

12-2016

Evaluation of a Supervisor Training Program for ODOT's EcoDrive Program

Donald M. Truxillo

Portland State University

John MacArthur

Portland State University, macarthur@pdx.edu

Leslie B. Hammer


Portland State University, hammerl@pdx.edu

Talya N. Bauer

Portland State University, talyab@sba.pdx.edu

Let us know how access to this document benefits you.

Follow this and additional works at: https://pdxscholar.library.pdx.edu/trec_reports

 Part of the [Environmental Engineering Commons](#), [Transportation Commons](#), and the [Transportation Engineering Commons](#)

Recommended Citation

Truxillo, D.M., MacArthur, J., Brady, G., Hammer, L., & Bauer, T. (2016). Evaluation of a Supervisor Training Program for ODOT's EcoDrive Program. NITC-RR-781 Portland, OR: Transportation Research and Education Center (TREC). <https://doi.org/10.15760/trec.155>

This Report is brought to you for free and open access. It has been accepted for inclusion in TREC Final Reports by an authorized administrator of PDXScholar. For more information, please contact pdxscholar@pdx.edu.



FINAL REPORT

Evaluation of a Supervisor Training Program for ODOT's EcoDrive Program

NITC-RR-781 ■ December 2016

*NITC is the U.S. Department of Transportation's national
university transportation center for livable communities.*



EVALUATION OF A SUPERVISOR TRAINING PROGRAM FOR ODOT'S ECODRIVE PROGRAM

Final Report

NITC-RR-781

by

Donald M. Truxillo, Ph.D.

John MacArthur, M.S.

Grant Brady

Leslie Hammer, Ph.D.

Talya N. Bauer, Ph.D.

Portland State University

Transportation Research and Education Center

for

National Institute for Transportation and Communities (NITC)

P.O. Box 751

Portland, OR 97207



December 2016

Technical Report Documentation Page			
1. Report No. NITC-RR-781	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Evaluation of a Supervisor Training Program for ODOT's EcoDrive Program		5. Report Date December, 2016	
		6. Performing Organization Code	
7. Author(s) Donald M. Truxillo, Ph.D., John MacArthur, M.S., Grant Brady, Leslie Hammer, Ph.D., & Talya N. Bauer, Ph.D.		8. Performing Organization Report No.	
9. Performing Organization Name and Address Donald M. Truxillo, Ph.D. Portland State University Department of Psychology PO Box 751 Portland, OR 97207-0751 (503) 725-3969 truxillod@pdx.edu		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. NITC-781	
12. Sponsoring Agency Name and Address National Institute for Transportation and Communities (NITC) P.O. Box 751 Portland, Oregon 97207		13. Type of Report and Period Covered Final Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract			
17. Key Words Eco-Driving, EcoDrive, Supervisor Training, Supervisor Support, Efficient Driving, Intervention		18. Distribution Statement No restrictions. Copies available from OTREC: www.otrec.us	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages	22. Price

Acknowledgements

We thank the following participating organizations: Oregon Department of Transportation (ODOT), the City of Hillsboro, and Washington County. We also thank Stephanie Millar, Senior Planner for ODOT, for soliciting participation from the organizations and for all of her support during the data collection and providing collateral material.

This research was also funded in part by the National Institute for Transportation and Communities (NITC), a program of the Transportation Research and Education Center at Portland State University and a U.S. Department of Transportation university transportation center.

Disclaimer

The contents of this report reflect the views of the authors, who are solely responsible for the facts and the accuracy of the material and information presented herein. This document is disseminated under the sponsorship of the U.S. Department of Transportation University Transportation Centers Program, Portland State University, and Oregon Department of Transportation (ODOT) in the interest of information exchange. The U.S. Government, Portland State University, and Oregon Department of Transportation (ODOT) assume no liability for the contents or use thereof. The contents do not necessarily reflect the official views of the U.S. Government, Portland State University, and Oregon Department of Transportation (ODOT). This report does not constitute a standard, specification, or regulation.

© June 14, 2016

Donald M. Truxillo, Ph.D.
Portland State University
Department of Psychology
PO Box 751
Portland, OR 97207-0751
(503) 725-3969
truxillod@pdx.edu

John MacArthur
Portland State University
TREC - Transportation Research and
Education Center
P.O. Box 751
Portland, OR 97207-0751
(503) 725-2866
macarthur@pdx.edu

Reproduction

This report may be reproduced for educational purposes and should be cited as follows: Truxillo, D.M., MacArthur, J., Brady, G., Hammer, L., & Bauer, T. (2016). Evaluation of Oregon Department of Transportation's EcoDrive Program. Portland State University, Portland, OR.

Table of Contents

EXECUTIVE SUMMARY	2
1.0 INTRODUCTION.....	3
2.0 EVALUATION AND METHODOLOGICAL OVERVIEW.....	4
2.1 THE STEPS TO THE EVALUATION WERE AS FOLLOWS (SEE FIGURE 1):	5
3.0 CHARACTERISTICS OF ORGANIZATIONS PARTICIPATING IN THE ECODRIVE STUDY	6
4.0 EVALUATION SURVEYS.....	7
4.1 OVERVIEW	7
4.2 INDIVIDUAL AND ORGANIZATIONAL READINESS MEASURES	7
4.3 OUTCOMES OF THE INTERVENTION	9
5.0 SURVEY RESPONSES.....	10
6.0 SURVEY RESULTS.....	11
6.1 ENERGY-REDUCING ATTITUDES	12
6.2 MOTIVATION TO PERFORM FUEL EFFICIENT BEHAVIORS	13
6.3 ORGANIZATIONAL SUPPORT FOR ECO-DRIVING	13
6.4 SUPERVISOR SUPPORT FOR ECO-DRIVING.....	14
6.5 EMPLOYEE REPORTS OF VIEWING ECODRIVE MATERIALS	15
6.6 ECO-DRIVING KNOWLEDGE.....	16
6.7 EFFICIENT DRIVING PRACTICES	18
6.8 ECO-DRIVING BEHAVIORS	18
6.9 PERCEIVED UTILITY OF THE ECODRIVE MATERIALS	20
7.0 EXIT INTERVIEW RESULTS.....	20
7.1 DISTRIBUTION OF MATERIALS.....	21
7.2 REACTION TO THE ECODRIVE MATERIALS	21
7.3 EMPLOYEE SUGGESTIONS ABOUT THE PROGRAM.....	22
8.0 INTERPRETATION OF STUDY RESULTS.....	22
8.1 STUDY STRENGTHS	23
8.2 CHANGES IN OUTCOMES	23
9.0 SUGGESTIONS FOR FUTURE RESEARCH AND APPLICATIONS.....	25
10.0 SUMMARY	26
11.0 REFERENCES.....	28

APPENDICES

Appendix A: Overview of the EcoDrive Educational Materials

Appendix B: Survey Questions

Appendix C: Survey Scales at Each Time Point

Appendix D: Unpaired Graphs of Outcomes

Appendix E: Written Summary of Supervisor Training Video

Appendix F: Sample Support Letter for EcoDrive Program

Appendix G: Exit Interview Questions for Fleet Managers/Organizational Contacts

EXECUTIVE SUMMARY

Eco-driving consists of using energy-efficient approaches to driving aimed at reducing fuel consumption and, ultimately, CO₂ emissions. A previous study found that an EcoDrive informational campaign was effective at increasing the use of eco-driving behaviors, but only when employees perceived that their supervisor supported the program and when they were personally motivated to perform the eco-driving behaviors. In order to build upon the findings of our previous study, the present study focused on increasing the use of eco-driving behaviors through an informational eco-driving campaign combined with supervisor training to support the use of eco-driving practices.

In this study we collected baseline measures of driving knowledge, attitudes, and behaviors from employees at three organizations, as well as follow-up data collected at two months (Time 2) and six months post-intervention (Time 3). Implementing a quasi-experimental design with a control group (informational campaign only) and an experimental group (informational campaign combined with supervisor training), we tested the incremental effectiveness of supervisor training compared to the effect of an informational campaign alone.

In total, 19 supervisors received supervisor training (supervisor training group) and 10 supervisors were provided with the informational campaign materials only (control group). We collected data from 144 unique participants across the three time points, and of these responses we were able to match responses for 50 participants from Time 1 to Time 2 and 48 from Time 1 to Time 3. We were also able to match responses from 38 participants across all three time points; however, because our interest was in change from baseline, and in order to increase our statistical power, analyses were conducted comparing Time 1 to Time 2 and Time 1 to Time 3 data. We assessed changes in self-reported knowledge, attitudes, and behaviors using mixed-method ANOVAs to assess the within-person change across time points and compare the effectiveness of the intervention between the control and supervisor training groups.

We found that, in general, participants reported using eco-driving behaviors more often in the follow-up surveys compared to baseline measures. However, we did not find direct support for the supervisor training intervention providing an incremental increase in eco-driving behaviors and attitudes compared to the informational campaign alone. On the other hand, we did find that supervisor support, frequency of communication about eco-driving, and the percentage of employees who viewed the EcoDrive materials were greater in the supervisor training group compared to the control group. Additionally, employees in the supervisor training group rated the EcoDrive materials as more useful compared to the control group.

Based on these findings, the supervisor training seemed to be effective in improving indicators of supervisor support; however, it may be that our limited sample size did not allow us to find statistically significant differences between the two groups in eco-driving behaviors. In this report we discuss in more detail the basis for this study, the implementation of the intervention, the results, and potential explanations for our findings in order to inform future studies. We also provide a detailed account of the methodology used in this study.

1.0 INTRODUCTION

Eco-driving is the adoption and use of energy-efficient driving techniques aimed at reducing greenhouse gas emissions through a reduction in fuel consumption (Martin, Chan & Shaheen, 2012). These behaviors are economical, ecological, and in many cases safe driving practices. Estimates of their effectiveness in reducing fuel consumption range from 5% to 20% based on the driving context (Barkenbus, 2010; Stillwater & Kurani, 2013; van der Voort, Dougherty & van Maarseveen, 2001). Some specific eco-driving behaviors include minimizing rapid braking and acceleration, and the use of vehicle cooling and heating systems (Mansfield, Guros, Truxillo & MacArthur, 2016). Eco-driving has been promoted through a number of methods including information campaigns to increase driver knowledge, in-vehicle feedback systems (Wada, Yoshimura, Doi, Youhata & Tomiyama, 2011), and social norm messaging (Cristea, Paran & Delhomme, 2012). In order to maximize the effectiveness of an eco-driving initiative, Barkenbus (2010) noted that a comprehensive approach for promoting eco-driving including a combination of educational materials, feedback devices, and social reinforcement are likely to be most effective.

Eco-driving is currently being promoted by ODOT through the EcoDrive program, and the present study builds on a previous study also funded by OTREC that evaluated the effectiveness of the EcoDrive materials (Mansfield et al., 2016). The EcoDrive program was created to help improve fuel efficiency for individuals and drivers of light-duty fleet vehicles. While some eco-driving behaviors may actually be unsafe, or cause more wear and tear on vehicles (e.g., shifting into neutral while going downhill), the behaviors this specific program focuses on are not only fuel-efficient, but are also safe driving practices. The program includes educational materials that highlight specific behaviors and practices that are effective in reducing fuel consumption. Included in these materials are posters, postcards, static cling tags, and an informational website which includes educational eco-driving videos. The seven eco-driving behaviors included in these materials were the focus of this study. These behaviors are: *driving at a slow and steady speed, accelerating/braking gradually, spending less time idling the engine, using heating and cooling systems sparingly, closing windows at high speeds, planning ahead to consolidate trips, and avoiding quick starts and stops.*

The initial study showed that when provided with these EcoDrive materials, changes in self-reported fuel efficient behaviors were found, but only when employees were motivated to participate and when employees believed that supervisors also supported the EcoDrive program (Mansfield et al., 2016). While supervisor support has long been demonstrated to be positively correlated with employee outcomes such as increased engagement, satisfaction, and health and decreased stress, only recently has research focused on training supervisors on how to be more supportive in specific domains. In particular, Hammer and colleagues (2011) showed, in a randomized controlled trial, that when we train supervisors on Family Supportive Supervisor Behaviors (FSSBs), employees report higher levels of job satisfaction, lower intentions to quit, and improved physical health. In addition, Zohar (2002) showed that training supervisors to communicate with employees about safety more frequently can lead to reductions in minor

injuries, increases in the use of protective equipment, and improvements in employee perceptions of the safety climate.

Based on literature supporting the use of supervisor-based interventions, and findings from the initial study, we developed and tested the effectiveness of a supervisor training intervention aimed at encouraging supervisors to support eco-driving behaviors among their employees. The present study included two experimental groups: 1) the control group which received the stand-alone EcoDrive program with no supervisor training; and 2) the experimental group which received the EcoDrive materials, plus team supervisors were trained on how to support eco-driving among their employees.

The purpose of this report is to provide information about how the supervisor training for supporting the EcoDrive program was implemented at three participating organizations and to provide a preliminary evaluation of the training program. Specifically, this report will highlight how the training program impacted fleet drivers in terms of their attitudes, knowledge, and behavior over a six-month timeframe.

2.0 EVALUATION AND METHODOLOGICAL OVERVIEW

The EcoDrive program and training intervention evaluated in this report involves the introduction of various educational materials developed by Pac/West Communications and ODOT (see Appendix A for a description of the educational materials and specific examples of the materials). Additionally, this study introduced supervisor training materials for supporting the EcoDrive program (See Appendices A, E, and F). The EcoDrive materials were delivered to each of the three participating organizations for dissemination; in addition, the supervisor training materials were delivered to the supervisors in the supervisor training condition. To evaluate the effectiveness of the supervisor training compared to the standard EcoDrive program, a series of surveys were administered to two groups of participants. In the “standard EcoDrive” control group, participants worked in locations where the EcoDrive materials were placed at their worksite (as was done in the original study). Participants in the “supervisor training” group received the same EcoDrive materials, but in addition, their supervisors received a supervisor training video, written training materials, and reminder emails throughout the course of the study all focused on supporting the EcoDrive intervention (see Figure 1). This resulted in a time-series, quasi-experimental design (no random assignment). We initially attempted to randomly assign teams to either the control or experimental condition; however, random assignment was ultimately not possible because some supervisors specifically requested not to participate in the training portion of the study. Additionally, supervisors working at the same facility were assigned to the same condition in order to try and reduce the amount of crossover between the two groups.

