

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Factors Affecting the Risk of Crash Involvement Amongst New Zealand Truck Drivers

**A thesis presented in partial fulfilment of the requirements for
the degree of Doctor of Philosophy in Human Resource
Management at Massey University**

Mark J. M. Sullman

2002

Abstract

Compared to countries such as Australia, England, Sweden and Finland, New Zealand has a relatively high rate of fatal road crashes. This high rate is not evenly distributed amongst the different groups of road users, with trucks being one group who are involved in a disproportionately high number of fatal crashes. Although truck drivers are an important group to study, if New Zealand is to reduce its relatively high road toll, very little research has investigated the role of human factors in the crash involvement of truck drivers.

Drawing upon research amongst private vehicle drivers and safety climate research from other industries, the current study investigated the relationship crash involvement has with two personality traits (driver selfishness and mild social deviance), four different types of aberrant driving behaviour (violations, errors, lapses and aggressive violations) and safety climate.

The violations factor was the only factor that directly predicted crash involvement amongst truck drivers. The relationship between violations and crash involvement was such that a one unit increase in the violations factor score increased the odds of being crash involved by 49%.

Tests for mediation effects revealed that a number of other variables indirectly increased the risk of crash involvement. One of the four different types of driver selfishness, mild social deviance and safety climate all indirectly affected crash involvement through their relationships with other variables.

The findings of this research highlight the important role human factors have in the risk of crash involvement amongst New Zealand truck drivers. Possible avenues for future research are discussed, along with the implications of the findings for decreasing truck drivers' crash involvement.

Acknowledgements

I would like to thank my main supervisor, Dr Karl Pajo for his guidance, patience and the long hours he put into reading and commenting on my work. I would also like to thank Dr Michelle Meadows (formally of Staffordshire University, England) for her expert advice. In addition I would like to thank Professor Philip Dewe (Birkbeck College, London) for his help, especially during the initial stages of the research.

I am very grateful for the statistical advice received from a number of sources, especially: Professor Robert MacCallum (Ohio State University), Associate Professor Timo Lajunen (Middle-East University, Turkey), Dr David Clark-Carter (Staffordshire University), and finally Ted Drawneck and Duncan Headley (Statistics Consultants at Massey University).

I would also like to acknowledge the many transport companies' truck drivers who gave up their time to take part in the project. A special thank you goes to Patrick Kirk (Carter Holt Harvey) who helped encourage the participation of the log transport companies. I also wish to thank Jacqui Cleland for her kind assistance.

Finally, I would like to thank my friends, family and colleagues for their support and understanding, especially during the write up stage of the thesis. Hopefully, now I can reacquaint myself with life outside of my office!!!!

Articles

The following articles based on this thesis were published or are currently in press (see Appendices 1-4).

Sullman, M.J.M., Meadows, M.L., & Pajo, K. (2002). Aberrant driving behaviours amongst New Zealand truck drivers. *Transport Research – Part F*, 5(3), 217-232.

Sullman, M.J.M., Pajo, K., & Meadows, M.L. (2002). The impact of transport company safety climate on truck crashes. In D. de Waard, K.A. Brookhuis, J. Moraal, and A. Toffetti (Eds.). *Human Factors in Transportation, Communication, Health and the Workplace* (121-129). Maastricht, The Netherlands: Shaker Publishing.

Sullman, M., Meadows, M., & Pajo, K. (2001). *The role of attitudes and reported driving behaviour in truck crashes* (COHFE Report, 2, 6). Rotorua, New Zealand: Centre for Human Factors and Ergonomics.

Sullman, M.J.M., Meadows, M.L., & Pajo, K. (In Press). Errors, lapses and violation in the drivers of heavy vehicles. In the Proceedings of the *International Conference on Traffic and Transport Psychology*. Berne, Switzerland (4-7th September).

