect truly exists. Since it is beyond the scope of this paper to present a detailed discussion of statistical power analysis, the interested reader is referred to Cohen (1988) for a detailed review of power analysis for the behavioral sciences, and to Hsieh (1989) and Whittemore (1981) for a detailed discussion of power analysis for logistic regression.

Because the effect of interest was the region by time of application interaction, the power analysis was computed for the pre-DPE vs. post-DPE logit (odds) differences for the two regions. For purposes of the power analysis, it was determined that the design should be sensitive enough to detect a 2% standardized effect size for the interaction. The effect size for the interaction is defined as the differences in the pre-post odds ratios for the two regions. The odds were standardized by dividing each one by the estimated error in the prediction model. The power for detecting the 2% effect was .99, indicating that the model has an extremely high probability of rejecting the null hypothesis of no interaction between region and time of application when, in fact, such an interaction effect actually occurred.

RESULTS

Selection of Offices

Table 2 presents the regional means on the covariates before selection of the control offices. The means are based on office-level scores rather than individual-level scores. The northern and southern regions differ considerably from each other on many of the covariates. The differences between the two regions on driver-level covariates are the most important because these variables reflect the actual history and demographic characteristics of the individual applicants themselves. Group differences on the aggregate-level covariates reflect differences in the driving environments and social contexts in which the applicants live.

Table 2

Comparison of Regional Field Office Means on the Covariates Before Selection of Control Offices

Covariate	Mean		Net difference[a]	% difference[b]	*t*	*p*
	Northern (*n* = 28)	Southern (*n* = 30)				
Driver-level (pre-DPE subjects)						
Total citations per 100	55.36	59.80	-4.44	-7.42	-1.77	.08
Total accidents per 100	14.72	14.37	0.36	2.48	0.50	.62
Age at application	24.11	25.70	-1.59	-6.17	-4.77	.00
Total applicants	2,681	8,218	-5,536	-67.38	-11.25	.00
% male	52.93	54.77	-0.02	-3.36	-3.26	.00
Aggregate driving locality						
Average total accidents in ZIP Code	13.92	15.85	-1.93	-12.16	-1.79	.08
Average total citations in ZIP Code	54.34	61.58	-7.23	-11.74	-4.04	.00
Aggregate 1990 US. Census						
% African American in ZIP Code	4.69	8.21	-3.52	-42.83	-3.07	.00
% Hispanic in ZIP Code	20.66	31.84	-11.19	-35.13	-3.89	.00
% driving alone to work in ZIP Code	74.54	72.75	1.79	2.46	1.52	.13
Mean minutes to work in ZIP Code	24.44	27.83	-3.40	-12.20	-4.12	.00
% completing elementary school as highest level of all adults in ZIP Code	11.62	14.07	-2.45	-17.40	-1.60	.11
% completing high school as highest level of all adults in ZIP Code	24.86	21.20	3.66	17.26	4.79	.00
% receiving public assistance in ZIP Code	5.08	4.00	1.08	26.90	3.11	.00
% unemployed in ZIP Code	4.71	4.52	0.19	4.18	0.62	.54
% renting in ZIP Code	39.55	48.52	-8.97	-18.48	-5.71	.00
% 55 or older in ZIP Code	19.80	16.84	2.97	17.62	3.19	.00
Median income in ZIP Code	$37,235	$41,370	-$4,135	-9.99	-2.45	.02

[a]Net difference = mean of northern region minus mean of southern region.
[b]Percentage difference is referenced to mean of southern region.

There were significant ($p < .10$) differences between offices in the two regions on four of the subject-specific covariates: Prior total citations, age at application, total number of applicants, and percentage of men applicants. Drivers in the southern region were older and more likely to be men than their northern counterparts. In addition, southern subjects had a higher rate of prior total citations and had a higher number of applicants per field office than did northern subjects.

Northern and southern applicants also differed on a number of the aggregate ZIP Code variables prior to selection of the control offices. For example, southern applicants score higher on accident and citation rates, proportion of Hispanic residents, and median income.

As stated above, an ordinary least squares regression equation was used to select control offices to minimize any pre-existing differences between subjects in the two regions that could have biased the results. The equation used to select the offices is shown below:

$$Y = 0.368842 + (.189405 * X_1) + (-0.036076 * X_2) + (-0.006294 * X_3) + (-0.114653 * X_4)$$

where Y is the predicted field office total accident rate 2 years after application date for subjects in the post-DPE period; X_1 is the field office total accident mean 2 years after application date for subjects in the pre-DPE period; X_2 is the field office total citation mean 2 years after application date for pre-DPE subjects; X_3 is the average age of pre-DPE subjects in the field office; and X_4 is the proportion of male pre-DPE subjects in the field office.

The selection was based on whether each candidate control office had an accident risk score from the equation that fell within range (plus or minus one standard deviation) of the risk scores for the 30 DPE offices. The application of the equation resulted in the selection of all 28 northern California offices. The predicted scores generated from the equation ranged from 0.13143 to 0.17495 for the DPE offices and from 0.13452 to 0.18577 for the selected control offices. The predicted risk score for each office and the number of applicants processed in each office are presented in Appendix III.

Table 3 describes the covariate measures for the two regions following selection of the 28 northern offices. A comparison of entries in Table 3 with those in Table 2 suggests that the selection substantially reduced the regional mean differences on several covariates. For example, the difference between the prior citation means for the two regions was -4.44 ($p = .08$) before the selection and only 0.01 ($p > .99$) after the selection. Likewise, on ZIP Code total accidents, the mean difference was -1.93 ($p = .08$) before selection and 0.64 ($p = .22$) after selection.

Table 3

Comparison of Regional Field Office Means on the Covariates After Selection of Control Offices

Covariate	Mean		Net difference[a]	% difference[b]	*t*	*p*
	Northern (*n* = 28)	Southern (*n* = 30)				
Driver-level (pre-DPE subjects)						
Total citations per 100	59.81	59.80	0.01	0.02	0.00	.99
Total accidents per 100	16.33	14.37	1.96	13.65	3.08	.00
Age at application	25.26	25.70	-0.44	-1.71	-1.14	.26
Total applicants	5,266	8,218	-2,952	-35.92	-4.16	.00
% male	52.07	54.77	-2.70	-4.92	-5.05	.00
Aggregate driving locality						
Average total accidents in ZIP Code	16.49	15.85	0.64	4.05	1.25	.22
Average total citations in ZIP Code	61.04	61.58	-0.53	-0.87	-0.29	.77
Aggregate 1990 US. Census						
% African American in ZIP Code	9.07	8.21	0.86	10.50	0.42	.68
% Hispanic in ZIP Code	15.65	31.84	-16.20	-50.86	-5.76	.00
% driving alone to work in ZIP Code	72.47	72.75	-0.28	-0.39	-0.15	.88
Mean minutes to work in ZIP Code	27.41	27.83	-0.43	-1.54	-0.61	.54
% completing elementary school as highest level of all adults in ZIP Code	8.24	14.07	-5.84	-41.46	-3.91	.00
% completing high school as highest level of all adults in ZIP Code	22.28	21.20	1.08	5.11	1.42	.16
% receiving public assistance in ZIP Code	4.35	4.00	0.35	8.59	0.79	.43
% unemployed in ZIP Code	3.93	4.52	-0.59	-12.97	-2.18	.03
% renting in ZIP Code	42.06	48.52	-6.46	-13.31	-2.69	.01
% 55 or older in ZIP Code	18.03	16.84	1.20	7.10	1.92	.06
Median income in ZIP Code	$45,980	$41,370	$4,609	11.14	2.07	.04

[a]Net difference = mean of northern region minus mean of southern region.
[b]Percentage difference is referenced to mean of southern region.

Table 4 compares the covariate means based on individual applicants in the two regions after the control office selection. While statistical differences exist for several variables (primarily due to large sample sizes), in most instances they are small. As can be seen, the selection did not remove all differences between the two samples of offices and applicants on the potentially biasing variables. However, using individual offices and these variables as covariates in the logistic regression models statistically adjusted the criterion measures for these differences.

Table 4

Regional Means on the Covariates After Control Office Selection Based on Individual Subject Scores in Both Time Periods

Covariate	Mean		Net difference[a]	% difference[b]	*t*	*p*
	Northern (n = 147,554)	Southern (n = 246,547)				
Driver-level (both time periods)						
Age at application	25.67	25.74	-0.07	-0.27	-2.06	.04
% male	52.81	55.28	-2.47	-4.47	-15.04	.00
Aggregate driving locality						
Avg. number of total accidents in ZIP Code	16.56	16.32	0.24	1.47	25.98	.00
Avg. number of total citations in ZIP Code	62.42	61.44	0.98	1.60	27.48	.00
Aggregate 1990 US. Census						
% African American in ZIP Code	9.45	7.99	1.46	18.27	33.16	.00
% Hispanic in ZIP Code	16.47	33.67	-17.20	-51.08	-258.23	.00
% driving alone to work in ZIP Code	70.33	72.25	-1.92	-2.66	-46.08	.00
Mean minutes to work in ZIP Code	27.17	28.03	-0.86	-3.07	-67.17	.00
% completing elementary school as highest level of all adults in ZIP Code	8.95	14.95	-6.00	-40.13	-167.64	.00
% completing high school as highest level of all adults in ZIP Code	21.77	21.26	0.51	2.40	30.62	.00
% receiving public assistance in ZIP Code	4.48	4.09	0.39	9.54	42.00	.00
% unemployed in ZIP Code	4.01	4.63	-0.62	-13.39	-105.19	.00
% renting in ZIP Code	44.06	49.36	-5.30	-10.74	-86.94	.00
% 55 or older in ZIP Code	18.27	16.81	1.46	8.69	75.99	.00
Median income in ZIP Code	$45,422	$40,660	$4,762	11.71	97.86	.00

[a]Net difference = mean of northern region minus mean of southern region.
[b]Percentage difference is referenced to mean of southern region.

Subsequent Driver Record Comparisons

Table 5 presents the percentages of applicants in each study group involved in accidents and citations during the 2-year period after application date.