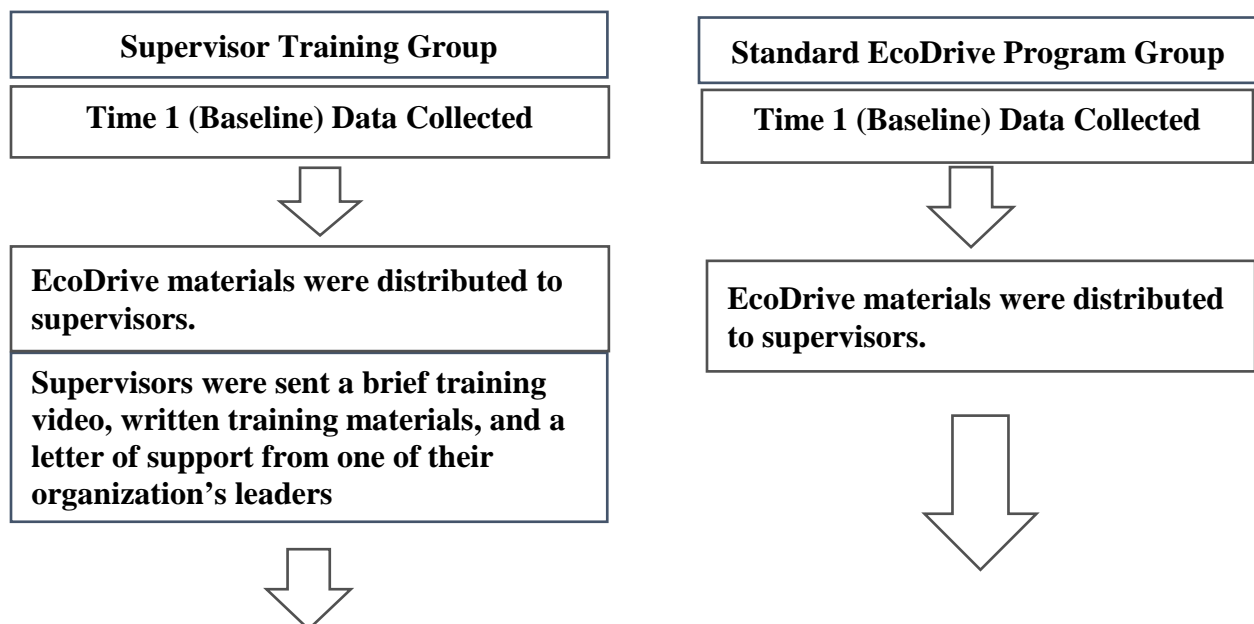
Each department was able to distribute the provided materials themselves. In the Washington County sample, one member of the research team, along with our contact at Washington County, assisted supervisors in physically putting up the materials around the worksites. The static cling tags which are intended to be placed in the windshield of the vehicle were given to supervisors because the majority of the vehicles were in use during our trip to the worksites. At ODOT and the City of Hillsboro, the materials were given to the supervisors or their administrative staff in accordance with their directions. We note this as a potential

limitation because we could not control where the materials were placed or how staff were notified of the presence of these materials.

2.1 THE STEPS TO THE EVALUATION WERE AS FOLLOWS (SEE FIGURE 1):

- Collection of employee baseline data through a survey (Time 1) to assess employee (driver) attitudes, knowledge, and behavior prior to dissemination of the EcoDrive materials. We also assessed the “readiness” of the individual drivers (e.g., motivation) and the organization (e.g., supervisor support for eco-driving).
- Materials were then disseminated to each of the participating organizations and those selected for the additional supervisor training were provided a training video and written materials.
- The second survey (Time 2) was then sent out approximately two months after the EcoDrive materials were first introduced to collect initial post-intervention data regarding changes in employee (driver) attitudes, knowledge, and behavior.
- Following this survey, a series of four email reminders highlighting specific EcoDrive tips and supervisor training reminders were sent to supervisors over the course of the next four months.
- Four months after the Time 2 surveys were collected, the Time 3 surveys were sent out (for a full table of survey measures included see Appendix C).
- Brief interviews were then conducted with some of the participating managers in the training group to help provide any additional qualitative feedback on the materials themselves and the supervisor training.

Study Overview Diagram



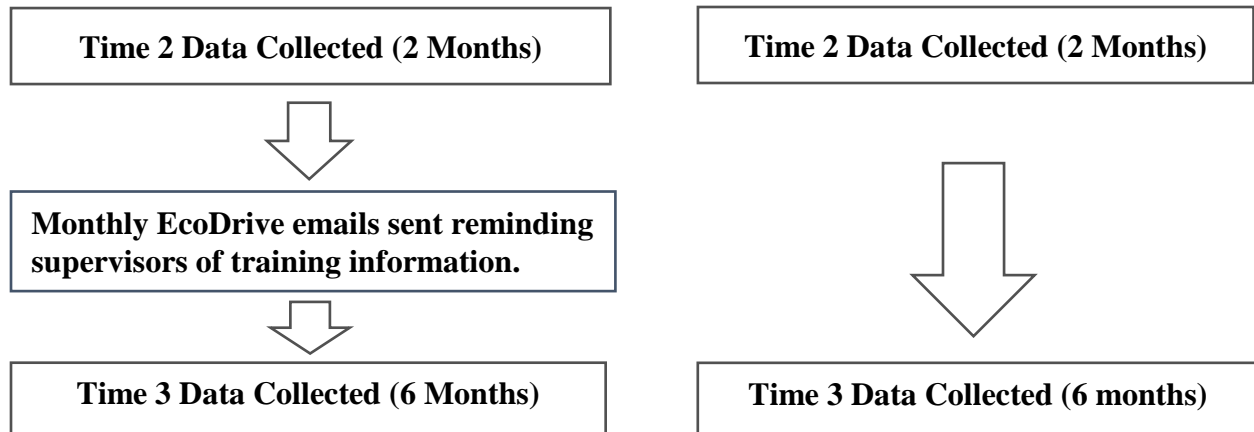


Figure 1. Summary diagram of the intervention procedure and evaluation design. Differences in procedure between the two groups are highlighted in Blue. All other aspects of the study (those highlighted in green) were the same between the control and supervisor training groups.

3.0 CHARACTERISTICS OF ORGANIZATIONS PARTICIPATING IN THE ECODRIVE STUDY

Three public-sector organizations agreed to participate in the EcoDrive Program and the evaluation process: Oregon Department of Transportation (ODOT), the City of Hillsboro, and Washington County (see Table 1 for a summary of the participants). Individual driver knowledge, attitudes, and self-reported behaviors were assessed at each time point, and Time 1 data were compared to data collected at Time 2 and Time 3. The drivers were separated into a control group, who received only the EcoDrive materials, and a supervisor training group where supervisors also received a brief (six-minute) supervisor training video, as well as written training materials and reminder emails. We compared change from Time 1 to Time 2 and 3 in driver knowledge, attitudes, and behaviors between the control and supervisor training groups. Time 1 data were used in many of the statistical analyses to control for baseline differences between the supervisor training and control groups.

The majority of participants were from Washington County (68%). The average age of the participants in this study was 47. The sample was predominately male (71%) and white (73%). On average, employees had been with their respective organizations for over 11 years and drove approximately 10 hours per week for their job.

Table 1
*EcoDrive Participants – Summary**

	ODOT	City of Hillsboro	Washington County	Total
Total # of Participants (All surveys)	24	22	98	144
Number of supervisors in the training group	1	5	13	19

Number of supervisors in the control group	1	5	4	10
Age (years)	46.1 (8.8)	50.7 (10.2)	46.4 (9.9)	46.9 (9.8)
% Male	78	91	65	71
% White (non-Hispanic)	81	73	70	73
Tenure (years with organization)	9.5 (9.1)	15.1 (7.8)	11.6 (7.2)	11.9 (7.7)
About how many hours do you expect to drive each week for work?	9.6 (7.8)	15.9 (13.5)	8.5 (9.7)	10.0 (10.5)

* Total number of participants reflects all time points combined. Age, tenure, and hours driven per week are means with standard deviations in parentheses.

4.0 EVALUATION SURVEYS

4.1 OVERVIEW

The survey measures used to assess the EcoDrive intervention were selected based on previous research on eco-driving behavior change, including the original study evaluating the ODOT EcoDrive materials (Mansfield et al., 2016). We decided to use many of the same measures as we used in the original study in order to maintain consistency in the assessments and to aid in comparison of findings across studies. We also drew on measures from other supervisor training literature (e.g., employee training; workplace safety) to assess employee readiness (e.g., employee motivation) and outcomes. A table showing the entire set of survey items collected in this study is included in Appendix B. The time point in which each construct was assessed is included in Appendix C.

In addition to the knowledge, attitudes, and behaviors assessed at each time point, we also assessed organizational factors that have been linked to the effectiveness of other training programs. For example, we included employees' perceptions of organizational climate and how much their supervisors supported eco-driving behaviors. In order to increase participation, we offered participants one entry per completed survey into a drawing for \$50 Amazon or Fred Meyer gift cards. Thus, the more surveys an individual completed, the better their chances were of winning a gift card. Surveys were left open for two weeks each, and three reminders were sent out to solicit responses during each data collection period. In addition, coordinators at each organization sent one reminder email per survey to increase the response rates.

4.2 INDIVIDUAL AND ORGANIZATIONAL READINESS MEASURES

The following four measures were used to assess driver and organizational readiness for the EcoDrive Program. These measures were included in the original study where we found that both individual motivation and supervisors that supported the program were critical to the effectiveness of the EcoDrive program (Mansfield et al., 2016). Additionally, these variables

have been shown to consistently predict the success of other organizational interventions. For example, these variables, which reflect both the individual (motivation) and the contextual (organizational and supervisor support) factors, have been shown to be important to the successful implementation of similar organizational programs (e.g., training, safety).

Energy-reducing attitudes. Energy-reducing attitudes is the overall concern one may have about saving fuel or reducing energy consumption and was assessed by five items. A sample item is, “I am motivated to save energy.” This scale was included in the survey because research has shown that energy-reducing attitudes are related to eco-driving attitudes (Harvey et al., 2013). Cronbach’s alpha across Time 1 to Time 3 was .66-.76.

Motivation to perform fuel-efficient behaviors. There are three subscales of this measure (eight items total) to reflect the three primary components of motivation described by expectancy theory when applied to an energy-reducing context (Van Eerde & Thierry, 1996). First, valence is conceptualized as the value placed on energy/fuel efficiency at work. A sample item of valence is, “I think it’s important to learn how to save gasoline.” Second, instrumentality is the belief that energy-reducing behaviors will lead to fuel-efficient/cost-saving outcomes. A sample item of instrumentality is, “There are things that I can do that will influence fuel efficiency.” Finally, expectancy is the belief that expending effort will lead to fuel-efficient behavior. A sample item of expectancy is, “I can actually improve my car’s fuel efficiency if I try.” This scale was included in the survey because past research has shown that higher motivation increases the likelihood that we will see changes in attitudes and behaviors toward organizational training programs (Zaniboni, Fraccaroli, Truxillo, Bertolino & Bauer, 2011), and it was a significant predictor of change in eco-driving behavior in past studies (Mansfield et al., 2016). Motivation for fuel-efficient behaviors was assessed at Time 1 and Time 3 only; Cronbach’s alpha was .90 at Time 1 and .93 at Time 3.

Organizational support for eco-driving. Organizational support for eco-driving is the individual’s perception of the organizational climate toward fuel efficiency and energy reduction. These include perceptions about the organizational policies, practices, and procedures surrounding eco-driving and was assessed with three items. A sample item is, “My organization places a strong emphasis on efficient driving behaviors.” This scale was included in the survey because past research indicates that it predicts the success of similar organizational interventions (e.g., safety programs and training) (e.g., Neal & Griffin, 2006). Cronbach’s alpha was .95-.96.

Supervisor support for eco-driving. Supervisor support is similar to organizational support except that it is the employee’s perception that the supervisor supports fuel efficiency and energy reduction. These include perceptions about the supervisors’ support of the policies, practices, and procedures surrounding eco-driving. Supervisor support was assessed through five items. A sample item is, “My supervisor places a strong emphasis on efficient driving behaviors.” Higher scores on this measure indicate a more positive perception of supervisor support toward eco-driving. This scale was included in the survey because past research indicates that a supportive supervisor is positively related to the success of organizational programs such as safety programs (e.g., Neal & Griffin, 2006). Further, past eco-driving research found that perceived supervisor support for eco-driving is related to eco-driving behavior (Mansfield et al., 2016). Cronbach’s alpha across Time 1 to Time 3 was .90-.96.

4.3 OUTCOMES OF THE INTERVENTION

Although the initial intent of this project was to examine both objective (actual fuel use) and subjective (reported driving behaviors) indicators of eco-driving practices, we were unable to obtain sufficiently detailed information to properly analyze changes in fuel consumption. For example, Washington County had 98 participants from nine departments that had access to 90 vehicles. Six of these vehicles were not used during all months of the intervention and survey period and did not have pre- or post-use data. Of the remaining vehicles, 51 did have complete monthly data through the intervention period as well as two years of prior fuel data. Fuel consumption (monthly miles per gallons) was computed by reported monthly fuel quantities and monthly vehicle mileage. Using these data, our initial findings did not show evidence of a reduction in fuel consumption following the intervention period. However, these findings should be interpreted with caution because the use of fuel receipts and manual reporting of vehicle mileage does not necessarily apportion miles driven and fuel consumed to the correct month, and thus makes analyses using these data difficult and potentially inaccurate. In order to appropriately associate the results of the surveys to actual driving behavior and fuel consumption, each vehicle would need to have a tracking device installed and individuals would need to be tracked. Because we did not have sufficient resources to equip the vehicles in this study with these devices, objective fuel analyses are not reported in the following sections.