Table 5

Percentage of Subjects in Each Group Involved in Accidents and Citations 2 Years After Application Date

Region Time period	Total accidents	Fatal/injury accidents	Total citations
Northern			
Pre-DPE	13.89	4.41	32.16
Post-DPE	13.66	4.32	30.75
Southern			
Pre-DPE	12.93	4.29	33.91
Post-DPE	12.40	4.18	32.56

As can be seen, the criterion measures decline in value from pre-DPE to post-DPE for applicants in both regions. For example, the percentage of northern applicants involved in fatal/injury accidents dropped from 4.41% pre-DPE to 4.32% post-DPE. Likewise, among southern applicants, the criterion measure shrank from 4.29% pre-DPE to 4.18% post-DPE. The percentages are presented for descriptive purposes only; no tests were conducted to determine whether the differences on the observed percentages are statistically significant since these tests are more properly executed through the logistic regression presented below.

Total accidents. The summary of the significance tests from the logistic regression analysis for the total accident criterion is displayed in Table 6.

Table 6

Summary of Logistic Regression Results for Total Accidents

Source	*df*	χ^2	*p*
Covariates	8	5949.35	.0001
Region	1	61.8341	.0001
Time of application	1	15.3695	.0001
Region by time of application	1	0.2493	.6176
Office within region	56	309.8805	.0001
Time of application by office within region	56	114.0815	.0001

Recall that the effect of interest is the region by time of application interaction. This effect addresses whether the change in accident risk for southern offices following implementation of the DPE differs from that for northern offices over the same time periods. As displayed in Table 6, the region by time of application interaction is not statistically significant ($\chi^2 = 0.2493$, $p = .62$).

Figure 2 illustrates the region by time of application interaction effect by displaying the covariate-adjusted total accidents logit (or log odds) for each region in each time period.

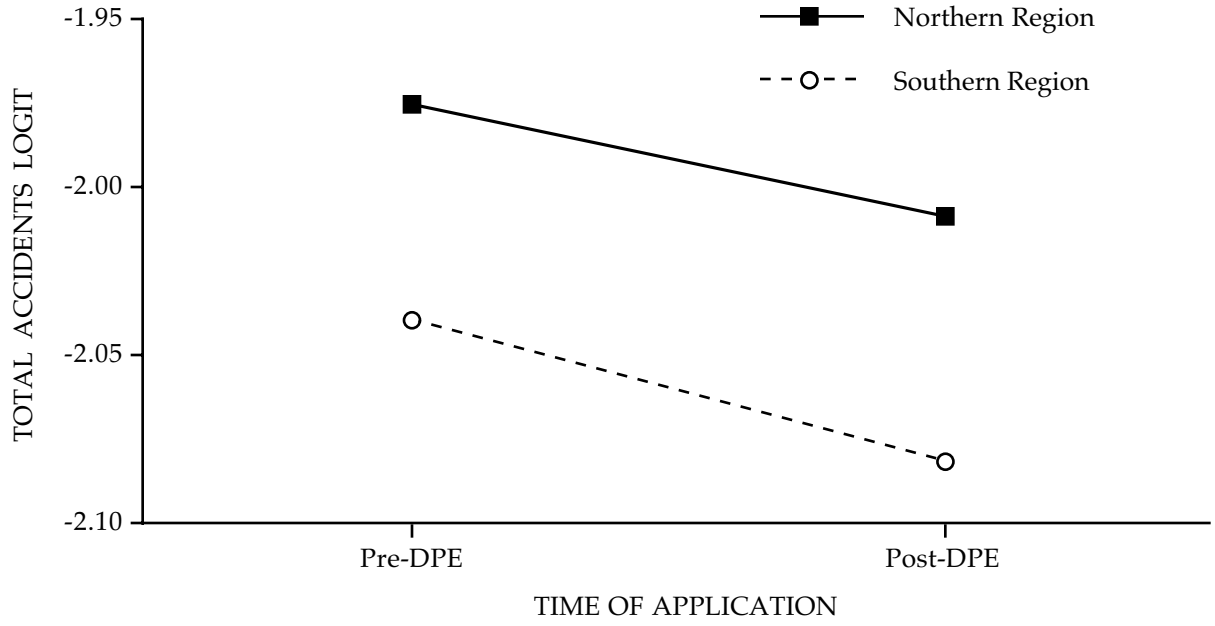

Figure 2. Adjusted 2-year total accidents logit by region and time of application.

As stated above, the outcome variable is presence or absence of a traffic accident. The two lines in Figure 2 have very similar slopes, indicating that the effect of time is roughly the same for applicants in the two regions. The odds ratio comparing pre-DPE and post-DPE subjects in each region are shown in Table 7.

Table 7

Results of Comparison of Pre-DPE Versus Post-DPE Groups Within Region for Total Accidents

Comparison	χ^2	p	Regression coefficient	Odds ratio
Pre vs. post (northern)	4.47	.0345	0.0324	1.03
Pre vs. post (southern)	11.53	.0007	0.0410	1.04

The northern contrast yielded a statistically significant effect ($\chi^2 = 4.47$, $p = .0345$). The odds ratio computed from the regression coefficient ($e^{0.0324}$) is 1.03, meaning that the odds of accident involvement for northern applicants was 1.03 times higher in the pre-DPE period than in the post-DPE period. Again, both groups of drivers within this region would, if tested, have received the standard non-DPE drive test.

The southern contrast also yielded a statistically significant effect ($\chi^2 = 11.53$, $p = .0007$). The odds ratio computed from the regression coefficient ($e^{0.0410}$) is 1.04, indicating that the odds of accident involvement for southern drivers was 1.04 times higher before DPE implementation than it was afterward.

In addition to examining the odds ratios, the adjusted probabilities of total accident involvement were also computed and are shown in Figure 3. The estimates were obtained from the logistic regression equation. The values represent the estimated percentage of subjects in each group involved in accidents during the 2-year post-application criterion period after statistically adjusting scores to equate the groups on the covariates. (The reader is referred to Table 5 for the unadjusted values.)

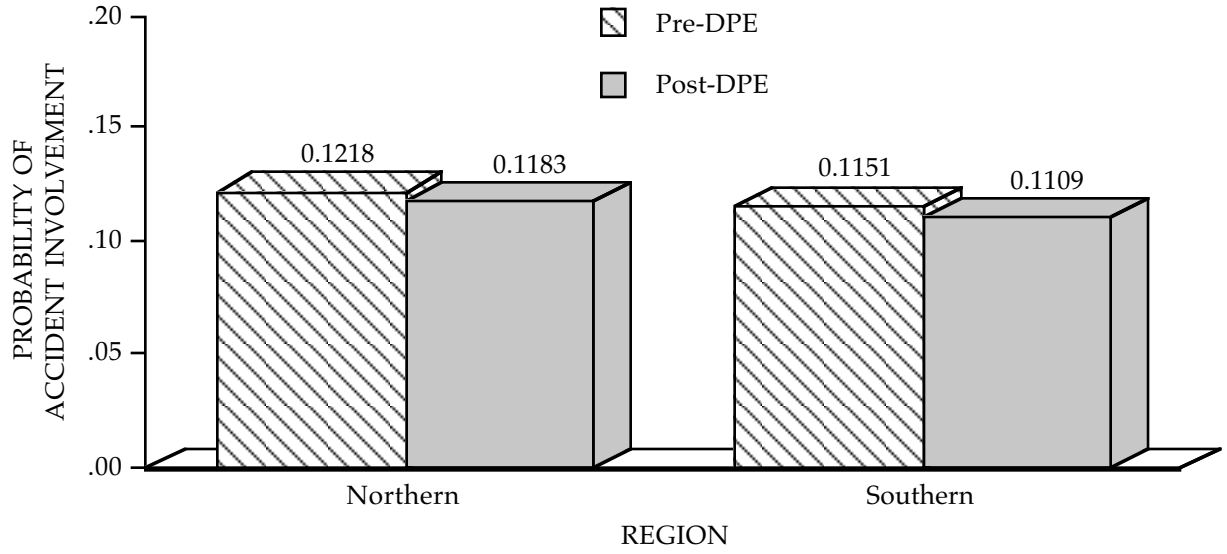

Figure 3. Adjusted 2-year total accident probability by region and time of application.

Based on the data represented in Figure 3, northern post-DPE applicants had 2.9% fewer accident involved drivers than did the northern pre-DPE applicants. Likewise, southern post-DPE applicants had 3.6% fewer accident involved drivers than did the southern pre-DPE applicants.

The similarity of the odds ratios over time for the two regions reflects the lack of a statistically significant interaction between time and region. However, the results are directionally supportive of a positive impact of the DPE with a greater risk reduction over time shown for southern offices exposed to the DPE.

Fatal/injury accidents. A second set of analyses was conducted using fatal/injury accidents as the criterion. It has been well established in prior research that the total accident measure is subject to accident-reporting bias. On the other hand, fatal/injury accidents form a relatively "clean" measure because they are usually much less subject to non-reporting than are property-damage-only accidents.

Table 8 summarizes the results of the logistic regression analysis for fatal/injury accidents.

Table 8

Summary of Logistic Regression Results for Fatal/Injury Accidents

Source	*df*	χ^2	*p*
Covariates	9	1986.49	.0001
Region	1	19.762	.0001
Time of application	1	5.3958	.0202
Region by time of application	1	0.0515	.8205
Office within region	56	357.0414	.0001
Time of application by office within region	56	71.0996	.0842

As was the case for the total accident criterion, the effect of interest is the region by time of application interaction. The results indicate that the region by time of application interaction is not statistically significant ($\chi^2 = 0.0515$, $p = .8205$).

Figure 4 illustrates the interaction effect by plotting the adjusted fatal/injury accidents logit for each group.