Organizational and supervisor support for eco-driving (described above). Perceptions of organizational and supervisor support for eco-driving were also measured at Time 2 and Time 3 as manipulation checks to ensure that the supervisor training was increasing supervisor and organizational support as intended. In addition to those measures, supervisor frequency of communication regarding eco-driving and the percent of individuals who saw the EcoDrive materials were also collected as manipulation checks.

Supervisor frequency of communication. Supervisor frequency of communication regarding eco-driving practices was assessed by a one-item scale at Time 3 only. Frequency of communication was scored on a 7-point scale, (1=never and 7= more than once per week).

Employee reports of viewing EcoDrive materials. Exposure to EcoDrive materials was assessed using a total of five items (Truxillo, MacArthur, Guros & Mansfield, 2013). The five items asked if participants had seen the materials that were made available to the participating organizations (one item per type of EcoDrive material; e.g., tip card) using a binary, “yes/no” response option. Responses are reported as percentages of those indicating they saw the material.

Eco-driving knowledge. Eco-driving knowledge is self-assessed knowledge that one has about eco-driving practices and behaviors (Truxillo et al., 2013). Two items assessed change in knowledge across the three time points. Higher scores on these items indicate higher knowledge. A sample item is, “I am aware of what ‘eco-driving’ practices are and could briefly explain them to another person.” Knowledge acquisition is critical because it is a necessary component of being able to actually implement the eco-driving behaviors. Eco-driving knowledge was assessed using two items. Item 1 asked participants to rate their ability to explain eco-driving to another person, and item 2 asked participants in an open-ended question to provide one to two examples of eco-driving behaviors. These items were used in the previous study by Truxillo and colleagues (2013), and were used as indicators of eco-driving knowledge for this study.

Efficient driving practices. Efficient driving practices are those general practices found to be important in previous eco-driving studies and were assessed with two items. The scale originally included five items (Truxillo et al., 2013); however, based on discussions with the

supervisors and employee feedback, items regarding maintenance were dropped because employees were not responsible for maintenance of the vehicles. The two items focused on the driving behaviors of the individual, as opposed to maintenance of the vehicle (Martin, Chan & Shaheen, 2012). A sample item is, “In terms of fuel usage, how efficiently do you think you drive your work vehicle now?”

Eco-driving behaviors. Eco-driving behaviors are those behaviors based on the top eco-driving tips, as outlined in the educational materials developed by Pac/West Communications and ODOT. These were assessed with seven items: *driving at a slow and steady speed, accelerating/braking gradually, spending less time idling the engine, using heating and cooling systems sparingly, closing windows at high speeds, planning ahead to consolidate trips, and avoiding quick starts and stops.* This scale was included in the survey to ascertain behaviors both pre- and post-implementation in regard to the EcoDrive tips. Cronbach’s alpha ranged from .69 to .79 across the three time points. This scale originally included 13 items (Truxillo et al., 2013); however, the maintenance items were removed from these analyses because the participants were not responsible for maintenance of any of the vehicles at any of the organizations.

Perceived utility of the EcoDrive materials. Perceived utility is the reaction that participants have toward the EcoDrive program in terms of its value to participants. Research indicates that utility reactions are related to learning and behavior change (Alliger, Tannenbaum, Bennett & Traver, 1997). That is, the more a participant believes that the EcoDrive program is useful and effective, the more likely they will be to learn about eco-driving and use the knowledge back on the job. Utility evaluation was assessed through three items scored on a 1-7 scale with higher scores indicating more favorable perceptions of the utility of the EcoDrive materials. A sample item is, “How effective do you think the eco-driving program is overall?” Utility evaluation was assessed after the intervention (Time 2 and Time 3). Cronbach’s alpha was .93 at Time 2 and .97 at Time 3.

5.0 SURVEY RESPONSES

Our surveys were administered online through Qualtrics survey software. Surveys were left open for two weeks each and three reminder emails were sent out for each data collection. Across all organizations, there were 98 participants at Time 1, 80 participants at Time 2, and 75 participants at Time 3 (See Table 2). In order to assess changes over time, we matched the surveys of participants who filled out a survey at more than one time point. We were able to match survey responses for 38 participants across the three time points. However, in order to increase the statistical power of our tests, and because our primary interest was change from baseline, we conducted analyses that compare Time 1 to Time 2 and Time 1 to Time 3 responses. In analyses comparing Time 1 to Time 2 data, we were able to match responses from 50 participants. When comparing responses from Time 1 to Time 3, we were able to match responses from 48 participants. Of the matched surveys, 19 from Time 1 to Time 2 and 21 from Time 1 to Time 3 were from the control condition, and 31 from Time 1 to Time 2 and 27 from Time 1 to Time 3 were from the supervisor training group.

Table 2
Number of Participants by Organization and Survey Time

	ODOT	City of Hillsboro	Washington County	Total
Time 1	16	17	65	98
Time 2	18	12	50	80
Time 3	15	11	49	75
Total (unique participants)	24	22	98	144

*Of the 144 participants, we were able to match surveys for 50 of the participants from Time 1 to Time 2 and 48 of the participants for Time 1 to Time 3. We were able to match data from 38 participants across all three time points; however, analyses were conducted comparing only Time 1 to Time 2 and Time 1 to Time 3 in order to increase statistical power.

6.0 SURVEY RESULTS

The following section highlights the survey findings from the present study. These results will be reported by survey time (Time 1, Time 2, or Time 3) and group (control and supervisor training). The majority of the results pertain to participants who could be matched from Time 1 to Time 2 or from Time 1 to Time 3 and will focus on statistically significant changes. Note that the data for all three organizations were combined for these analyses because the numbers of matched participants for any one organization was relatively small. Due to the relatively small sample size for matched participants, and thus the limited amount of statistical power these tests have in detecting significant changes in the constructs of interests, two important adjustments were made in our interpretation of these results. These adjustments have been noted as reasonable adjustments in order to balance the risk of concluding that a novel intervention is ineffective when in fact it does provide some benefit (type 2 error) and the risk of concluding an intervention is effective when in fact it is not (type 1 error) (Cascio & Zedeck, 1983; Lipsey & Hurley, 2009). First, in all of our analyses we are using a cutoff alpha level of $p < .10$ rather than the conventional $p < .05$ in assessing the statistical significance of the tests conducted in our analyses. Furthermore, we will conduct all analyses using a one-tailed rather than two-tailed test as we have a clear theoretical rationale for believing that the supervisor training will have a positive impact on the constructs of interest.

In all analyses where baseline (Time 1) and follow-up (Time 2 or Time 3) data were collected, 2 x 2 mixed-measure factorial ANOVAs were conducted. The two factors were the within-person factor, change over time (with T1 and either Time 2 or Time 3 as the second level of this factor) and the between-subjects condition (control and supervisor training). To assess whether or not change occurred from Time 1 to follow-up (Time 2 or Time 3), the main effects for change across time points are reported. To assess whether the change from baseline differed by condition, the interaction effect (time by condition) is reported. Repeated measures analyses were conducted in order to account for any differences at baseline and to assess within-person change across the measurement points. In all analyses where only follow-up (Time 2 or Time 3) data were collected, independent samples t-tests were conducted to assess the differences

between the control and supervisor training groups. Data for all (unmatched) participants is presented in bar graphs in Appendix D by time point and group.

6.1 ENERGY-REDUCING ATTITUDES

The results showed that individuals in this study had relatively high levels of positive attitudes toward energy reduction at baseline. This is indicated by a mean response of 5.5 on a 7-point scale where 5 corresponds to “somewhat agree” and 6 corresponds to “agree.” Across groups there was not a significant change in energy-reducing attitudes from Time 1 to Time 2, $F(1, 48) = 1.24, p = .14$. However, at Time 3 we did find an increase in energy-reducing attitudes compared to Time 1, $F(1, 46) = 4.57, p = .02$. This suggests that, on average, participants had higher energy-reducing attitudes at the end of this study compared to the beginning of the study, and that this effect was maintained throughout the intervention rather than showing signs of deterioration over time.

Although energy-reducing attitudes were generally high and increased following the intervention (particularly at Time 3) the increase in energy-reducing attitudes did not differ by condition in the Time 1 to Time 2 comparison $F(1, 48) = .38, p = .27$. On the other hand, in the Time 1 to Time 3 comparison the change in energy-reducing attitudes did differ between the two conditions such that the control group improved more than the supervisor training group $F(1, 46) = 1.74, p = .097$. Upon further investigation, this interaction appears to be largely driven by the lower Time 1 value (5.26) in the control group’s energy-reducing attitudes in the Time 1 to Time 3 comparison compared to the Time 1 value (5.43) in the Time 1 to Time 2 comparison. Although the control group’s energy-reducing attitudes did improve more than the supervisor training group, both groups ultimately ended up with similar ratings in energy-reducing attitudes at the Time 3 follow-up.

Table 3
Energy-Reducing Attitudes (overall)

Measure	Overall Means		
	T1	T2	T3
Energy-reducing attitudes	5.53	5.65	5.63*

Note. Time 1 to Time 2 comparison: $N = 50$ (Control group $N = 19$, Training group $N = 31$). Time 1 to Time 3 comparison: $N = 48$ (Control group $N = 21$, Training group $N = 27$). *Significant change from Time 1 to Time 3 $p < .05$. For the T1 to T3 comparison, the T1 value was 5.26 for the control group and 5.57 for the supervisor training group.

Table 4
Energy-Reducing Attitudes (by condition)

Measure	Control Group			Training Group		
	T1	T2	T3	T1	T2	T3
Energy-reducing attitudes	5.43	5.63	5.60†	5.59	5.65	5.65†

Note. Time 1 to Time 2 comparison: $N = 50$ (Control group $N = 19$, Training group $N = 31$). Time 1 to Time 3 comparison: $N = 48$ (Control group $N = 21$,

Training group N = 27). †Change from T1 to T3 differed based on condition, such that the control group improved more than the supervisor training group, $p < .10$. For the T1 to T3 comparison, the T1 value was 5.26 for the control group and 5.57 for the supervisor training group.

6.2 MOTIVATION TO PERFORM FUEL-EFFICIENT BEHAVIORS

Motivation to perform fuel-efficient behaviors was found to be similar between the control ($M = 5.30, SD = .90$) and supervisor training ($M = 5.46, SD = .80$) groups at baseline with only a slight nonsignificant mean difference. Follow-up testing at Time 3 showed a similar trend, indicating that participants experienced minimal changes in motivation to engage in fuel-efficient behaviors compared to their Time 1 level of motivation. Although there were no significant changes in motivation to perform fuel-efficient behaviors, it is important to note that the motivation to perform fuel-efficient behaviors among participants in both groups was relatively high. Thus, although no changes were found, it seems that the participants in this study were adequately motivated to learn about and perform the EcoDrive behaviors.

Table 5
Motivation to Perform Fuel-Efficient Behaviors (overall)

Measure	Overall Means	
	T1	T3
Motivation to perform fuel-efficient behaviors	5.40	5.37

Note. Control group N=21, Training group N=27.

Table 6
Motivation to Perform Fuel-Efficient Behaviors (by condition)

Measure	Control Group		Training Group	
	T1	T3	T1	T3
Motivation to perform fuel-efficient behaviors	5.30	5.32	5.46	5.41

Note. Control group N=21, Training group N=27.

6.3 ORGANIZATIONAL SUPPORT FOR ECO-DRIVING

Across conditions, organizational support for eco-driving behaviors improved from Time 1 ($M = 4.47, SD = 1.56$) to Time 2 ($M = 4.66, SD = 1.43$); $F(1,48) = 1.72, p = .098$. At Time 3, organizational support increased further, demonstrating the maintenance of this effect rather than showing signs of the effect deteriorating over time $F(1, 46) = 10.06, p < .01$. Although there were no observed differences in the change between the two groups, the supervisor training group ($M = 4.80, SD = 1.11$) reported higher levels of organizational support by nearly one full point (on a 7-point scale) higher than the control group ($M = 3.93, SD = 2.03$) at Time 1, and the supervisor training group maintained this higher level of organizational support throughout the

intervention. Although the supervisor training group did not improve more than the control group, the supervisor training group started with higher perceptions of organizational support, and thus there was less room for the supervisor training group to improve. It may be that because these participants were highly motivated to perform fuel-efficient behaviors, the supervisor training had less of an impact on how individuals perceived organizational support for eco-driving. On the other hand, in organizations that have lower levels of organizational support at baseline, supervisor training may play a more important role in boosting perceptions of organizational support for eco-driving.

Table 7
Organization Support for Eco-driving (overall)

Measure	Overall Means		
	T1	T2	T3
Organizational Support for Eco-driving	4.47	4.66†	4.92**

Note. Time 1 to Time 2 comparison: N = 50 (Control group N = 19, Training group N = 31). Time 1 to Time 3 comparison: N = 48 (Control group N = 21, Training group N = 27). †Change from T1 to T2 significant at $p < .10$. **Change from T1 to T3 significant at $p < .01$.

Table 8
Organization Support for Eco-driving (by condition)

Measure	Control			Training		
	T1	T2	T3	T1	T2	T3
Organizational Support for Eco-driving	3.93	4.11	4.35	4.80	5.00	5.36

Note. Time 1 to Time 2 comparison: N = 50 (Control group N = 19, Training group N = 31). Time 1 to Time 3 comparison: N = 48 (Control group N = 21, Training group N = 27).

6.4 SUPERVISOR SUPPORT FOR ECO-DRIVING

Over the course of the study, we found that perceived supervisor support did increase across groups from Time 1 to Time 2, $F(1, 48) = 10.83, p < .01$ and from Time 1 to Time 3, $F(1, 46) = 18.18, p < .01$. However, the increase in supervisor support for the control group seemed to dissipate as observed by the lower mean supervisor support at Time 3 compared to Time 2. On the other hand, supervisor support continued to improve for the supervisor training group throughout the intervention. The change from T1 to T3 did differ by condition, indicating that supervisor support in the supervisor training group increased more than it did in the control group $F(1, 46) = 2.43, p = .06$. Treating the supervisor support as a manipulation check, this suggests that the supervisor training intervention did in fact increase supervisor support for eco-driving.

In addition to measuring perceived supervisor support, we also asked participants, as a manipulation check, to recall how frequently their supervisor talked to them about eco-driving over the course of the study. Employees in the control group ($M = 1.52, SD = .65$) reported that

their supervisors talked to them about eco-driving less frequently than those in the supervisor training group ($M = 2.57$, $SD = 1.35$); $t(65) = 3.65$, $p < .01$. This was one of the key outcomes because the supervisor training emphasized the importance of communicating with employees about the eco-driving behaviors. Although there was a significant difference between the control and supervisor training groups in the frequency of communication about eco-driving, the frequency of communication was still relatively low for both groups. The response option of 2 indicates “once or twice over the past six months”, and a response of 3 indicates “about once per month.” Thus, it seems that on average even supervisors in the supervisor training condition were communicating with employees about eco-driving more than supervisors in the control condition, but less than once per month.

Table 9
Supervisor Support for Eco-driving (overall)

Measure	Overall Means		
	T1	T2	T3
Supervisor Support for Eco-driving	3.86	4.44**	4.52**

Note. Time 1 to Time 2 comparison: $N = 50$ (Control group $N = 19$, Training group $N = 31$). Time 1 to Time 3 comparison: $N = 48$ (Control group $N = 21$, Training group $N = 27$). **Change from baseline is significant at $p < .01$.

Table 10
Supervisor Support for Eco-driving (by condition)

Measure	Control Group			Training Group		
	T1	T2	T3	T1	T2	T3
Supervisor Support for Eco-driving	3.52	4.15	3.88†	4.15	4.62	5.02†
Frequency of communication about eco-driving			1.52**			2.57**

Note. Time 1 to Time 2 comparison: $N = 50$ (Control group $N = 19$, Training group $N = 31$). Time 1 to Time 3 comparison: $N = 48$ (Control group $N = 21$, Training group $N = 27$). Time 3 comparison between conditions, $N = 67$ (Control group $N = 25$, Training group $N = 42$). †Change from T1 to T3 differed between the two groups, $p = .06$. **T-test indicated there was a significant difference between the Control and Supervisor Training groups at $p < .01$.

6.5 EMPLOYEE REPORTS OF VIEWING ECODRIVE MATERIALS

In addition to supervisor support, another key component to this intervention was exposure to the EcoDrive materials themselves. Viewing the materials and having them readily available are important to aid in learning the behaviors that constitute eco-driving. Supervisors who went through the training were instructed on how they could incorporate the EcoDrive materials into regularly scheduled meetings, in emails, and in other forms of communication.

Thus, the employees of supervisors who went through the training should report having viewed the EcoDrive materials at a higher rate compared to the control group. Indeed, participants in the supervisor training group reported seeing three of the five EcoDrive materials more frequently than participants in the control group. Roughly 19% more employees reported seeing the EcoDrive tip card at Time 2 in the supervisor training group (69%) compared to the control group (50%), $t(57) = 1.44, p = .08$. Additionally, 37% and 48% more employees reported viewing the EcoDrive videos at Time 2 and Time 3, respectively, in the supervisor training group compared to the control group, $t(65) = 3.31, p < .01$; $t(58) = 4.17, p < .01$. Interestingly, a slightly higher percentage of participants in the control group noted that they had seen the static cling tags at Time 2 (56%) and Time 3 (64%) compared to the supervisor training group at Time 2 (40%) $t(63) = -1.26, p = .11$ and Time 3 (44%), $t(64) = -1.59, p = .06$. This discrepancy points to potential issues with how the materials are initially distributed, and suggests a need for more uniform and thorough dissemination of the EcoDrive materials.

Table 11
Employee Reports of Viewing EcoDrive Materials

EcoDrive Material	Control Group		Training Group		Comparison T Values	
	T2	T3	T2	T3	T2	T3
EcoDrive Tip Card	50%	65%	69%	74%	1.44†	.69
EcoDrive Poster	55%	54%	54%	68%	-.14	1.13
Static Cling Tag	56%	64%	40%	44%	-1.26	-1.59†
Visited EcoDrive Website	7%	4%*	12%	22%	.63	2.34*
Viewed EcoDrive Videos	11%	9%	48%	57%	3.31**	4.71**

Note. Control group N=23-27, Training group N=35-42. Comparison t-values indicate the t-values comparing the supervisor training group to the control group. †Indicates a difference between Control and Supervisor Training groups, $p < .10$. *Indicates a significant difference between Control and Supervisor Training groups, $p < .05$. **Indicates a significant difference between Control and Supervisor Training groups, $p < .01$.

6.6 ECO-DRIVING KNOWLEDGE

Eco-driving knowledge refers to the self-rated understanding one has about eco-driving practices. We assessed self-rated eco-driving knowledge with two items. In regard to item 1, there was a statistically significant increase in knowledge from Time 1 ($M = 4.04, SD = 1.58$) to Time 2 ($M = 5.37, SD = 1.04$) for participants across groups on their ability to explain eco-driving to another person, $F(1, 47) = 35.34, p < .01$. The increase in eco-driving knowledge was also found when testing from Time 1 to Time 3 $F(1, 45) = 39.41, p < .01$. Although both groups improved in their eco-driving knowledge, the increase in knowledge did not differ as a result of receiving the supervisor training in either the Time 1 to Time 2 comparison $F(1, 47) = .40, p = .27$ or the Time 1 to Time 3 comparison $F(1, 45) = .93, p = .17$.

For item 2, there was not a significant change from Time 1 to Time 2, $F(1, 47) = 1.59, p = .11$, but there was a significant change from Time 1 to Time 3, $F(1, 45) = 5.85 p = .02$. These results suggest that although there was no additional improvement for the supervisor training group, on average knowledge of EcoDrive practices increased for the participants in this study. Similar to some of the previous findings, there may also be a ceiling effect that is masking the effectiveness of the intervention in these analyses. Given the small samples sizes and that over 75% of the participants in the control group were able to recall at least one eco-driving practice, nearly 100% of the supervisor training group would have needed to recall at least one eco-driving behavior in order to be able to identify a significant difference between the two conditions. Although the findings did not show a statistically significant improvement for the supervisor training group beyond that of the control group, the supervisor training group did have a slightly greater ability to recall the eco-driving behaviors and had a slightly greater endorsement of knowledge of eco-driving practices following the intervention.

Table 12
Eco-driving Knowledge (overall means)

Item	Overall Means		
	T1	T2	T3
1. EcoDrive knowledge (explain to another person)	4.04	5.37**	5.19**
2. If you are able to, please provide one or two (brief) examples of what you think eco-driving consists of	67%	78%	81%*

Note. Time 1 to Time 2 comparison: N = 50 (Control group N = 18, Training group N = 31). Time 1 to Time 3 comparison: N = 48 (Control group N = 21, Training group N = 26). **Indicates a significant change compared to Time 1, $p < .01$.

*Indicates a significant change compared to Time 1, $p < .05$. Responses scored on 1 (Strongly Disagree) to 7 (Strongly Agree) scale for the first question. The second question was on a 1 (Yes) to 2(No) scale.

Table 13
Eco-driving Knowledge (by condition)

Item	Control Group			Training Group		
	T1	T2	T3	T1	T2	T3
1. EcoDrive knowledge (can explain eco-driving to another person)	3.84	5.0	5.14	4.17	5.60	5.23
2. If you are able to, please provide one or two (brief) examples of what you think eco-driving consists of	63%	74%	76%	70%	80%	85%

Note. Time 1 to Time 2 comparison: N = 50 (Control group N = 18, Training group N = 31). Time 1 to Time 3 comparison: N = 48 (Control group N = 21, Training group N = 26). Responses scored on 1 (Strongly Disagree) to 7 (Strongly Agree) scale for the first question. The second question was scored on a (Yes/No) scale.

6.7 EFFICIENT DRIVING PRACTICES

Adjusting driving behavior. Across groups, participants reported they adjusted their driving behavior more at Time 2 ($M = 4.97$, $SD = 1.33$) compared to Time 1 ($M = 4.03$, $SD = 1.75$); $F(1, 37) = 9.49$, $p < .01$ (see Table 14). This effect was maintained and even slightly strengthened when comparing Time 1 to Time 3, $F(1, 38) = 17.48$, $p < .01$. Although both groups reported increases in how much they adjusted their driving behaviors, the two groups did not differ in this regard.

Efficient driving of work vehicle. Regarding item 2, (In terms of fuel efficiency how do you think you drive your work vehicle now?), no changes were found either across time points or between groups. This is interesting because participants rated themselves as more likely to adjust driving habits to save fuel, yet not more likely to have more efficient driving behaviors in general. One potential explanation may be that the general behavior of “driving in a fuel-efficient manner” already had relatively high mean scores (5.6 and 5.4) on a 7-point scale at Time 1. Thus, there was less room for improvement on item 2 compared to item 1.

Table 14
Efficient Driving Practices (overall)

Item	Overall		
	T1	T2	T3
1. When driving your primary work vehicle, how often do you adjust your driving behavior in ways to save fuel?	4.03	4.97**	5.08**
2. In terms of fuel efficiency how do you think you drive your work vehicle now?	5.46	5.57	5.54

Note. Control group $N=14-20$, training group $N=23-28$. ** Indicates a significant change compared to T1, $p < .01$.

Table 15
Efficient Driving Practices (by condition)

Item	Control Group			Training Group		
	T1	T2	T3	T1	T2	T3
1. When driving your primary work vehicle, how often do you adjust your driving behavior in ways to save fuel?	3.86	4.57	4.88	4.12	5.20	5.22
2. In terms of fuel efficiency how do you think you drive your work vehicle now?	5.56	5.67	5.5	5.39	5.50	5.58

Note. Control group $N=14-20$, training group $N=23-28$.

6.8 ECO-DRIVING BEHAVIORS

Four of the seven assessed eco-driving behaviors improved across the supervisor training and control groups when compared to their baseline levels. Additionally, when taken together as

a scale, the results suggest that participants' driving behaviors did improve from Time 1 ($M=5.52$, $SD = .62$) to Time 2 ($M =5.65$, $SD = .69$); $F(1, 48) = 3.05$, $p = .09$ (see Table 16), and that this change was maintained and even slightly increased when comparing Time 1 to Time 3 ($M = 5.71$, $SD = .67$); $F(1, 46) = 11.76$, $p < .01$. Among the three behaviors where no change was found, the baseline levels were exceptionally high for one or both groups (at least 6 on a 7-point scale). Thus, there may have been a ceiling effect for those items that limited our ability to actually detect any change in participants' behavior.

Although our interest was primarily in investigating the effect of the supervisor training beyond the standard EcoDrive program, we did not find support for the supervisor training group improving more than the control group in terms of eco-driving behaviors. In cases where there was a difference between the groups in the amount of improvement in a given eco-driving behavior, the control group actually improved more than the supervisor training group. Further investigation of the mean values for each item showed that this finding is primarily due to the lower level of reported eco-driving behavior at baseline for the control group. On average, the control group started with baseline levels of these eco-driving behaviors that were .3 lower than the supervisor training group. This meant that the control group participants had more room to improve than the training group due to their lower baseline levels of eco-driving behaviors.

Table 16
Eco-driving Behaviors (overall)

Item	Overall Means		
	T1	T2	T3
1. Drive at a slow and steady speed	5.90	5.94	5.89
2. Accelerate/brake gradually	5.94	5.84	6.02
3. Spend less time idling your engine	5.18	5.42	5.52*
4. Use the heating and cooling systems sparingly	4.02	4.14	4.50**
5. Close windows at high speeds	6.00	6.02	6.19
6. Plan ahead to consolidate trips	5.78	6.12**	5.92
7. Avoid quick starts and stops	5.84	6.08*	5.94†
Behavior Subscale	5.52	5.65*	5.71**

Note. Time 1 to Time 2 comparisons: $N = 50$ (Control group $N = 18$, Training group $N = 31$). Time 1 to Time 3 comparisons: $N = 48$ (Control group $N = 21$, Training group $N = 26$).
*Change from T1 significant, $p < .05$. **Change from T1 significant, $p < .01$.

Table 17
Eco-driving Behaviors (by condition)

Item	Control Group			Training Group		
	T1	T2	T3	T1	T2	T3
1. Drive at a slow and steady speed	6.11	6.05	5.76	5.77	5.87	6.0
2. Accelerate/brake gradually	5.53	5.68	5.81	6.19	5.94	6.19
3. Spend less time idling your engine	4.84	5.16	5.29	5.39	5.58	5.70

4. Use the heating and cooling systems sparingly	4.00	4.16	4.33	4.03	4.13	4.63
5. Close windows at high speeds	6.11	6.05	6.19	5.94	6.00	6.19
6. Plan ahead to consolidate trips	5.26	6.05*	5.71	6.10	6.16*	6.07
7. Avoid quick starts and stops	5.58	6.16*	5.86†	6.00	6.03*	6.00†
Behavior Subscale	5.35	5.68	5.56	5.63	5.67	5.83

Note. Time 1 to Time 2 comparisons: N = 50 (Control group N = 18, Training group N = 31). Time 1 to Time 3 comparisons: N = 48 (Control group N = 21, Training group N = 26). †Amount of change from T1 differed between the control and supervisor training groups, $p < .10$. *Amount of change from T1 differed between the control and supervisor training groups, $p < .05$.