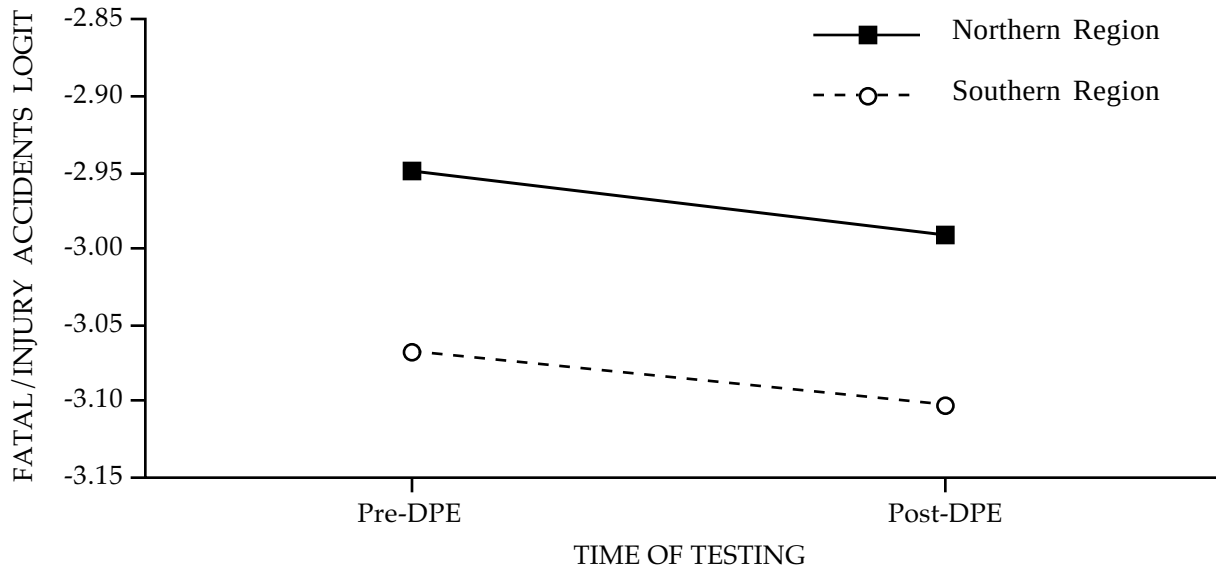

Figure 4. Adjusted 2-year fatal/injury accidents logit by region and time of application.

The absence of a significant interaction effect is evidenced by the fact that the vertical distance between the two lines (representing the effect of region) is essentially the same for both time periods. The odds ratio comparing pre-DPE and post-DPE subjects in each region are shown in Table 9.

As displayed in the table, the comparison of change in fatal/injury accident odds from pre to post was 1.04 for both regions. The similarity in these odds ratios are reflections of the absence of a significant period by area interaction as noted above.

Table 9

Results of Comparison of Pre-DPE Versus Post-DPE Groups Within Region for Fatal/Injury Accidents

Comparison	χ^2	p	Regression coefficient	Odds ratio
Pre vs. post (northern)	2.49	.1146	0.0409	1.04
Pre vs. post (southern)	2.96	.0853	0.0349	1.04

Figure 5 displays the adjusted probability of fatal/injury accident involvement for each group. Within the northern region, post-DPE applicants had 4.0% fewer fatal/injury accident involved drivers than did pre-DPE applicants. Within the southern region, post-DPE applicants had 3.4% fewer fatal/injury accident involved drivers than did pre-DPE applicants.

These results are consistent with the findings for total accidents.

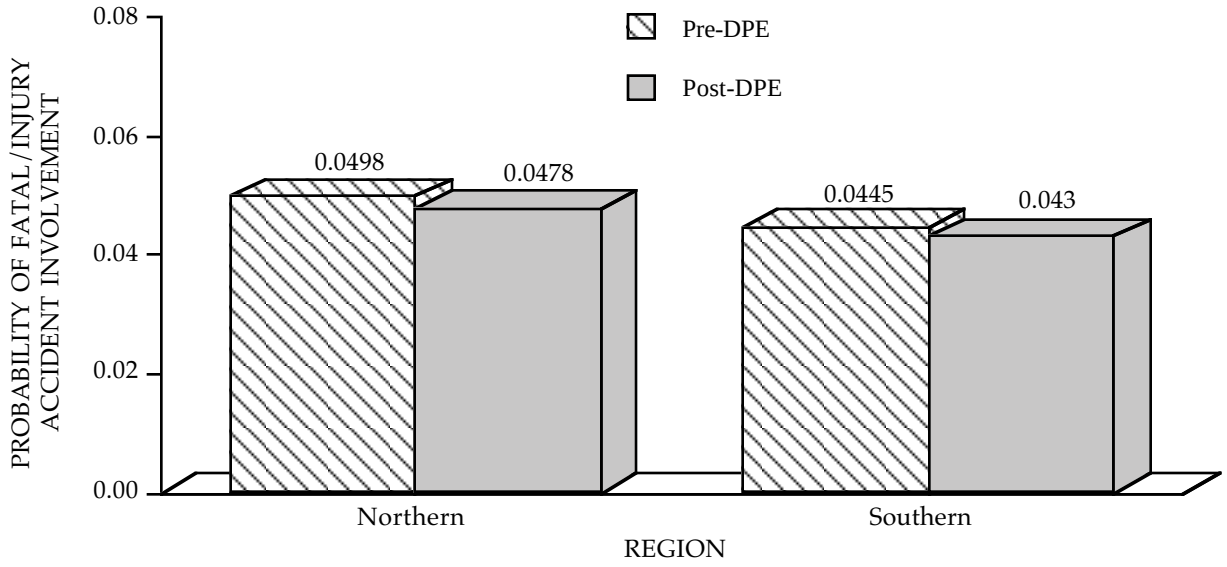

Figure 5. Adjusted 2-year fatal/injury accident probability by region and time of application.

Total Citations. Table 10 summarizes the logistic regression results for total citations. The region by time of application interaction is not statistically significant ($\chi^2 = 0.2997$, $p = .5841$).

Table 10

Summary of Logistic Regression Results for Total Citations

Source	*df*	χ^2	*p*
Covariates	14	27749.61	.0001
Region	1	34.54	.0001
Time of application	1	172.3136	.0001
Region by time of application	1	0.2997	.5841
Office within region	56	1212.305	.0001
Time of application by office within region	56	170.5295	.0001

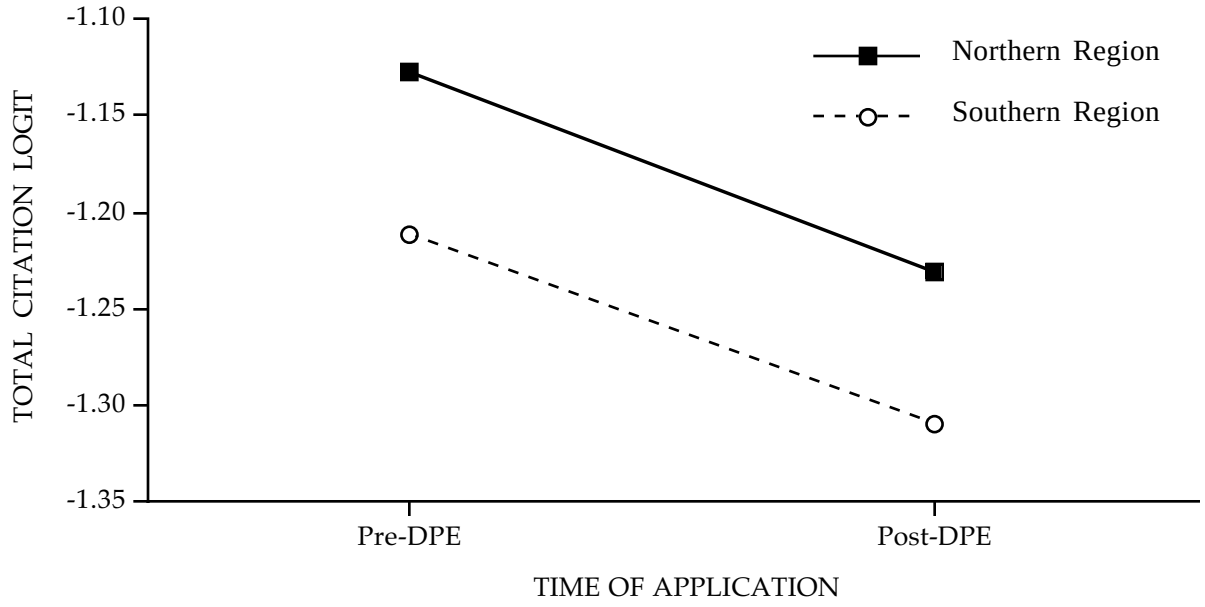

Figure 6. Adjusted 2-year total citations logit by region and time of application.

Figure 6 graphically displays the adjusted total citations logit by region and time of application. The similarity in the slopes of the two lines indicates that the change in citation risk over time is the same for applicants in the northern and southern regions. Table 11 shows the odds ratio comparing pre- and post-DPE subjects within each region.

Table 11

Results of Comparison of Pre-DPE Versus Post-DPE Groups Within Region for Total Citations

Comparison	χ^2	p	Regression coefficient	Odds ratio
Pre vs. post (northern)	76.76	.0001	0.1027	1.11
Pre vs. post (southern)	117.31	.0001	0.0962	1.10

The northern contrast produced a statistically significant effect (χ^2 = 76.76, p = .0001). The odds ratio is $e^{0.1027}$ or 1.11, meaning that the odds of citations for northern applicants are 1.11 times higher in the pre-DPE period than they are in the post-DPE period. Again, both groups of northern drivers would, if tested, have received a standard non-DPE drive test.

The pre-DPE versus post-DPE effect for southern applicants was also statistically significant (χ^2 = 117.31, p = .0001). The odds ratio computed from the regression coefficient ($e^{0.0962}$) is 1.10, indicating that the odds of citations for southern drivers were 1.10 times higher before DPE implementation than they were after.

Figure 7 displays the adjusted probabilities for the four groups. Within the northern region, post-DPE applicants had 7.6% fewer drivers with one or more citations than did pre-DPE applicants. Within the southern region, post DPE applicants had 7.3% fewer drivers with one or more citations than did pre-DPE applicants.