6.9 PERCEIVED UTILITY OF THE ECODRIVE MATERIALS

Perceived utility is the participants' reaction toward the usefulness of the EcoDrive program. These reactions are important because the more a participant believes that the EcoDrive program is useful and effective, the more likely they will be to learn about eco-driving and use the acquired eco-driving knowledge on the job. The results indicated that individuals in the supervisor training group ($M = 4.50$, $SD = 1.37$) felt the EcoDrive materials were more useful than those in the control group ($M = 3.93$, $SD = 1.29$) at Time 2, $t(58) = 1.60$, $p = .06$ (see Table 19). Furthermore, at Time 3, participants' ratings of the utility of the EcoDrive program were maintained and even slightly increased in the supervisor training group ($M = 4.66$, $SD = 1.67$), whereas in the control group the utility ratings decreased ($M = 3.56$, $SD = 1.45$). This led to a significant difference in utility ratings at Time 3, where the training group rated the materials as more useful than those in the control group $t(56) = 2.49$, $p < .01$.

Table 19
Perceived Utility of the EcoDrive Materials

Measure	Control Group		Training Group	
	T2	T3	T2	T3
Utility Ratings	3.93†	3.56**	4.50†	4.66**

Note. Control group N=20-25, Training group N=35-38. †Difference between the control and supervisor training conditions was significant, $p < .10$. ** Difference between the control and supervisor training conditions was significant, $p < .01$. The response options for this scale varied by question and were (1=Not very useful – 7 = Very useful), (1= Not at all effective – 7= Very effective), (1= Not at all – 7 = Very much so).

7.0 EXIT INTERVIEW RESULTS

One member of the research team conducted formal exit interviews with three of the participating supervisors. These interviews were conducted in order to obtain more contextual information regarding how the EcoDrive materials and supervisor training materials were distributed and perceived. Additionally, we sought feedback regarding any suggestions or comments from supervisors in the exit interviews and the qualitative open-ended questions at the end of the surveys to employees. See Appendix G for the complete set of exit interview questions.

7.1 DISTRIBUTION OF MATERIALS

In general, supervisors noted that they allowed their team members to choose where the materials were placed. Each of the supervisors noted that the distribution of the EcoDrive materials was relatively simple and was not a burden to complete. When visiting the facilities to conduct these interviews we did note that some of the EcoDrive materials were still visible. Specifically, the tip cards were found in the break room and posted on a wall with other materials at two of the three locations visited for interviews. A concern brought up by one of the supervisors was that easier access to more replacement materials would have been helpful. They stated that over time the materials “grew legs” and that he only had a handful of replacements available.

Each of the supervisors noted that they received the reminder emails sent following the Time 2 data collection. However, one of the three supervisors said that they did not really change their behavior or mention anything about the program during this time to their employees. The other two supervisors noted that they either sent email reminders to their employees or tried to bring up some aspect of eco-driving practices during the week they received the email. Thus, although supervisors were provided instruction to make at least brief mention of the EcoDrive program to their employees, there was likely a fair amount of variability in the uptake of the EcoDrive program across the supervisor training groups.

7.2 REACTION TO THE ECODRIVE MATERIALS

Supervisor feedback. The supervisors noted that the materials seemed to be well thought out and well made. Additionally, they stated that the tips were not particularly difficult to remember and that the materials served as good reminders to employees about these behaviors. The supervisors did mention that some of their employees stated that they already knew that these practices would save fuel and considered some of these tips just common sense.

Regarding the supervisor training video, the supervisors felt that the video was well made. The supervisors appreciated that the video was not excessively long (the video was six minutes), and they thought showing the EcoDrive videos to their employees was a nice way of introducing and talking about the EcoDrive materials. The supervisors also noted that the reminder emails were frequent enough to maintain dialogue with employees about eco-driving, but not so frequent as to be off-putting to the supervisors or employees.

Employee feedback. One member of the research team summarized the qualitative feedback provided by participants in the open-ended question at the end of each survey. Employees seemed to have mixed opinions on the materials. Echoing the comments of the supervisors, some of the employees thought the materials were too simple and that they already knew everything in the materials. However, others noted that even though they know the

EcoDrive behaviors save fuel, the EcoDrive materials were good reminders to actually engage in those behaviors. Unfortunately, there were a couple of concerning comments by participants who noted they had not seen the materials at all and that their supervisor had not mentioned the materials to them. Of course, without any exposure to the materials or supervisor support for the program, uptake of the EcoDrive program and thus changes in behavior seem unlikely to occur.

One concern mentioned during these interviews and in the qualitative comments was that some of these behaviors could not be performed for heavy duty vehicles and vehicles that engaged in roadwork that required hazard or safety lights be left on for long periods of time. In these cases, the supervisor and employees felt that turning their vehicle off when using the equipment that runs on the vehicle battery may drain the battery to the point that they would need to jump-start their vehicle. Thus, those tips and practices did not apply to these individuals, which seemed to cause a slight negative reaction to the materials in some cases. Another concern mentioned by some supervisors and participants was that some of the EcoDrive tips, particularly those related to maintenance tips, did not really apply to them. We noted this in our initial discussions with each organization, and we tailored the training videos to focus on the behaviors that were most applicable; however, we were unable to change the materials that were already printed and developed from the original ODOT EcoDrive program.

7.3 EMPLOYEE SUGGESTIONS ABOUT THE PROGRAM

As noted, the main suggestion from supervisors and qualitative feedback from employees was that further tailoring of the materials to each organization and their specific driving context may lead to a greater impact in behavior change. While we initially attempted to include a video of an organization leader from each organization in the training materials, this was ultimately not possible due primarily to the feasibility of having professional quality video obtained from each organization. In place of this, we provided written letters of support to supervisors from the organization leaders (See Appendix F for a sample letter). Despite this attempt to tailor the materials, we acknowledge that further tailoring of the material would likely yield more buy in from supervisors and employees.

A second suggestion was primarily regarding the actual EcoDrive materials. As mentioned, having the maintenance tips included in the EcoDrive materials and in the surveys made the program feel less applicable to the employees. Although the majority (seven of the 10 tips) are directly related to individual driving habits and only three of the 10 tips deal with vehicle maintenance (something not typically done by employees), the employees still perceived these tips as not fitting their job duties. These changes – deleting tips that are not relevant to a particular work organization – could be made fairly easily. However, it would require additional resources from ODOT or any organization that is starting an EcoDrive program to print new materials. Although these criticisms didn't seem overly negative, making these slight improvements may yield greater behavior changes by better capturing the participants' focus.

8.0 INTERPRETATION OF STUDY RESULTS

The present study evaluated the effects of ODOT's EcoDrive program in a workplace context, and whether the program's effects could be increased by training supervisors to show support for it. Overall, we found support for the effectiveness of the EcoDrive program in affecting some employee attitudes and behaviors over time. Employees whose supervisors were trained on how to support eco-driving reported greater supervisor support for the program; this did not necessarily translate into differences in eco-driving attitudes and behaviors between the two conditions. This may be due to 1) the relatively positive eco-driving attitudes and motivation among employees in both conditions to begin with, and 2) the relatively small sample sizes which limited our ability to statistically detect differences between the two groups. Study strengths, study results, and recommendations for future research are discussed below.

8.1 STUDY STRENGTHS

One strength of this study is that, unlike in the original study which was conducted over a short period of time (six weeks), this study assessed behavioral changes over longer intervals (two months and six months). Assessing behavioral change over longer periods of time is critically important because this provides support for the changes being maintained and the intervention yielding more value to the organization compared to an intervention effect that deteriorates over time.

A second strength of this study is the inclusion of both a control group and an intervention group. This allowed us to directly compare changes in the outcomes of interest between the two groups (control and supervisor training). It is also important to note that because the control group did still receive the standard EcoDrive program, effects of the supervisor training represent improvement beyond the standard program rather than simply changes in the outcomes of interest for the supervisor training group. Future studies could include a true control group that receives no intervention to help tease apart the unique effects of the EcoDrive program and the supervisor training component.

Another strength of this study is the increased proportion of individuals actually exposed to the EcoDrive materials compared to the original study. Whereas in the original study only 10-20% (Truxillo et al., 2013) of the sample reported having seen the materials at follow-up, in this study most materials were seen by 40-50% of respondents in both groups and the tip cards were seen by 74% of the supervisor training group at Time 3.

8.2 CHANGES IN OUTCOMES

Although the differences between the control and supervisor training groups appeared minimal and were often not statistically significant, looking at the mean responses for the outcomes variables showed that, in some cases, the initial improvement from the materials alone began to dissipate whereas the improvement seen in the training group was maintained. For example, supervisor support for eco-driving initially improved (at Time 2) for both groups; however, at Time 3 supervisor support began to regress back towards baseline levels for the control group but continued to increase for the training group. Similarly, the utility ratings of the EcoDrive program decreased for the control group from Time 2 to Time 3 but increased for the supervisor training group.

Another important outcome that differed between the groups was frequency of communication about eco-driving. Supervisors in the training group were rated as having talked about the EcoDrive program more frequently than the supervisors in the control condition.

Although there was improvement in supervisor support and frequency of communication about eco-driving in the supervisor training group, the average levels of supervisor support and frequency of communication were still relatively low. For example, supervisor support was still only at 5 out of 7 post-intervention, which corresponds to the “slightly agree” anchor. Similarly, the frequency of communication about eco-driving remained between the “once or twice in the past six months” to “about once per month” anchors. This shows that although the supervisor training group did support the program more than the control group, there was still ample room for increasing supervisor support for both groups.

One of the more robust differences between the control and supervisor training groups was the percentage of individuals exposed to the various EcoDrive materials. The largest difference was in the percentage of participants that reported viewing the EcoDrive video at Time 3, which was 9% for the control group and 57% for the training group. Given that exposure to these materials is key for any knowledge acquisition and likely for behavior change, this finding is promising regarding the increased effectiveness of the EcoDrive program when combined with supervisor training.

In total, four of the seven EcoDrive behaviors and one of the two general efficient driving practices improved at two months and six months post-intervention. These changes were found across groups, meaning that both groups improved and there were not statistically significant differences in the changes between the two groups. These were the key outcomes of interest in this study, and although there was no effect found for the supervisor training, the improvement across groups still demonstrated that the EcoDrive program was effective in promoting eco-driving practices. One caveat to the lack of significant findings for the effectiveness of the supervisor training is that in many cases the training group had higher baseline levels of the EcoDrive behaviors compared to the control group. Based on those higher baseline levels, the supervisor training group had less room for improvement compared to the control group and this difference may have masked the effectiveness of the supervisor training.

One possible explanation to the finding that both groups seemed to improve in several outcomes of interest is that being exposed to a study may be sufficient to induce behavior change. The survey links that were sent out, combined with the emails to solicit responses, likely left individuals in the control condition with a greater sense of support or awareness about the program than they may have felt had they not received these surveys and emails.

Another factor that may have limited our ability to find statistically significant changes in some of the assessed behaviors is a ceiling effect for some of the outcomes of interest. For example, on the EcoDrive behavior checklist the three items that did not show significant changes over time also had a baseline level of at least 6 from one of the groups. Given that these responses were on a 7-point scale, changing an individual’s response from a 6 (agree) to a 7 (strongly agree) may be fairly challenging. It may be that the scaling of these measures or the specific items should be adjusted to increase the sensitivity of these measures in order to better detect changes in these behaviors.

Although we did not find significant differences between the conditions on many of the outcomes of interest, we did find differences in supervisor support, frequency of communication about eco-driving, ratings of the utility of the EcoDrive program, and exposure to the EcoDrive materials which are key antecedents to changing behavior. Given that these changes were maintained throughout the intervention, it seems likely that this intervention will have a lasting impact on the eco-driving practices of members of the participating organizations.

9.0 SUGGESTIONS FOR FUTURE RESEARCH AND APPLICATIONS

Overall, there are a few areas where we note the potential for additional research and for future interventions to focus their attention in order to maximize the impact of the EcoDrive program.

- 1. More uniform and thorough distribution of EcoDrive materials:** Although 65% of participants in the control group and 74% in the supervisor training group saw the EcoDrive tip card by the conclusion of the study, only 44% of those in the supervisor training group saw the static cling tags compared to 64% in the control group. Additionally, only 48% at Time 2 and 57% at Time 3 in the supervisor training group saw the EcoDrive videos. Given that showing these materials to employees is one of the primary mechanisms for showing support for the program, this is certainly an area where improvements could be made. The improvements may be needed in the actual distribution of materials as well as perhaps more frequent email reminders to supervisors.
- 2. Larger samples and longer follow-up periods:** One of the limiting factors in this study, as well as the previous study by Mansfield et al. (2016) was the relatively small sample size. A larger sample would allow us to have a more robust test of the effectiveness of the supervisor training compared to the standard EcoDrive program. Furthermore, as shown in the changes in general trajectory between the control and supervisor training groups it may be that the impact of the supervisor training is greatest as the program is maintained long term. Whereas both groups saw an initial increase in EcoDrive behaviors and support indicators, the training group showed sustained increases in supervisor support and ratings of the utility of the EcoDrive program which were not found in the control condition. These sustained effects may lead to a greater benefit for the supervisor training group at later follow-up periods (e.g., nine months and one year).
- 3. Individuals with low vs high motivation to perform fuel-efficient behaviors:** One interesting point made about this sample is that they generally had high levels of motivation to perform fuel-efficient driving behaviors. This may have led to the supervisor training having a limited additional benefit compared to training supervisors working with individuals who have low or average levels of motivation

to perform fuel-efficient behaviors. Thus, future research should assess the effectiveness of the supervisor training component of this intervention among a wider variety of individuals and organizations who may have closer-to-average levels of motivation to engage in the EcoDrive behaviors at the beginning of the study.

- 4. Objective fuel consumption indicators.** As noted, although we did obtain objective fuel data, the data were not sufficiently detailed and did not allow us to properly assess the impact of the intervention on fuel consumption. One potential method for addressing this gap in future studies is to equip vehicles with vehicle tracking devices. These devices can monitor not only fuel consumption, but also the occurrence of hard stops and quick starts, which would provide another indicator of some of the eco-driving behaviors that were the focus of this study. Future studies should make a concerted effort to incorporate objective fuel indicators in conjunction with self-reported driving behaviors in order to obtain a more complete understanding of the impact of the eco-driving and supervisor support interventions.