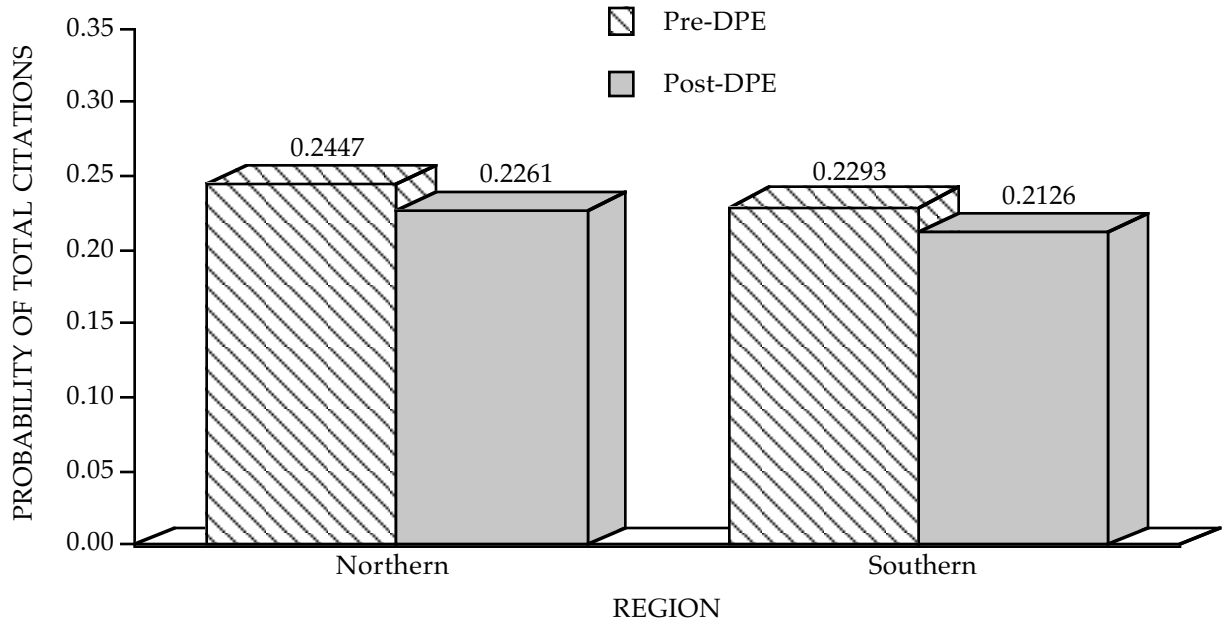

Figure 7. Adjusted 2-year total citation probability by region and time of application.

As was the case for accidents, the magnitude and direction of the differences in the odds ratios for the total citation criterion indicate that the risk differential between the two regions is essentially the same during both time periods.

DISCUSSION

The failure to demonstrate a significantly greater safety benefit for the DPE test than for the standard road test is disappointing. None of the differences between the two test groups on the three post-application driver record measures approached statistical significance. Although there was a very slight trend for those assigned to the DPE test to have a reduced odds (1%) of being accident involved in terms of total reported accidents, the comparison on fatal/injury accidents showed no difference in odds. Clearly, the very small variations between the groups on the subsequent driver record

measures is consistent with the null hypotheses of no measurable differences in the relative safety impact of the two testing programs.

Having acknowledged this outcome, it is essential to also consider the limitations of the research design. These limitations stem from the inability to utilize a classical experimental design in which subjects and/or offices are randomly assigned to the test conditions (DPE or standard road test). Instead, a quasi-experimental design was used in which the type of road test was based on geographical area (southern offices versus northern offices). This would normally be a very weak design because the treatment condition is completely confounded with area, and likely differences between the applicants and driving environments could bias the comparisons of subsequent accident rates. The present design was strengthened considerably against potential bias by statistically adjusting the comparisons for group differences on criterion-related covariates. More importantly, precise measures on the accident rates for the southern and northern offices were also available based on applicants licensed in these offices prior to implementation of the DPE. Since the correlation between the total accident rates for offices over the pre-DPE and post-DPE time periods was substantial (r = .79), the pre-DPE accident rates for the offices provided a very powerful referent or baseline for interpreting any subsequent differences between the DPE and non-DPE groups (i.e., the time by region interaction).

Nevertheless, the design is still subject to extraneous sources of variance (bias). The most obvious bias threat is the possibility of uncontrolled historical events occurring between or during the two time periods. Recall that the office accident rates for the pre-DPE period were based on the 2-year time interval after subjects' 1993 license application date, whereas the period used for the post-DPE comparisons was the 2-year interval after subjects' 1995 license application date. The occurrence of any changes in applicant demographics, driving environment, and police enforcement or accident reporting policies over this time horizon that differed between the northern and southern regions could potentially have biased the outcome. Since a very small reduction in accidents was considered sufficient to have justified the DPE on public safety and benefit cost grounds, even small time-related biases could have obscured a real positive effect of interest. Unfortunately, there is no independent way of evaluating this possibility, and the need for pointing this out is not to assert that such a bias did occur but rather to make explicit the assumptions required in accepting the conclusion that the two tests had equivalent safety impacts.

If one accepts the conclusion that the DPE did not produce a demonstrable safety impact, the question that naturally arises is "why?" As documented in the Introduction section of this report, the DPE evolved as part of a carefully developed plan to enhance driver competency by improvements in the driver licensing assessment process. One of the central components of this plan was to improve the reliability, validity, and stringency of the road test. Prior studies by Hagge (1994) and Romanowicz & Hagge (1995) provide clear evidence that the road test developed pursuant to this plan was more reliable, more stringent, and more discriminating than the conventional DMV road test. Despite these earlier findings, the present study has failed to provide any evidence that the DPE results in a population of drivers having lower accident propensities than those licensed through the conventional DMV road test.

There are several explanations that could be given to explain this paradox. First, there is an important distinction between driving as a skill or competency and driving in a way that minimizes accident risk. As acknowledged in the Introduction section, most accidents are not caused by deficiencies in the driving skills that are measurable on a road test. In addition, there is an even more fundamental question of how well a road test reflects the way a person drives in "real-world" non-test conditions (McPherson & McKnight 1981).

Second, many investigators have emphasized the deficiencies in using accident-involvement as a criterion measure in assessing the validity of a test or accident countermeasure program. This problem stems from the large random or stochastic component inherent in determining when and how given driving behaviors interact to produce an actual accident occurrence, which is a relatively rare event. For these reasons, accidents are not very reliable or sensitive measures of actual driving or "safety" behavior. In the present study, we used very large sample sizes to compensate for this problem, but there is still some non-trivial risk of not being able to detect very small effects.

A third possibility is failure to implement the DPE as specified in policy directives and as reflected in the studies by Hagge (1994) and Romanowicz and Hagge (1995). Based on the authors' familiarity with the ongoing program gained through interactions with DPE examiners, program administrators, policy staff, and departmental management, this is judged to be highly unlikely. In addition, any significant relaxation in the DPE program requirements would be expected to have resulted in a substantial lowering of the test fail rate from its initial high of 49% when the program was first implemented in September 1994. This hypothesis could not be directly evaluated in this study due to the lack of test results data. However, it was possible to estimate the average time between application and licensure, and the results refute the hypothesis. The average time in months for subjects in the northern (non-DPE) region was 3.26 in the pre-DPE period and 3.23 in the post-DPE period. On the other hand, subjects in the southern (DPE) region had average times of 2.89 and 3.43 for the two respective time periods, indicating a significant delay of licensure following the use of the new test. This finding runs counter to the proposition that the DPE guidelines as originally established were not being followed during the period of the study. Had there been laxity in carrying out the program requirements, it is very unlikely that this average 2-week delay of licensure for subjects exposed to the DPE would have occurred.

It is usually instructive to consider how the findings of a given study articulate with the extant literature in the field. The Introduction section of this paper acknowledged that performance on road tests has never been shown to be correlated with the subsequent accident rates of tested drivers. In this sense, the present results should not be surprising. However, it was also noted that this correlational paradigm was flawed for reasons elaborated by authorities such as McKnight and Stewart (1990). We pointed out that the proper evaluation of the safety impact of a driver licensing test requires a control group of drivers who are allowed a driver license without being required to take the test. The present study did not attempt to evaluate the effects of a test versus no-test policy and, indeed, such a study would be prohibited by statutory and ethical considerations. Instead, we attempted to evaluate the incremental value of a more stringent road test—an objective that is much more difficult to achieve because both

groups have been required to take a road test and would have undergone some form of preparation and training. It cannot be stressed too strongly that the present findings do not mean that the road test requirement for novice drivers has no safety value.

There has been only one prior study on the relative safety effects of different types of road tests for novice drivers. Ratz (1978) compared two experimental road tests or test variants to the standard California novice driver road test. He utilized a nested mixed model analysis of variance design in which three road tests were assigned randomly among nine offices. Thus, three offices conducted one of three tests: (1) a standard road test, (2) a standard road test with a higher passing score threshold, and (3) an experimental road test designed to emphasize safety-related skills. None of the differences on subsequent accident rates reached statistical significance, although the experimental test group had a 12% lower covariate-adjusted accident rate than did the other two groups ($p < .20$). These findings are consistent with the results of the current study, which utilized a much larger sample size and a different type of experimental road test.

The statistical approach used by Ratz raises an interesting methodological issue, which was addressed in the Methods section. Ratz used a more conservative procedure in considering treatment (type of test) to be a random-effects rather than a fixed-effects factor. Under this nested mixed-model design, the degrees of freedom for experimental error are based on the number of offices rather than the number of drivers, resulting in much lower statistical power. Had Ratz treated type of test as a fixed-effects factor as was done in this study, the lower accident rate of his experimental test group would have been highly significant. However, the small number of offices used in his study would make a fixed-effect interpretation indefensible for evaluating a program intended for statewide implementation. It should also be noted that, had office been treated as a random-effects rather than fixed-effects factor in the current study, the statistical significance tests would have resulted in even larger p values than those obtained and thus the outcome of the study would not have changed.

RECOMMENDATIONS

Subsequent to the initiation of this study, the department reduced the length of the DPE and eliminated the freeway component due to budgetary constraints. Because the DPE as evaluated in this study is longer than the standard road test and had additional maneuvers, such as a freeway driving component, it is a more costly program requiring a more extensive allocation of resources than is required for the standard road test. The failure to demonstrate any bottom line benefits to offset program costs makes it difficult to recommend that the department reinstate the freeway maneuvers and expand the original DPE statewide. However, there is no question that the method of testing (route selection and scoring procedures) produces a more reliable and "content valid" test than does the current testing procedure. It is therefore recommended that the department expand the DPE scoring procedures to all offices in the state.

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APPENDIX I

Driving Performance Evaluation Procedural Information

DRIVING PERFORMANCE EVALUATION

OVERVIEW

Introduction

This chapter includes basic procedural information concerning the administration of Driving Performance Evaluation (DPE).

Contents

This chapter is divided into the following sections:

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GENERAL INFORMATION

What is DPE	The Driving Performance Evaluation (DPE) is an in-vehicle evaluation of an applicant's Class C driving competency.
Main objective	The DPE determines whether the applicant: • Has the ability to operate a vehicle safely. • Has formed proper habits for safe driving. • Can translate knowledge of traffic laws into actual practice. • Compensates for any physical conditions that might be present, such as subnormal vision, poor hearing, or loss of limb. **NOTE:** Another objective of the DPE is to call the applicant's attention to those deficiencies in skill or habit that are unsafe, but do not necessarily disqualify the applicant from obtaining a license.
Verification of accompanying driver and insurance	Verbal verification by the applicant of an accompanying driver and presenting evidence of insurance is to be performed inside the field office at the time the applicant reports for the DPE.
Turn signals	Inform the applicant that electric turn signals will be required during the evaluation even on occasions when not actually required by law, i.e., when no other vehicle would be affected by the maneuver.
Use of brake pedal	The department is neutral regarding which foot should be used on the brake pedal. The examiner should only be concerned with the proper control and effective use of the brakes. It is not an error when an applicant uses the left foot on the brake (when there is no clutch pedal) unless the applicant is pressing the right foot on the accelerator while simultaneously braking with the left foot.

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REGISTRATION AND INSURANCE

Registration and insurance requirement

All vehicles used in a DPE must have a license plate located at the rear of the vehicle displaying current registration sticker(s) and must be insured. The following indicates what is acceptable for plates, registration sticker(s), and proof of insurance.

If any requirement is not satisfied, the DPE is to be re-scheduled, if possible, for a later time that day.

Item	*Requirement*
Plate(s)/Registration Sticker(s)	California registerd or out-of-state registered vehicle must display • at least one plate and current sticker(s), or • California Temporary Operation Permit (Reg 19), or • California trip permit **NOTE:** Presentation of a registration card is not mandatory for the DPE.
Insurance	Evidence of insurance may be: • Any document with the insurance policy number or surety bond number and the name of the insurer. • A certificate or acknowledgment of deposit issued by the DMV to a owner who is self-insured or a depositor. • Current insurance "binder" agreement. **IMPORTANT:** For a rental vehicle, the applicant's name must appear on the rental agreement and the contract must not exclude driving tests. **NOTE:** If the office manager or designee is satisfied that coverage does exist, the DPE will be given.

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ELEMENTS OF THE DPE

Pre-drive checklist	The pre-drive checklist is used to determine whether the driver's vehicle and the driver's knowledge of the vehicle meet the department's minimum safety standard.
Turn and Stop	The turn and stop element is used to help determine whether the driver can be safely evaluated on the road test portion of the DPE. The driver is directed to turn into and exit from a space marked by 7 stanchions (See Appendix for details). If the test vehicle is an oversized Class C vehicle, e.g., motor home, or a straight truck, see **Oversized Class C Vehicles** towards the end of this chapter.
Road test	The road elements are used to determine whether the driver can operate the vehicle safely in varying driving situations after passing the pre-drive and Turn and Stop. • **parking lot driving.** • **street park.** – Applicant pulls to the side of the road and parks, then pulls back into traffic. • **eight intersections.** – two controlled by a light (red, yellow, and green). – two controlled by a stop sign. – two through (straight ahead) intersections **not** involving stops. – two additional intersections (preferably intersections controlled by traffic lights, but can be any of the above). • **four left and four right turns.** – mixed difficulty levels. – at least two left and two right turns should have multiple lanes requiring correct lane choice on approach and finish. – two at signal controlled locations — one left — one right – two additional turns (preferably at intersections controlled by stop signs, but may be uncontrolled with limit lines, crosswalks, turn lanes, etc.).

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ELEMENTS OF THE DPE, continued

Road test, continued

- **one straight residential section.**
  - minimum 3 blocks; preferably a narrow street.
- **one straight business section.**
  - minimum 3 blocks.
  - moderate traffic density.

  NOTE: The objective of the residential and business section is to put the applicant at ease so that the applicant will more likely drive as if not being evaluated.
- **two lane changes**
  - one lane change to the right
  - one lane change to the left
  - located anywhere on the route; preferably at higher speeds.
- **one curve.**
  - preferably a left curve.
  - lanes should be marked if possible.
  - must require driver to adjust speed.
  - located anywhere on the route (freeway, freeway entrances, residential area, etc.).
- **one segment of freeway driving.**
  - minimum of one-half mile, preferred
  - must have merge on-ramp and exit lane or ramp.
  - if there is no merge on-ramp, a merge elsewhere on the route may be used.

  NOTE: A four-lane highway with a minimum speed of 45 mph and with an acceleration and deceleration lane may be substituted *for* a freeway *only* if a freeway is not available.

Freeway driving

When it becomes necessary to eliminate the freeway component for a limited period of time (road construction, major accident, etc.) the office is to use the alternative route to evaluate the applicant's ability to merge on and off a major road.

DO NOT restrict original drivers to non-freeway driving because it was not included on the DPE. However, for limited term and special drive applicants, a non-freeway driving restriction will still be utilized as needed for P&M conditions.

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SCORING OF DPE

Scoring objective	The DPE examiner scores a series of maneuvers at predetermined locations. The score sheet and scoring criteria break down each maneuver into a series of task and behaviors that the driver must perform correctly. The scoring criteria provides the examiner with explicit objective cues and standards for deciding if a behavior was performed correctly. If the task and/or behavior is not performed according to the criteria, the examiner marks the appropriate space on the score sheet.
Score sheet	The score sheet consists of a pre-drive, nine driving maneuvers, and a list of the different types of automatic disqualifications. The three principal purposes of score sheets are: • To document the standard of driving required of all applicants. • To make examining techniques and passing requirements uniform. • To record the driving performance results.
Disposition of score sheet	The original copy of the score sheet is given to the applicant. The department copy of the score sheet is retained in one of two files in date order. • Retain passing score sheets for two months. • Retain failing score sheets for twelve months.
Scoring the pre-drive	The DPE starts with a pre-drive checklist. Each item has a box next to it. If the vehicle and/or the applicant meets the criteria check the box for that item. If the criteria is not met, circle the number of the item.

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SCORING OF DPE, continued

Scoring the road test maneuvers

There are nine driving maneuver categories. For each category, there is:

- A list of driver behaviors to be scored.
- Beside each behavior within that category there is a 0 to be used for marking the driver behavior.
- At the top of each column of 0s is a bolded letter or number.

Use the following method for tracking when a maneuver is scored:

- Immediately before scoring a list of driver behaviors, circle the bolded letter or number at the top of the column of 0s.
- If the driver performs the maneuver incorrectly, draw a line through the 0.
- If the driver performs the maneuver correctly, **do not** make a mark through the 0.
- If for some reason a maneuver is not scored, draw a vertical line through the entire column of 0s for that maneuver.

NOTE: Do not score items unless you actually observe them. If the route or traffic conditions do not permit a maneuver to be scored at the designated location, draw a line through the entire column of 0s for that maneuver.

Scoring automatic disqualifications

If an Automatic Disqualification error occurs anywhere on the route, score the error in the Automatic Disqualification section of the score sheet and end the DPE. Direct the applicant back to the office by the most suitable route.

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Page 6 CLASS C DRIVING PERFORMANCE EVALUATION

SCORING OF DPE, continued

Score as you go	Mark the score sheet when a driver does not perform a maneuver according to the scoring criteria at the time the maneuver is to be performed. ***Do not*** **depend on your memory to do so later.**
Do not instruct	Never coach or instruct the driver while scoring. A good job of scoring will take all of your time. Give directions, not instructions.
Completing the score sheet	At the end of the evaluation complete the Comments section. Review the scoring form and check that everything is marked clearly and correctly. Be sure you lined out the maneuvers that were not performed during the evaluation. Carefully add up the number of marked 0s and write in the total in the space opposite "Number of errors:." Passing is 15 errors or less. **EXCEPTION:** An immediate automatic disqualification does not have a numeric score, only the letters "DQ."
Always double check calculations	Before informing the applicant of the test results, and before entering the total number of errors in the Result box, **always** double check to be sure that you have added the score correctly.
Comments section	This section provides an area on the score sheet to: • Describe how the driver failed to meet the specific scoring criteria for satisfactory performance. • Describe in detail the circumstances of any automatic disqualification. **NOTE:** It is ***extremely*** important on point failures and automatic disqualifications that the error(s) be documented in the Comments section of the score sheet.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 9

SCORING CRITERIA FOR DPE

Introduction

The DPE scoring criteria apply to **all** Class C DPEs.

The detailed scoring criteria are designed to maximize scoring consistency. Nevertheless, it is not possible to develop scoring criteria that are so explicit or rigid that examiners will always agree on every driver behavior.

NOTE: The Class C DPE scoring criteria do not apply to Commercial Class C applicants.