10.0 SUMMARY

In summary, for this study we extended the existing EcoDrive program and developed and implemented a supervisor training program combined with the EcoDrive program developed by ODOT. The primary goal of this study was to test the effectiveness of the supervisor training component compared to the EcoDrive materials as a stand-alone program. We found that participants in both groups increased their eco-driving behaviors according to four of the seven EcoDrive behaviors, and one of the two general fuel-efficient behaviors. Participants in the supervisor training group reported viewing the EcoDrive materials at a higher rate than those in the control group and reported higher perceptions of supervisor support. Furthermore, those in the supervisor training group rated the EcoDrive program as more useful than those in the control group. Thus, the stand-alone EcoDrive program seemed to produce some behavior change; however, the supervisor training led to greater exposure to the EcoDrive materials, higher ratings of the usefulness of the EcoDrive program, and higher levels of perceived supervisor support. Given that supervisor support was identified as a key antecedent to behavior change in the original study (Mansfield et al., 2016), the increase in supervisor support provided by the supervisor training remains valuable.

Based on these findings, we suggest that organizations continue to pursue supportive supervision for efficient driving behaviors as a mechanism for creating change in fuel-efficient behaviors. However, we also recommend that future eco-driving studies use more rigorous methods for delivering and disseminating the EcoDrive materials (e.g., specific procedures for setting up materials) and maintain regular dialogue (e.g., monthly email reminders) about these behaviors between supervisors and employees. Finally, we suggest that future studies focus on obtaining larger samples, particularly with regard to the ability to match participants across time points. A larger sample and more diverse range of individuals and organizations participating in the program may yield a clearer understanding of how the supervisor training impacts the

effectiveness of the EcoDrive program.

11.0 REFERENCES

- Alliger, George M., Scott I. Tannenbaum, Winston Bennett, Holly Traver, and Allison Shotland. "A meta-analysis of the relations among training criteria." *Personnel psychology* 50, no. 2 (1997): 341-358.
- Barkenbus, Jack N. "Eco-driving: An overlooked climate change initiative." *Energy Policy* 38, no. 2 (2010): 762-769.
- Boriboonsomsin, Kanok, Alexander Vu, and Matthew Barth. "Eco-driving: pilot evaluation of driving behavior changes among us drivers." *University of California Transportation Center* (2010).
- Cascio, Wayne F., and Sheldon Zedeck. "Open a new window in rational research planning: Adjust alpha to maximize statistical power." *Personnel Psychology* 36, no. 3 (1983): 517-526.
- Cristea, M., F. Paran, and P. Delhomme. "The role of motivations for eco-driving and social norms on behavioural intentions regarding speed limits and time headway." *World Academy of Science, Engineering and Technology* 6 (2012): 1307-6884.
- Harvey, Joan, Neil Thorpe, and Richard Fairchild. "Attitudes towards and perceptions of eco-driving and the role of feedback systems." *Ergonomics* 56, no. 3 (2013): 507-521.
- Lipsey, Mark W., and Sean M. Hurley. "Design sensitivity." *The SAGE handbook of applied social research methods* (2009): 44-76.
- Mansfield, Layla R., Frankie Guros, Donald M. Truxillo, and John MacArthur. "Individual and contextual variables enhance transfer for a workplace eco-driving intervention." *Transportation research part F: traffic psychology and behaviour* 37 (2016): 138-143.
- Martin, Elliot, Nelson Chan, and Susan Shaheen. "How public education on ecodriving can reduce both fuel use and greenhouse gas emissions." *Transportation Research Record: Journal of the Transportation Research Board* 2287 (2012): 163-173.
- Neal, Andrew, and Mark A. Griffin. "A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels." *Journal of applied psychology* 91, no. 4 (2006): 946.
- Stillwater, Tai, and Kenneth S. Kurani. "Drivers discuss ecodriving feedback: Goal setting, framing, and anchoring motivate new behaviors." *Transportation research part F: traffic psychology and behaviour* 19 (2013): 85-96.
- Van der Voort, Mascha, Mark S. Dougherty, and Martin van Maarseveen. "A prototype fuel-

- efficiency support tool." *Transportation Research Part C: Emerging Technologies* 9, no. 4 (2001): 279-296.
- Van Eerde, Wendelien, and Henk Thierry. "Vroom's expectancy models and work-related criteria: A meta-analysis." *Journal of applied psychology* 81, no. 5 (1996): 575.
- Wada, Takahiro, Koki Yoshimura, Shun-ichi Doi, Hironori Youhata, and Koichi Tomiyama. "Proposal of an eco-driving assist system adaptive to driver's skill." In *2011 14th International IEEE Conference on Intelligent Transportation Systems (ITSC)*, pp. 1880-1885. IEEE, 2011.
- Zaniboni, Sara, Franco Fraccaroli, Donald M. Truxillo, Marilena Bertolino, and Talya N. Bauer. "Training valence, instrumentality, and expectancy scale (T-VIES-it) Factor structure and nomological network in an Italian sample." *Journal of Workplace Learning* 23, no. 2 (2011): 133-151.
- Zohar, Dov. "Modifying supervisory practices to improve subunit safety: a leadership-based intervention model." *Journal of Applied psychology* 87, no. 1 (2002): 156.

APPENDIX A

Overview of the EcoDrive Educational Materials

Top Ten Eco-driving Tips

1. Drive at a steady and slower speed.
2. Avoid quick starts and stops.
3. Reduce the time your engine idles.
4. Keep your tires inflated.
5. Maintain your vehicle.
6. Remove unnecessary weight from vehicle.
7. Use heating and air conditioning sparingly.
8. Close windows at high speeds.
9. Choose the right oil.
10. Plan ahead to consolidate trips.

Eco-driving Project Logo

- A logo to include the Top Ten Eco-driving Tips

Eco-driving Educational Video(s)

- A series of video shorts (15 to 45 seconds) developed to cover all of the Top Ten Eco-driving Tips

Eco-driving Tip Card for Cars and Light Vehicle fleets

- A rearview mirror hanging Eco-driving tip card

Eco-driving Prompt Static Clings for Light Vehicles

- Prompt static clings that can be affixed to the inside of a vehicle windshield. The purpose of the prompt static clings is to remind drivers to utilize the Top Ten Eco-driving Tips.

Eco-driving Posters

- A full-color poster featuring the Top Ten Eco-driving Tips and how drivers can save money at the gas pump

Website (including videos):

- <http://www.oregon.gov/ODOT/TD/TP/pages/ecodrive.aspx>

Supervisor Training Video:

- <https://www.youtube.com/watch?v=DxIKUufi6J8&feature=youtu.be>

APPENDIX B

Survey Questions

All questions appeared on each survey for all organizations, unless noted.

Proactive Personality (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. I am constantly on the lookout for new ways to improve my life.
2. Wherever I have been, I have been a powerful force for constructive change.
3. If I see something I don't like, I fix it.
4. No matter what the odds, if I believe in something, I will make it happen
5. I excel at identifying opportunities.
6. I am always looking for better ways to do things.

Adaptability (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (5)

1. I take responsibility for acquiring new skills.
2. I enjoy learning new approaches for conducting work.
3. I take action to improve work performance deficiencies.
4. I often learn new information and skills to stay at the forefront of my profession.
5. I quickly learn new methods to solve problems.
6. I train to keep my work skills and knowledge current.
7. I am continually learning new skills for my job.
8. I take responsibility for staying current in my profession.
9. I try to learn new skills for my job before they are needed.
10. I believe it is important to be flexible in dealing with others.
11. I tend to be able to read others and understand how they are feeling at any particular moment.
12. My insight helps me to work effectively with others.
13. I am an open-minded person in dealing with others.
14. I am perceptive of others and use that knowledge in interactions.
15. I try to be flexible when dealing with others.
16. I adapt my behavior to get along with others.

Conscientiousness (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. I am always prepared at work.
2. I pay attention to details at work.
3. I get tasks done right away at work.
4. I carry out my plans at work.
5. I make plans and stick to them at work.

Work self-efficacy (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. I can successfully overcome obstacles at work.
2. I can effectively handle difficult tasks at work.
3. I have no problem meeting the expectations that my employer has for me.
4. I can successfully organize and prioritize my duties at work.
5. When at work, I am able to give full attention to my assignments.
6. I am confident in my ability to meet most deadlines on my job.
7. I am able to solve most work problems in a timely fashion.
8. I am more capable at doing my job than most other employees.

Energy-reducing attitudes

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. I try to reduce energy consumption in general.
2. I am motivated to save energy.
3. I switch off lights whenever not in use.
4. I like to check my own car's miles per gallon (mpg).
5. Wasting energy annoys me.

EcoDrive Motivation (Time 1 & Time 3 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. I want to learn about reducing fuel consumption.
2. I feel I want to know how to drive more efficiently.
3. I think it's important to learn how to save gasoline.
4. I am open to learning new skills that will improve my performance as a driver.
5. There are things that I can do that will influence fuel efficiency.
6. I can actually improve my car's fuel efficiency if I try.
7. If I put in the effort, I am able to engage in fuel saving behaviors at work.
8. If I try, I am able to follow fuel saving procedures.

Extrinsic Motivation

Strongly Disagree (1) to Strongly Agree (5)

The reason I would perform the driving behaviors above is that

1. My supervisor wants me to do them.
2. My organization wants me to do them.
3. My coworkers support them.

Intrinsic Motivation

Strongly Disagree (1) to Strongly Agree (5)

The reason I would perform the driving behaviors above is that

1. It is the right thing to do.
2. I think it is important for the environment.

3. I think it is important to save fuel.

Role Overload (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. The amount of work I am expected to do is too great.
2. I never seem to have enough time to get everything done.
3. It often feels as if I have too much work for one person to do.

Workload (Time 1 only)

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. My job requires me to work very fast.
2. My job requires me to work very hard.
3. My job leaves me with little time to get things done.

Relationship with Supervisor (Time 1 and 3 only)

Strongly Disagree (1) to Strongly Agree (5)

1. I can count on my manager to bail me out even at his/her own expense when I really need it.
2. My manager understands my problems and needs.
3. My manager recognizes my potential.
4. My manager has enough confidence in me that he/she would defend and justify my decisions if I were not present to do so myself.
5. I usually know where I stand with my manager.
6. Regardless of how much power he/she has built into his/her position, my manager would be personally inclined to use his/her power to help me solve problems in my work.
7. My relationship with my manager is effective.

Eco-driving Practices (*Indicates the item was removed at time 2 and 3 based on participant and supervisor feedback regarding maintenance of the fleet vehicles)

1. *Overall, how well do you think that your fleet car is maintained? [Not well at all (1) to Very well (7)]
2. In terms of fuel usage, how efficiently do you think you drive your work vehicle now? [Very inefficiently (1) to Very efficiently (7)]
3. When driving your primary work vehicle, how often do you adjust your driving behavior in ways to improve your fuel economy? [*Never (1) to Always (7)*]
4. *When driving your primary work vehicle how often do you conduct a pre-trip inspection (e.g., check the oil and tire pressure)? [*Never (1) to Always (7)*]

Eco-driving Behaviors (*Indicates the item was removed from the eco-driving behavior scale and analyses based on participant and supervisor feedback regarding maintenance of the fleet vehicles)

Response Scale: Very Unlikely (1) to Very Likely (7)

1. Drive at a slow and steady speed
2. Accelerate/break gradually
3. Spend less time idling your engine
4. *Keep tires inflated
5. *Maintain your vehicle properly
6. *Leave unnecessary weight out of your vehicle
7. Use the heating and cooling systems sparingly
8. Close windows at high speeds
9. *Choose the correct oil for your vehicle
10. Plan ahead to consolidate trips
11. Avoid quick starts and stops
12. *Conduct 'visual inspection' before each trip
13. *Conduct monthly vehicle maintenance inspection

Typical Driving Practices (Time 1 only, *Indicates item was collected at time 2 and 3 also)

1. *When you drive on the highway in free-flow traffic what cruising speed do you typically try to maintain? [*Less than 45 miles per hour, 45 miles per hour, 50 miles per hour, 55 miles per hour, 60 miles per hour, 65 miles per hour, 70 miles per hour, 75 miles per hour, 80 miles per hour, 85 miles per hour, More than 85 miles per hour*]
2. About how many hours do you expect to drive each week for work? [*Fill-in*]
3. Where do you typically drive for work? [*City driving in traffic, City driving, no traffic, Long-distance driving (e.g., highway miles), Mix of both city and long-distance/highway miles*]
4. What best describes the type of fleet vehicle you typically drive? [*Light-duty (cars, sedans, light trucks), Heavy (transport vehicle, construction equipment, Neither/other (please write vehicle description below)*]
5. About what percentage of the time that you spend driving for work are you pulling a trailer? [*0% to 100%*]

Organizational Support

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. My organization places a strong emphasis on efficient driving behaviors.
2. Eco-driving practices are given a high priority by my organization.
3. My organization considers eco-driving behaviors to be important.

Supervisor Support

Response Scale: Strongly Disagree (1) to Strongly Agree (7)

1. My supervisor places a strong emphasis on efficient driving behaviors.
2. The eco-driving program is given a high priority by my supervisor.
3. My supervisor considers eco-driving behaviors to be important.
4. My supervisor demonstrates how to utilize efficient driving behaviors.
5. My supervisor has talked to me about efficient driving behaviors

Eco-driving knowledge

1. I am aware of what “eco-driving” practices are and could briefly explain them to another person. [*Response Scale: Strongly Disagree (1) to Strongly Agree (7)*]
2. If you are able to, please provide one or two examples of what you think eco-driving consists of. If you can not think of an example, please mark an X in the box. [*Coded as (1) if participant correctly named eco-driving behaviors and (2) if they could not*]

Evaluate Intervention Materials (Time 2 and Time 3 only)

Response Scale: Yes (1) or No (2)

1. Have you seen the eco-driving tip card in your workplace or work vehicle?
2. Do you think the tip card was useful in increasing your knowledge about eco-driving?
3. Do you think the tip card was useful in increasing other people’s knowledge about eco-driving?
4. How effective was the tip card about eco-driving in changing your driving behavior?
5. How effective do you think the tip card about eco-driving was in changing other people's driving behaviors?
6. Have you seen the eco-driving poster in your workplace?
7. Do you think the poster was useful in increasing your knowledge about eco-driving?
8. Do you think the poster was useful in increasing other people’s knowledge about eco-driving?
9. How effective was the poster about eco-driving in changing your driving behavior?
10. How effective do you think the poster about eco-driving was in changing other people's driving behaviors?
11. Have you seen the eco-driving static cling in your workplace or work vehicle?
12. Do you think the static cling was useful in increasing your knowledge about eco-driving?