Pre-drive checklist

This section specifies the requirements for each item on the Pre-drive Checklist. If any one of items 1–8 or 15–17 is not satisfactory, the DPE is to be re-scheduled for a later time that day, if possible. If it is not possible to re-schedule for the same day, the DPE is to be postponed.

If four or more of items 9–14 (bold) are not satisfactory, the applicant is disqualified. This result is keyed as a failure on the Test Result screen in the automated system.

Item	*Requirement*
1. Driver window	The window on the driver side must open. (If the window is closed, have the applicant open the window.) NOTE: The window may be closed again after the demonstration.
2. Windshield*	The windshield must provide a full unobstructed field of view for both driver and examiner.
3. Rear view mirrors	The vehicle must have at least two mirrors. One must be located outside on the left side of the vehicle. The other may be located inside center or on the outside on the right side of the vehicle. Mirrors must be secure and provide clear visibility to the rear.

* In the agreement covering Bargaining Unit 7, Protective Services/Public Safety.

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SCORING CRITERIA FOR DPE, continued

Pre-drive checklist, continued

Item	*Requirement*
4. Turn signals	Both right and left turn signals in front and back of the vehicle must work.
5. Brake lights	Both brake lights (one each side of the vehicle) must work. **NOTE:** Both does not include the "cyclops" light on newer vehicles.
6. Tires*	Each tire must have 1/32" tread grooves and two major adjacent tread grooves. **NOTE:** The major grooves are in different locations, depending upon the type of tire.
7. Foot brake	There must be at least one inch of clearance between the pedal and the floor board when the pedal is pressed.
8. Horn*	The horn must be: • designed for a vehicle and in proper working condition. • audible from a distance of at least 200 feet. **NOTE:** The horn cannot be a bicycle horn.
9. Emergency/ parking brake	Correctly locates the emergency/parking brake control.
10. Arm signals	Correctly demonstrates arm signals for: • left turn • right turn • slowing down or stopping
11. Windshield wipers	Correctly locates the windshield-wipers switch.
12. Defroster	Correctly locates the defroster switch.

* In the agreement covering Bargaining Unit 7, Protective Services/Public Safety.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 11

SCORING CRITERIA FOR DPE, continued

Pre-drive checklist, continued

Item	*Requirement*
13. **Emergency flasher (4 way flashers)**	Correctly locates the emergency flasher switch if vehicle is equipped with emergency flashers.
14. **Headlights**	Correctly locates the headlight switch.
15. Passenger door*	Passenger side door must open and close properly.
16. Glove box*	Glove box door must be closed and securely shut.
17. Seat belts	• Starting with 1968 passenger vehicles and 1972 house cars and trucks weighing less than 6001 pounds, the vehicle must have seat belts for both the driver and examiner. • Both seat belts must work properly.

* In the agreement covering Bargaining Unit 7, Protective Services/Public Safety.

NOTE: In inclement weather, the applicant must demonstrate that items 11 – 14 are working properly or the evaluation will have to be postponed.

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SCORING CRITERIA FOR DPE, continued

Turn and Stop evaluation This section provides the criteria to evaluate the driver's ability to turn and stop in a prescribed space.

Section	*Maneuver*	*Item Scored*	*Criteria*
Turn and Stop	**Entering and Exiting**	Traffic check E/X	• Driver is observing traffic (vehicle and pedestrian) ahead and to the left and right while entering (E) space. • Driver is observing traffic (vehicle and pedestrian) to rear and to the left and right while exiting (X) from space. • Looks over appropriate shoulder while backing. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Speed E/X	Enters and exits space at a safe speed and in control of the vehicle.
		Braking E/X	• Brings vehicle to a smooth stop (does not jerk vehicle). • Depresses brake pedal without depressing the accelerator at the same time.
		Vehicle position E/X	• Enters and exits space without touching the stanchions. • Stops vehicle between the stanchions without touching any curb or stanchion(s). • Performs maneuver with no more than one correction. • Stops vehicle without impeding traffic.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 13

SCORING CRITERIA FOR DPE, continued

Parking lot driving evaluation This section provides the criteria to evaluate the driver's ability to drive through a parking lot.

Section	*Maneuver*	*Item Scored*	*Criteria*
Parking Lot Driving	N/A	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • Yields right-of-way to pedestrians and vehicles when appropriate. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Speed	Drives through the parking lot at a safe speed and in control of the vehicle.

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SCORING CRITERIA FOR DPE, continued

Street park evaluation This section provides the criteria to evaluate the driver's ability to park a vehicle along a curb and pull back out into traffic.

Section	*Maneuver*	*Item Scored*	*Criteria*
Street Park	**Entering and Exiting (E/X)**	Traffic check E/X	• While entering, driver is observing traffic ahead, to the right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • While exiting, driver is observing traffic ahead, to the left and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • Checks appropriate blind spot. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Signal E/X	• Activates signal prior to entering and exiting the parking space. • Cancels signal after entering and exiting the parking space.
		Speed E/X	Enters and exits parking space at a safe speed and in control of the vehicle.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 15

SCORING CRITERIA FOR DPE, continued

Street park evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Street Park, continued	**Entering and Exiting (E/X), continued**	Parking E/X	• Sets parking brake. • Releases parking brake. If parked on a hill: • Turns wheel in correct direction to prevent rolling. • Vehicle does not roll. (OK to block wheels against curb.)
		Parallel	• Vehicle is parallel to, and within 18 inches of, curb without hitting the curb. • Performs maneuver with no more than one correction. • Does not block driveway, fire hydrant, etc.

Intersection evaluation This section provides details on how to evaluate the driver's performance at intersections.

Section	*Maneuver*	*Item Scored*	*Criteria*
Intersections	**Through**	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, and right. Indicated by head and/or eye movement to the left and right. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Yields to vehicles or pedestrians in the intersection. • Reacts safely to traffic situations.

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SCORING CRITERIA FOR DPE, continued

Intersection evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Intersections, continued	**Through, continued**	Speed	• Maintains speed without exceeding the posted speed limit. • Maintains appropriate speed for traffic conditions (basic speed law).
		Unnecessary stop	• Stops on yellow light when should have gone through. • Stops vehicle when not necessary.
	Stop	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Speed	• Decelerates and brakes smoothly. • Depresses brake pedal without depressing the accelerator at the same time. • For manual-transmission vehicle, keeps gear engaged.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 17

SCORING CRITERIA FOR DPE, continued

Intersection evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Intersections, continued	**Stop, continued**	Full stop	• Brings vehicle to a full stop without jerking. • When necessary, brakes to stop for yellow light. • For manual-transmission vehicle, keeps gear engaged. Once stopped, applicant can place the vehicle in neutral. • No movement forward or roll backward.
		Gap or Limit line	• Able to see rear wheels of vehicle in front or has enough room to maneuver around vehicle without backing up. • Stops within 6 feet (about a half a car length) from the limit line. • If no limit line, stops within 6 feet (about a half a car length) from the corner of the intersection. • Stops without the front most part of the vehicle being: — in intersection. — over limit line. — beyond sidewalk or stop sign.

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SCORING CRITERIA FOR DPE, continued

Intersection evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Intersections, continued	**Start**	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, and right. Indicated by head and/or eye movement to the left and right. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Yield	• Yields to vehicles or pedestrians already at or in the intersection. • Accepts right-of-way without causing confusion or impeding traffic flow. • Accepts right of way within 4 seconds from when it is safe to start. • Reacts safely to traffic situations.
		Speed	Accelerates smoothly. (Includes proper gear and clutch usage by the applicant if the vehicle has a manual transmission.)

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SCORING CRITERIA FOR DPE, continued

Turns evaluation This section provides details on how to evaluate the driver's performance in turning.

Section	*Maneuver*	*Item Scored*	*Criteria*
Turns	Approach	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • Checks blind spot before merging into bike lane or center left-turn lane. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Signal	Activates turn signal approximately 100 ft. prior to turn, but not so early as to mislead other drivers as to intention.
		Speed	• Decelerates and brakes smoothly. • Presses brake pedal without pressing the accelerator at the same time. • For manual-transmission: – changes gears as necessary to maintain power. – keeps gear engaged.

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SCORING CRITERIA FOR DPE, continued

Turns evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Turns, continued	**Approach, continued**	Lane	• Uses designated lane for turn. — For right turns: – Enters bike lane where line is broken. – Enters right turn pocket lane at opening. – Uses the right-most part of right lane. — For left turns: – Enters two-way left-turn lane within 200 feet of turn and does not violate the right-of-way of any vehicle already in the lane. – Enter left-turn pocket lane at opening. – Uses the left-most part of left lane. • Stays within lane markings.
		Unnecessary stop	There was no vehicle or pedestrian traffic, signal light or traffic sign requiring a stop.
	Stop	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, and right. Indicated by head and/or eye movement to the left and right. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.

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SCORING CRITERIA FOR DPE, continued

Turns evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Turns, continued	**Stop, continued**	Speed	• Decelerates and brakes smoothly. • Depresses brake pedal without depressing the accelerator at the same time. • For manual-transmission vehicle, keeps gear engaged.
		Full stop	• Brings vehicle to a full stop without jerking. • When necessary brakes to stop for yellow light. • For manual-transmission vehicle, keeps gear engaged. Once stopped, applicant can place the vehicle in neutral. • No movement forward or roll backward.
		Gap or Limit line	• Able to see rear wheels of vehicle in front or has enough room to maneuver around vehicle without backing up. • Stops within 6 feet (about half a car length) from the limit line • If no limit line, stops within 6 feet (about half a car length) from the corner of the intersection. • Stops without the front-most part of the vehicle being: — in intersection. — over limit line. — beyond sidewalk or stop sign.