13. Do you think the static cling was useful in increasing other people's knowledge about eco-driving?
14. How effective was the static cling about eco-driving in changing your driving behavior?
15. How effective do you think the static cling about eco-driving was in changing other people's driving behaviors?
16. Have you visited the eco-drive website (<http://www.oregon.gov/ODOT/TD/TP/Pages/ecodrive.aspx>)?
17. Do you think the website was useful in increasing your knowledge about eco-driving?
18. Do you think the website was useful in increasing other people's knowledge about eco-driving?
19. Have you viewed the videos demonstrating eco-driving practices?

Video Questions (Time 2 and Time 3 only)

Did you watch this video?

Response Scale: [Yes (1), No (2), Not sure (3)]

1. Compilation (all videos - about six minutes in length)
2. EcoDrive - General Tips
3. EcoDrive - Maintain Vehicle
4. EcoDrive - Tire Care
5. EcoDrive - Avoid idling
6. EcoDrive - Slow & Steady
7. EcoDrive - Reduce Drag

How useful was this video to you?

Response Scale: [Not very useful (1) to Very useful (5)]

1. Compilation (all videos - about six minutes in length)
2. EcoDrive - General Tips
3. EcoDrive - Maintain Vehicle
4. EcoDrive - Tire Care
5. EcoDrive - Avoid idling
6. EcoDrive - Slow & Steady
7. EcoDrive - Reduce Drag

Utility reactions (Time 2 and Time 3 only)

1. How useful do you think the eco-driving program is in helping to save fuel?
[Not at all useful (1) to Very useful (7)]
2. How effective do you think the eco-driving program is overall? *[Not at all effective (1) to Very effective (7)] [Not at all (1) to Very much so (7)]*
3. Do you think the eco-driving program has allowed you to learn new skills that you can use on your job? *[Not at all (1) to Very much so (7)]*

Open-ended questions (Time 2 and Time 3 only)

1. Please tell us anything else about your reactions to the eco-drive materials that have been distributed in your workplace.
2. Do you have any additional comments about the survey?

Demographics (Time 1 only)

1. Age
2. Gender
3. Education
4. Ethnicity
5. Hours worked per week
6. Tenure department
7. Tenure with the city/county
8. Average hours worked per week
9. Full-time or seasonal employee

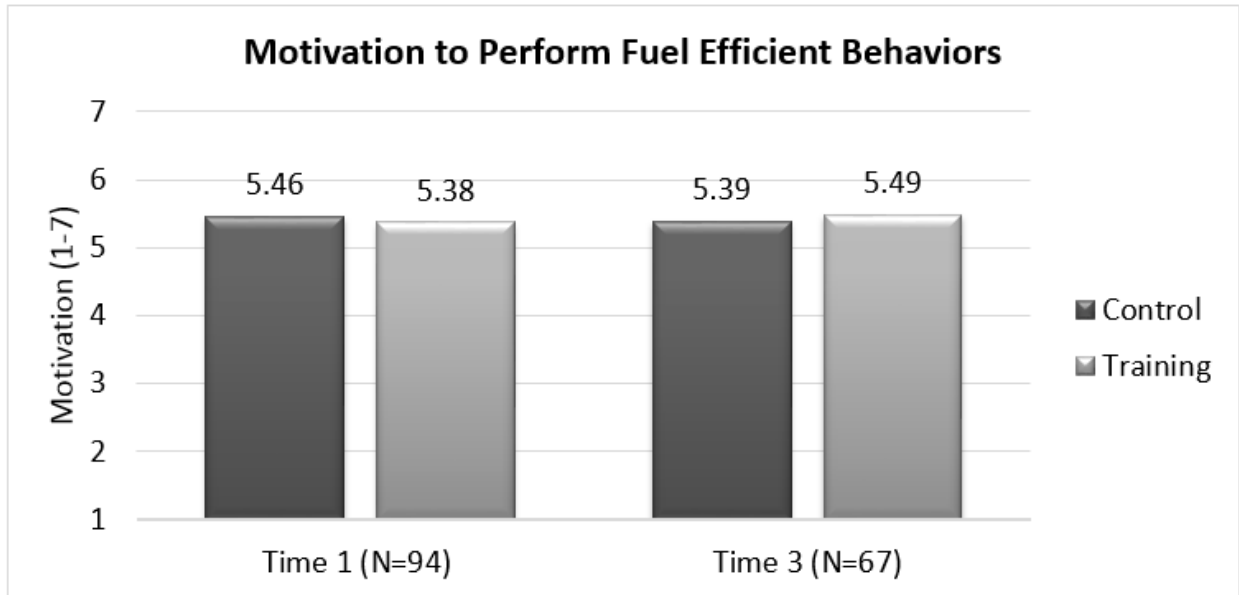
Appendix C

Survey Scales at Each Time Point

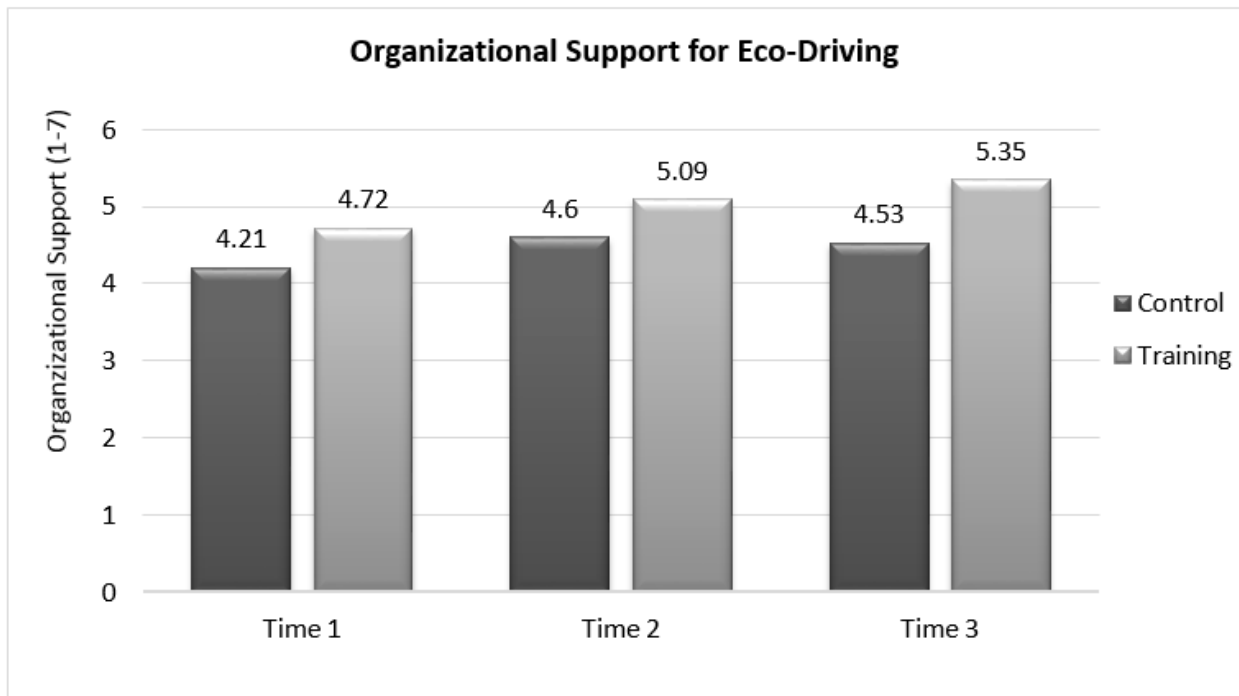
Scale	# items	T1	T2	T3
Proactive personality	6	X		
Conscientiousness	5	X		
Work self-efficacy	8	X		
Energy-reducing attitudes	5	X	X	X
Motivation to perform fuel-efficient behaviors	8	X		X
Role overload (time pressure)	3	X	X	X
Quantitative workload	5	X		
Eco-driving behaviors	4	X	X	X
Eco-driving behaviors (checklist)	7	X	X	X
Typical driving practices	2	X	X	X
Eco-driving knowledge	2	X	X	X
Demographics	6	X		
Organizational support for program	3	X	X	X
Evaluate intervention	25		X	X
Open-ended questions	2	X	X	X
LMX	7	X	X	X
Supervisor support- program specific	5	X	X	X
Spillover from EcoDrive intervention to home/personal driving-talking to others about EcoDrive program	6		X	X

Appendix D

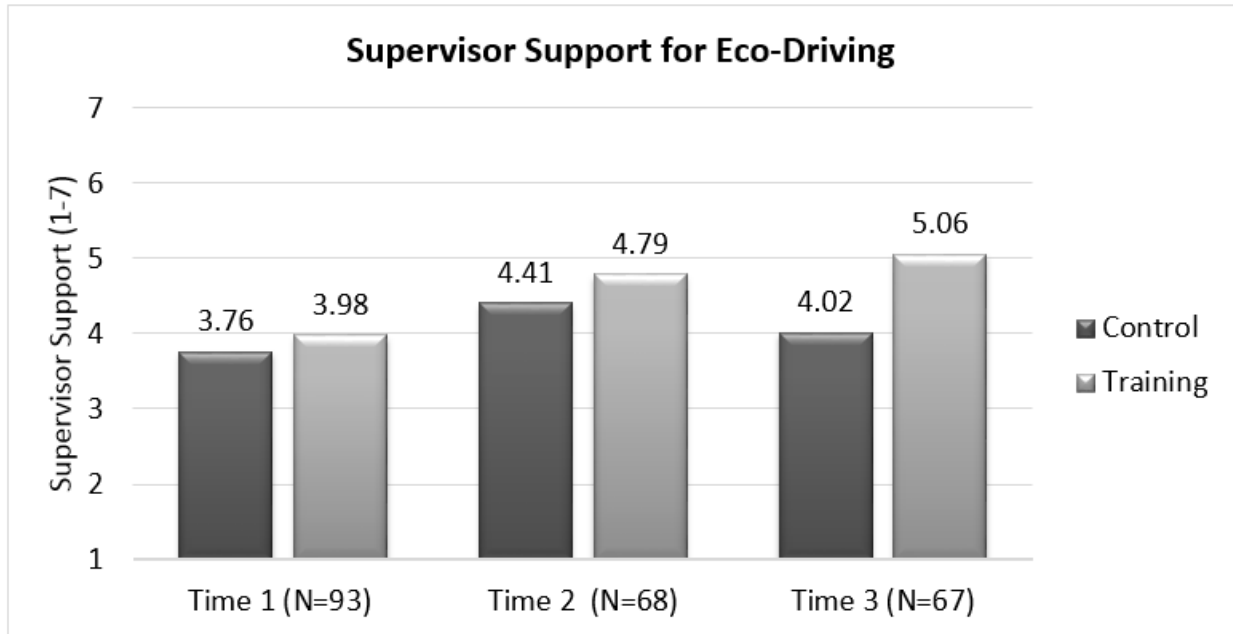
Means Separated by Condition (unpaired)



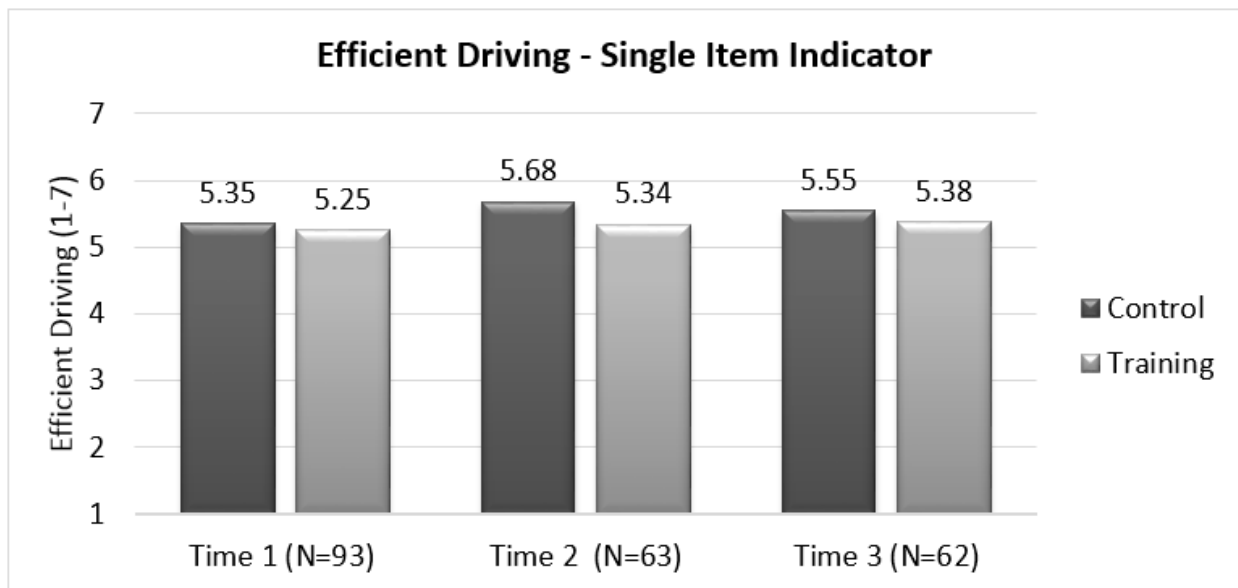
Note. This figure depicts the average motivation to perform fuel-efficient driving behaviors score across time points for the control and supervisor training group. These responses are unmatched responses.