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SCORING CRITERIA FOR DPE, continued

Turns evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Turns, continued	**Stop, continued**	Wheels straight (Left turns only.)	Wheels straight ahead when stopped.
	Turn/ Complete	Traffic check	• Driver is observing traffic (vehicle/pedestrian) ahead, to the left, and right. Indicated by head and/or eye movement to the left and right and use of mirrors. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Yields to other traffic. • Accepts right-of-way within 4 seconds from when it is safe to start. • Reacts safely to traffic situations.
		Steering control	• Turns steering wheel smoothly and with full control of vehicle. (No palming.) • Turns vehicle only the amount necessary (does not over-steer or under-steer).
		Too wide/short	Does not allow vehicle to touch the lane markings or curb.
		Correct lane	Ends turn in the proper lane.

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SCORING CRITERIA FOR DPE, continued

Turns evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Turns, continued	**Turn/ Complete, continued**	Speed	• Maintains smooth, safe speed and keeps control of the vehicle. • For manual-transmission: – changes gears as necessary to maintain power. – keeps gear engaged. • Makes no unnecessary stops during turn. • Accelerates smoothly after turn.
		Signal	Cancels signal upon completion of turn.

Straight Business / Residential evaluation

This section provides details on how to evaluate the driver's performance in a straight section of a business district or residential area.

Section	*Maneuver*	*Item Scored*	*Criteria*
Straight Business / Residential	N/A	Traffic check	• Watches ahead, to the left, and right for hazards. Indicated by head and/or eye movement to the left and right and use of mirrors. • Searches 10 to 15 seconds ahead as indicated by: – speed adjustments. – lane positioning. • Reacts safely to traffic situations: – traffic at entrances to roadway. – pedestrians. – vehicles parking.
		Lane position	Keeps in center of lane.

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SCORING CRITERIA FOR DPE, continued

Straight Business / Residential evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Straight Business / Residential, continued	**N/A, continued**	Speed	• Maintains speed without exceeding the posted speed limit. • Slows for hazards or obstruction. • Brakes to stop for yellow light when necessary. • Maintains appropriate speed for traffic conditions (basic speed law).
		Spacing	Leaves space cushion to front and sides.

Lane Changes evaluation This section provides details on how to evaluate the driver's performance in making a lane change.

Section	*Maneuver*	*Item Scored*	*Criteria*
Lane Changes	**Lane Change**	Traffic check	• **Left lane change:** Driver is observing traffic (vehicle and pedestrian) ahead, to the left, and rear. Indicated by head and/or eye movement to the left and proper use of mirrors. • **Right lane change:** Driver is observing traffic (vehicle and pedestrian) ahead, to the right, and rear. Indicated by head and/or eye movement to the right and proper use of mirrors. • Checks blind spot. • Reacts safely to traffic situations.

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SCORING CRITERIA FOR DPE, continued

Lane Changes
evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Lane Changes, continued	**Lane Change, continued**	Signal	• Activates signal prior to lane change. • Cancels signal after lane change.
		Speed	• Uses appropriate speed to change lanes without exceeding the posted speed limit. • Uses appropriate speed for traffic conditions (basic speed law).
		Spacing	• Waits for adequate gap. • Leaves space cushion to front and sides. • Maintains space cushion in front and rear of vehicle after lane change.
		Steering control	• Changes lanes by turning the steering wheel smoothly. • Moves to the center of lane.

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SCORING CRITERIA FOR DPE, continued

Freeway evaluation This section provides details on how to evaluate the driver's performance in freeway driving.

Section	*Maneuver*	*Item Scored*	*Criteria*
Freeway	Entering (On ramp or access way to freeway)	Traffic check	• Driver is observing traffic (vehicle and pedestrian) ahead, to the left, and/or right. Indicated by head and/or eye movement to the left and/or right and use of mirrors. • Looks toward and/or makes eye contact with other drivers and pedestrians when necessary. • Reacts safely to traffic situations.
		Signal	• Activates turn signal approximately 100 ft. prior to entering, but not so early as to mislead other drivers as to intention. • Cancels signal.
		Speed	Uses appropriate speed for traffic conditions (basic speed law).
		Spacing	• Waits for adequate gap. • Leaves space cushion to front and sides.
		Lane position	• Keeps in center of lane.
	Merge	Traffic check	• While merging onto freeway, driver is observing traffic ahead, to the left, and/or rear. Indicated by head and eye movement to the left and/or right and use of mirrors. • Checks blind spot. • Reacts safely to traffic situations.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 27

SCORING CRITERIA FOR DPE, continued

Freeway evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Freeway, continued	**Merge, continued**	Signal	• Activates signal as soon as freeway traffic can see signal. • Cancels signal after merging.
		Speed	Merges at appropriate speed for traffic conditions (basic speed law).
		Spacing	• Waits for and accepts first available adequate gap. • Leaves space cushion to front and sides.
		Lane position	Moves to the center of driving lane.
		Steering control	• Merges onto freeway without going over solid boundary lines. • Merges by turning the steering wheel smoothly.
	Lane Use	Traffic check	• Driver is observing traffic ahead, to the left, right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors. • Reacts safely to traffic situations.
		Speed	• Maintains traffic flow speed without exceeding the posted speed limit. • Uses appropriate speed for traffic conditions (basic speed law).
		Spacing	Maintains space cushion in front of vehicle.
		Lane position	Keeps in center of lane.

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SCORING CRITERIA FOR DPE, continued

Freeway evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Freeway, continued	Exiting	Traffic check	• Driver is observing traffic ahead, to the left, right, and rear. Indicated by head and/or eye movement to the left and right and use of mirrors • Checks blind spot. • Reacts safely to traffic situations.
		Signal	• Activates signal prior to entering exit lane. • Cancels signal after entering exit lane.
		Speed	• Decelerates in exit lane. • Exits at appropriate speed for traffic conditions (basic speed law).
		Spacing	• Waits for adequate gap. • Leaves space cushion to front and sides.
		Lane position	Keeps in center of lane.
		Steering control	• Exits freeway without going over solid boundary lines. • Exits by turning the steering wheel smoothly.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 29

SCORING CRITERIA FOR DPE, continued

Curve evaluation This section provides details on how to evaluate the driver's performance in negotiation of a curve.

Section	*Maneuver*	*Item Scored*	*Criteria*
Curve	N/A	Entering speed	• Reduces to a safe speed to enter curve. • For manual transmission: – change gears as necessary to maintain power. – keeps gear engaged.
		Through speed	• Does not brake unnecessarily while in curve. • Maintains safe speed during curve. • For manual transmission: – change gears as necessary to maintain power. – keeps gear engaged. • Presses brake pedal without pressing the accelerator at the same time.
		Lane position	Keeps vehicle in lane.

Automatic Disqualification evaluation This section provides details on action or inaction by an applicant that constitutes an automatic disqualification.

Section	*Maneuver*	*Item Scored*	*Criteria*
Automatic Disqualification	N/A	Intervention by examiner	• Any driver action or inaction requiring physical or verbal intervention by the examiner. • **Turn and Stop:** Makes four corrections to enter the space. • **Turn and Stop:** Makes four corrections to exit the space.

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SCORING CRITERIA FOR DPE, continued

Automatic Disqualification evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Automatic Disqualification, continued	**N/A, continued**	Strikes object	• Comes in contact with another vehicle, object, pedestrian, or animal when it could have been safely avoided. • Strikes any stanchion during the Turn and Stop maneuver.
		Up and over curb or sidewalk	Drives over the curb or on the sidewalk.
		Drives in oncoming traffic lane	Anytime the vehicle is in the oncoming traffic lane.
		Disobeys traffic sign, signal, or safety personnel	• At or exceeding a brisk walking speed (4 mph) goes through a: – stop sign. – flashing red light. – right turn on a red light. • Disobeys any safety personnel e.g., law enforcement officer or fire fighter. • Disobeys other traffic signs and/or lane markings: – lane drop. – painted arrows. – stanchions, etc.
		Dangerous maneuver	• Any driver action or inaction that could have or did cause another driver or pedestrian to take evasive action. • Neither looks in mirror(s) nor blind spot (over shoulder[s]) during: – lane change. – merge. – backing. – pulling from curb or side of road.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 31

SCORING CRITERIA FOR DPE, continued

Automatic Disqualification evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Automatic Disqualification, continued	**N/A, continued**	Dangerous maneuver, continued	• Does not move head and eyes for traffic check at uncontrolled intersection. • Kills engine in an intersection. • Anytime the vehicle blocks an intersection so that is impedes cross traffic. • **Street Park:** Parks vehicle so far away from the curb that it blocks or impedes traffic. • Drives further than 200 feet in a bike lane or two-way center left turn lane. • Drives straight from a designated turn lane.
		Reaction to school bus	Passes school bus with flashing red lights.
		Reaction to emergency vehicle	Fails to stop for an emergency vehicle.
		Speed	• Too Fast – Drives 10 mph over the posted speed limit. – Drives too fast for safety. • Too Slow – Drives 10 mph under the posted speed limit. – Drives too slow for safety.
		Auxiliary equipment use	Fails to use windshield wipers, defroster, or headlights when inclement weather or darkness requires it.

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SCORING CRITERIA FOR DPE, continued

Automatic Disqualification evaluation, continued

Section	*Maneuver*	*Item Scored*	*Criteria*
Automatic Disqualification, continued	**N/A, continued**	Turning from improper lane	Makes turn from wrong lane. **Exception:** If improper turn is made without merging into bike lane, do not mark automatic disqualification as long as the blind spot is checked. Instead score under **Turns, Approach, Lane.**

Skill evaluation for oversized Class C vehicles

When the applicant is driving an oversized class C vehicle (motor home, straight truck, etc.), replace the Turn and Stop with a Straight Line Backing test. The applicant is instructed to back the vehicle in a straight line for at least three (3) vehicle lengths. Begin with the vehicle 1 to 3 feet from the curb or stanchion.

The scoring for Parking Lot Driving and Street Park is the same as regular sized class C vehicles.

NOTE: Use Turn and Stop E column to score the Straight Line Backing items.