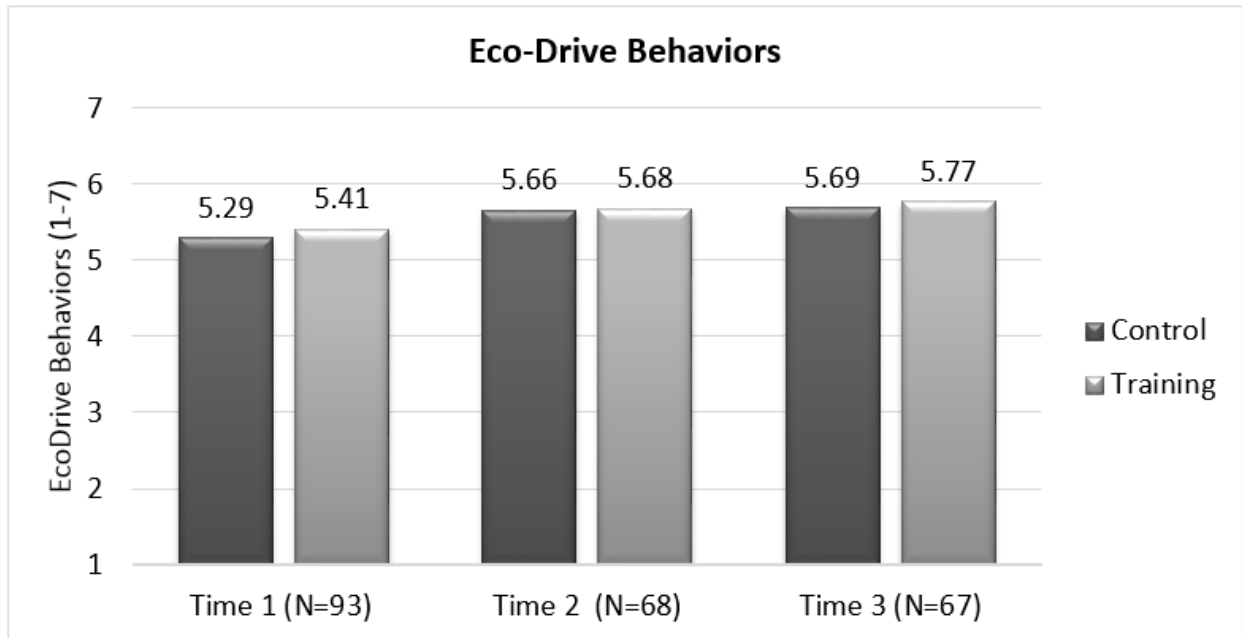
Note. This figure depicts the average organizational support score across time points for the control and supervisor training group. These responses are unmatched responses.



Note. This figure depicts the average level of supervisor support across time points for the control and supervisor training group. These responses are unmatched responses.



Note. This figure depicts the average efficient driving behavior score across time points for the control and supervisor training group. These responses are unmatched responses. The efficient driving behavior item asks “how efficient would you rate your driving behavior when driving your vehicle at work?”



Note. This figure depicts the average EcoDrive behavior checklist score across time points for the control and supervisor training group. These responses are unmatched responses.

Appendix E

EcoDrive Video Summary

Given your pivotal role as a supervisor, we are asking you to show support for the eco-driving program in the following ways:

1. **Describe the importance of the eco-driving program to employees.** Explain how it may not only save fuel for Washington County, but also that it is important to safe driving.
2. **Discuss eco-driving at staff meetings and in other communications with employees.** It is important for eco-driving practices to be clear to employees. In other words, people need to be aware of eco-driving behavior in order for these driving habits to develop. It is your role as a supervisor to have these open discussions with employees, both in groups and meetings and one on one. Here is a short video (six minutes) provided by ODOT that can be shown in a staff meeting (the video also includes a “maintain” section which may not be applicable to your employees). In order to skip the maintain section, skip to minute 3:00 in this video.
<http://www.oregon.gov/odot/td/tp/pages/ecodrive.aspx>
3. **Regularly point out the eco-driving program to people.** Everyone needs reminders of best practices from time to time. Similarly, when you see an employee performing these behaviors, be sure to acknowledge them and provide encouragement for continuing to perform those behaviors.
4. **Model the eco-driving behaviors.** That is, when you are using fleet vehicles yourself, perform these “plan” and “perform” eco-driving behaviors.

EcoDrive Behaviors Overview

Plan

CONSOLIDATE TRIPS. By planning ahead and accomplishing all your errands at once, you can save both time and gas.

LIGHTEN YOUR LOAD. Did you know that junk in your trunk is costing you money? You can improve your fuel economy by up to 2% by removing extra weight from your car. When not in use, remove roof racks and carriers and heavy items like golf clubs you may have stowed in your trunk.

Perform

SPEEDING COSTS. Fuel efficiency usually decreases rapidly at speeds over 55mph. You can save as much as 15% per gallon by slowing down from 65mph to 55mph.

STEADY IT UP. Maintaining a steady speed in town and on the highway improves fuel economy and makes roads safer. In town save gas by driving with the flow of traffic signal timing instead of rushing to a stop at the next signalized intersection. On the highway use your cruise control to keep a steady speed.

JACKRABBITS LOSE. Avoid quick starts and stops to conserve gas and maximize brake life. Starting from a stop takes more gas.

AVOID IDLING. Thirty seconds of idling uses more fuel than restarting the engine. If you know you will be waiting for more than 30 seconds, such as a railroad crossing, drive thru line, or picking up the kids, go ahead and turn the engine off. In addition to saving fuel, you will

reduce air pollution both outside and inside your car.

DRIVE WITH THE WIND. Added air drag on your car can cut fuel efficiency by 5%. Close windows when driving above 50mph and unload racks and carriers when not in use to improve your gas mileage.

MODERATE AC. Use your air conditioning sparingly to improve your gas mileage by 5 to 25%.

Appendix F



WASHINGTON COUNTY
OREGON

Dear Washington County Managers and Supervisors,

Over the last several years, in partnership with our employees, Washington County has made a significant commitment and considerable progress toward becoming an increasingly sustainable organization. We have installed new technology in our buildings, embraced best practices and reinforced common sense training and the simple notion that small changes of habits can make a difference, such as turning off lights and computers.

We measure the cumulative impact of our efforts annually and the data tells its own story. Simply, we are making significant inroads in reducing our energy and resource consumption, including natural gas, electricity, water and fuel, while increasing our recycling and reuse. Ultimately, this saves money that can be redirected to other priority service areas. In addition to all of our other sustainability efforts which are ongoing and continuous, Washington County is entering into an exciting partnership with PSU and ODOT to promote the “ECO Drive” program.

The ECO Drive program teaches and reinforces practical suggestions on how we approach driving, with the goal of reducing fuel consumption and reinforcing safer driving habits. The following video details the program and benefits. As with all things—the support and leadership of our supervisors and managers is critical to this program’s success. Through your enthusiasm and commitment, this program will become another enduring element in our overall sustainability efforts.

As we know, individual employee and organizational success hinges on providing employees with the tools, training, opportunity and leadership to keep us relevant and productive. Thank you for providing these elements to your employees and enthusiastically sponsoring and supporting the ECO Drive program. I am confident that it will make a difference.

Sincerely,

A handwritten signature in black ink, appearing to read 'Don Bohn', with a long horizontal flourish extending to the right.

Don Bohn
Assistant County Administrator

Appendix G

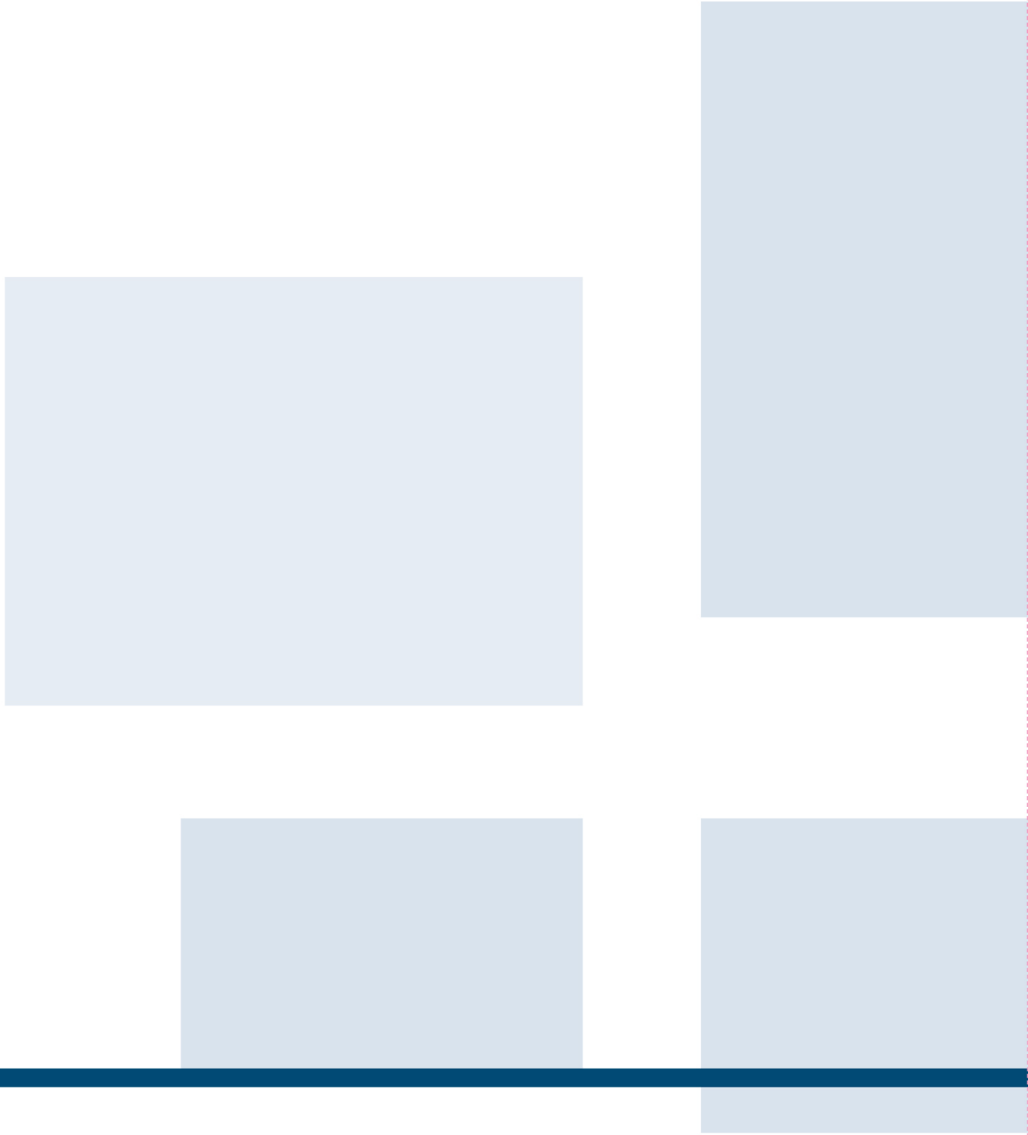
Exit Interview Questions for Fleet Managers/Organizational Contacts

The intent of this meeting is to learn about how the materials were distributed and promoted within (insert organization). We also want to know of any informal feedback that you might have, or may have received from employees, about the program and the materials. This is important to understand as we make recommendations for future implementation.

1. Can you describe your department and the teams that were most involved in the Eco-drive program?
 - a. Employee demographics that might be relevant to the program (Number of employees, # that use vehicles, etc.)
 - b. Types of jobs
 - c. Driving patterns/usages in the department
 - d. Is there anything about your department or certain teams that you think made the program more or less effective?
2. Who handled the materials?
 - a. Who decided on placement of posters and tip cards?
 - b. Can you describe where the materials were placed?
 - c. Did the supervisors/managers make eco-driving a part of any staff updates or meetings?
 - d. Were the static clings placed in each car?
 - e. Did employees watch the videos? (Or have you heard any feedback about them?)
 - i. If so, were employees given time at work to view the videos?
3. How were the materials promoted? That is, were any steps taken to increase awareness to the materials or to eco-driving?
4. As you may know, some of the supervisors were asked to model ecodrive behaviors and to promote the materials to their employees.
 - a. Do you think that the supervisors that were asked to promote the program did so? If not, what were the obstacles to doing so?

- b. What feedback did you hear about the materials that were given to supervisors reminding them to promote the ecodrive program? This includes email reminders and the video.
- 5. Did other eco-driving type practices already exist in the department?
 - a. Such as idle free programs or trip consolidation mandates
- 6. Did you receive any informal feedback on the materials from supervisors or employees?
 - a. Overall, how did you think the materials were received by employees? That is, do you think that people liked or disliked the materials and the program?
 - b. Do you think the materials were effective in increasing knowledge about driving efficiently?
 - i. If so, why and if not, why not?
 - c. Did you observe or hear of employees sharing the eco-driving materials with each other?
- 7. How would you change the eco-driving materials if you could? By that we mean content of the materials or the media (posters, videos, etc.).
- 8. How well do you feel this program integrates into your organization's culture, management structure and goals?
- 9. Do you think other organizations would find these materials useful?
 - a. Why or why not?
- 10. Would you recommend this program to other departments or organizations? Why or why not?
- 11. Which types of organizations do you think these materials would be most beneficial?
- 12. What are your future plans with the materials (if any)?
 - a. Do you have any long term goals in regards to Eco-driving?
- 13. In thinking over the eco-drive project, is there something you would change in the way you distributed or promoted the materials?
- 14. What (if any) barriers did you encounter in distributing the:
 - a. Surveys?
 - b. Materials?

15. Do you have any recommendations or general comments for regarding any aspect of this project?



Transportation Research and Education Center
Portland State University
1900 S.W. Fourth Ave., Suite 175
Portland, OR 97201