Skill	*Item Scored*	*Criteria*
Straight Line Backing	Traffic check	• Checks both sides and rear for traffic while backing three vehicle lengths in a straight line. • Reacts safely to traffic situations.
	Speed	Backs vehicle in a straight line at safe speed and in control of the vehicle.
	Braking	• Brings vehicle to a smooth stop (does not jerk vehicle). • Depresses brake pedal without depressing the accelerator at the same time.
	Vehicle position	Vehicle backs within a 3 feet weave to either side and without hitting curb.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 33

CONDUCT DURING DPE

Explaining DPE to applicant

Before starting the evaluation, explain to the applicant what will be occurring. Below are statements to use in explaining what is going to occur on the DPE. **Always** use statement number 1. The others are suggestions that can be used in your pre-drive instruction to applicant.

1. **You will be evaluated on your ability to drive safely and skillfully in different driving situations including on the freeway.**
2. The evaluation includes noting safe and unsafe driving practices and your ability to make decisions.
3. You will be driving in situations that are typical throughout the state.
4. I will be an observer, giving directions ahead of time, such as where to turn.
5. If I do not say anything, you should follow the road and signs, unless I ask you to do otherwise.
6. I will not try to trick you or ask you to do anything illegal.
7. I will be marking the sheet while you drive, but this does not necessarily mean you have done something wrong.

Have them sign the Driving Performance Evaluation form and ask if they have any questions.

Giving directions during DPE

Always give the direction to the applicant at the designated point on the route. Use the scripted directions for the route when having the applicant perform a maneuver. Be sure to speak clearly and distinctly. **Always** state **where** to do a maneuver before you say **what** to do.

Examples:
"At the first corner, turn right."
"At the first street, make a right turn please."
"The first (or next) intersection, left turn."
"At the major intersection make a right turn please."

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CONDUCT DURING DPE, continued

Giving directions during DPE, continued

Do not use phrases or words that are instructional. "Light, signal, and stop sign." You are helping the driver by pointing these items out. "Make a right lane change. Next street right turn." Let the driver figure out what lane to be in to make a legal turn.

If an applicant fails to follow directions, do not correct the applicant unless the action would result in a hazardous situation. Continue with the evaluation and give directions that will bring the applicant back to the route.

Suggested phrases for instruction during road element

The chart below gives suggested phrases to the road elements of the DPE.

Road Elements	*Suggested Phrase*
Signal light with other side streets preceding it.	First major intersection
Residential areas, stop, yield, or uncontrolled.	• First street, or • First corner
Business area, signal light, or stop signs.	First (or next) intersection
Short distance between streets reinforce when you pass second street.	Three blocks
"T" intersection	• Cross street, or • When road ends

Multiple directions

Use multiple directions **only** when necessary. When giving directions in advance, or multiple directions, reinforce when needed.

Examples:
When applicant will need to make an immediate lane change after the left turn or there isn't time to give another set of instructions before the right turn say, "next street, left turn, then a right turn at first intersection."

When there is a short distance to make one or more lane changes say, "at the first street, turn right and then make a left lane change."

CLASS C DRIVING PERFORMANCE EVALUATION Page 35

PROCESSING SUMMARY

Processing step for DPE Use the following steps in administering the DPE from the time the applicant reports in the office until after administering the DPE.

	Step	Action	Detail
Office personnel	1	Key DLP transaction.	Retrieves record from the data base.
	2	Applicant signs Test Results document.	Signature will be compared by the examiner to the applicant's signature on the DPE score sheet and instruction permit.
	3	Verify accompanying driver.	Once the accompanying driver and insurance has been verified inside the office, **do not** ask for verification again (even by the examiner at the vehicle).
	4	Verify insurance	
	5	Hand applicant Your Driving Evaluation (DL 180 Pilot)	Inform the applicant that the form contains important information regarding the DPE.
	6	Send applicant out to DPE line.	———
LRE	7	Insert carbon paper under the top form of the evaluation sheet.	Be sure the carbon paper is inserted properly.
	8	Check vehicle for license plate(s) and valid registration stickers.	California registered vehicle must have front and rear license plates. Out-of-state registered vehicles may have only a rear plate.
	9	Fill in top of score sheet.	• Date. • Driver License Number. • Circle Route 1 or 2. • Field Office Number. • Examiner signature. • Examiner identification number.

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PROCESSING SUMMARY, continued

Processing step for DPE, continued	Step	Action	Detail
LRE, continued	10	Have applicant sign score sheet.	This is important to detect ringers. Compare the signature on the score sheet to the signature on the Test Results document and instruction permit.
	11	Perform Pre-Drive Checklist.	Put the applicant at ease by giving directions in a calm, courteous, yet deliberate manner.
	12	Enter the vehicle.	
	13	Buckle-up and adjust the seat belt.	
	14	Give preliminary directions.	
	15	Begin the driving evaluation.	
	16	Mark any errors.	
	17	Calculate applicant's score.	If applicant passed, continue. If applicant is below standard, go to Step 24.
Applicant passes	18	Tell applicant he/she has passed.	Briefly explain any mistakes.
	19	Explain any restrictions that are to be imposed.	
	20	Record the scores on the Test Results document and have the applicant sign it.	
	21	Instruct the applicant to present the Test Results document at the appropriate workstation.	The employee who processes the photo must compare the signature on the Test Results document with the Signature Card (DL 620). This important final step will help prevent a fraudulent driver license from being issued.

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CLASS C DRIVING PERFORMANCE EVALUATION Page 37

PROCESSING SUMMARY, continued

Processing step for DPE, continued

Step	*Action*	*Detail*
Applicant passes, continued 22	Give the person the original evaluation sheet.	Inform the applicant that an interim license will be issued after the picture is taken.
23	Exit the vehicle.	Go to Step 28.
Applicant's score is below standard 24	Tell applicant he/she has not passed.	Explain the errors briefly. Indicate that the errors appear correctable with further practice.
25	Give the person the original evaluation sheet.	
26	Return the instruction permit or temporary license, whichever is appropriate.	Applicants applying for renewal may be issued a temporary license in the same class rather than an instruction permit if the failure does not indicate a hazardous condition. If the driving skills are deemed hazardous, issue an instruction permit. If a Class C applicant from out-of-state or a foreign country fails the DPE, the out-of-state or foreign license should be returned to the applicant.
27	Exit the vehicle.	
LRE 28	File office copy of score sheet.	Office retains duplicate copy.

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APPENDIX II

Descriptions of Criterion Measures and Variables Considered for Inclusion as Covariates in Statistical Models

Type/ name	Description
Criterion measures	
Post 2-year total accidents	Involvement in any accidents 2 years after license application date
Post 2-year fatal/injury accidents	Involvement in any fatal/injury accidents 2 years after license application date
Post 2-year total citations	Cited for traffic law violations 2 years after license application date
Demographic covariates	
Sex	Sex of applicant
Age	Age of applicant at time of reference date
Prior driver record covariates	
Prior 2-year total accidents	Involvement in total accidents 2 years before license application date
Aggregate U.S. Census covariates	
Urban	Percent urban in applicant's ZIP code
African American	Percent African American in applicant's ZIP code
Mean age	Average age in applicant's ZIP code
Married	Percent married of all adults in applicant's ZIP code
High school	Percent with high school degree of all adults in applicant's ZIP code
Social	Percent receiving social security in applicant's ZIP code
Unemployed	Percent unemployed in applicant's ZIP code
Age 55 & up	Percent age 55 and up in applicant's ZIP code
Income family	Median family income in applicant's ZIP code
Income household	Median household income in applicant's ZIP code
House	Median house value in applicant's ZIP code
White	Percent white in applicant's ZIP code
Hispanic	Percent Hispanic in applicant's ZIP code
Assistance	Percent receiving public assistance in applicant's ZIP code
Rent	Percent renting in applicant's ZIP code
Aggregate driving-locality covariates	
Average accidents	Average number of total accidents per driver in applicant's ZIP code
Average citations	Average number of total citations per driver in applicant's ZIP code

APPENDIX III

List of DPE and Control Field Offices

DPE office	Total applicants	Predicted accident score	Control office	Total applicants	Predicted accident score
Arleta	11,848	0.1397	Carmichael	5,067	0.1690
Bell Gardens	11,351	0.1517	Concord	3,386	0.1701
Bellflower	13,551	0.1623	Corte Madera	2,932	0.1542
Chula Vista	6,693	0.1440	Daly City	8,401	0.1528
Compton	5,961	0.1459	El Cerrito	5,511	0.1561
Culver City	7,044	0.1384	Fairfield	2,623	0.1671
Escondido	3,818	0.1484	Folsom	2,402	0.1709
Fullerton	9,515	0.1513	Fremont	6,834	0.1557
Glendale	11,266	0.1455	Hayward	5,249	0.1580
Hawthorne	8,513	0.1427	Los Gatos	4,876	0.1651
Hollywood	12,740	0.1356	Modesto	5,088	0.1827
Inglewood	6,495	0.1377	Mountain View	6,438	0.1362
Laguna Hills	5,644	0.1489	Oakland	6,306	0.1551
Lincoln Park	7,995	0.1450	Oakland Coliseum	6,009	0.1466
Montebello	9,326	0.1527	Pittsburg	3,221	0.1761
Oceanside	6,166	0.1470	Pleasanton	3,580	0.1530
Pasadena	14,036	0.1506	Redwood City	4,320	0.1453
Placentia	5,680	0.1750	Roseville	3,165	0.1858
Pomona	8,483	0.1621	Sacramento	4,545	0.1541
Poway	4,359	0.1541	Sacramento South	5,250	0.1726
San Clemente	3,911	0.1589	San Francisco	12,762	0.1345
San Diego	6,279	0.1314	San Jose	7,988	0.1448
San Diego Clairemont	9,263	0.1658	San Mateo	5,444	0.1424
San Pedro	4,949	0.1456	Santa Clara	8,006	0.1417
San Ysidro	4,564	0.1405	Santa Teresa	5,873	0.1618
Torrance	7,635	0.1514	Stockton	5,648	0.1750
Van Nuys	6,209	0.1519	Vallejo	3,085	0.1755
West Covina	12,622	0.1648	Walnut Creek	3,445	0.1638
Westminster	12,999	0.1492			
Winnetka	7,632	0.1603			