Table of Contents

Abstract.....	ii
Acknowledgements.....	iii
Articles.....	iv
Appendices.....	viii
List of figures.....	x
List of tables.....	xi
Chapter 1 - Overview.....	1
Chapter 2 - Introduction.....	5
2.1 - Chapter overview.....	5
2.2 - Size of the problem.....	5
2.3 - Demographic & descriptive variables related to crash involvement.....	7
2.4 - Demographic & descriptive variables amongst heavy vehicle drivers.....	12
2.5 - Chapter summary.....	15
Chapter 3 - Driver Behaviour Questionnaire.....	17
3.1 - Chapter overview.....	17
3.2 - Errors, lapses and violations.....	17
3.3 - Type and frequency of reported aberrant driving behaviour.....	19
3.4 - Reliability of the DBQ.....	19
3.5 - Factor structure of the DBQ.....	20
3.6 - Correlations between the DBQ and driver characteristics.....	23
3.7 - Correlations between the DBQ and crash involvement.....	24
3.8 – The DBQ and special driver populations.....	26

3.9 - Driving in a work-related context.....	28
3.9.1 - Truck drivers.....	30
3.10 - Research aims.....	30
3.11 - Chapter summary.....	31
Chapter 4 - Traffic Accidents and Personality Traits.....	32
4.1 - Chapter overview.....	32
4.2 - Personality traits and driving behaviour.....	32
4.3 - Social deviance and driving behaviour.....	34
4.4 - Selfishness and driver behaviour.....	38
4.5 - Personality traits and professional drivers.....	42
4.6 - Research aims.....	44
4.7 - Chapter summary.....	45
Chapter 5 - Safety Climate and Accidents.....	46
5.1 - Chapter overview.....	46
5.2 - Safety climate.....	46
5.3 - The utility of safety climate.....	49
5.4 - Safety climate and driving.....	52
5.5 - Research aims.....	54
5.6 - Chapter summary.....	54
Chapter 6 - Methodology.....	56
6.1 - Procedural overview.....	56
6.2 - The survey instrument.....	56
6.2.1 - Demographics and descriptive variables.....	57
6.2.2 - Aberrant driving behaviours.....	57
6.2.3 - Mild social deviance.....	57
6.2.4 - Driver selfishness.....	58
6.2.5 - Safety climate.....	59
6.2.6 - Crash involvement.....	59
6.3 - Data collection procedure.....	59
6.4 - Participants.....	61

6.5 - Data analysis	62
6.5.1 - Data screening.....	62
6.5.2 - Combining scale items.....	64
6.5.3 - Factor analysis strategy.....	65
6.5.4 - Testing for relationships between variables	67
6.5.5 - Testing for mediation effects.....	67
6.6 – Chapter summary	68
Chapter 7 - Results	69
7.1 - Chapter overview.....	69
7.2 - Demographic and descriptive variables	69
7.3 - Driver Behaviour Questionnaire.....	72
7.3.1 - Factor analysis of the DBQ.....	72
7.4 - Mild social deviance.....	76
7.5 - Driver selfishness	77
7.5.1 - Factor analysis of the driver selfishness scale.....	77
7.6 - Safety climate	80
7.7 - Correlations amongst the main variables	80
7.8 - Prediction of crash involvement.....	85
7.9 - Prediction of other variables	87
7.9.1 - Prediction using MSD	88
7.9.2 - Prediction of violations and risky driving using safety climate.....	90
7.10 - Testing for mediation effects.....	92
7.11 - Chapter summary	98
Chapter 8 - Discussion	99
8.1 - Chapter overview.....	99
8.2 - Research aims.....	99
8.2.1 - Level of aberrant driving behaviours.....	99
8.2.2 - DBQ factor structure	104
8.2.3 - DBQ factors and crash involvement	106
8.2.4 - Factor structure of the Driver Selfishness scale.....	107
8.2.5 - Driver selfishness factors and crash involvement	107

8.2.6 - Variables correlating with the driver selfishness factors.....	108
8.2.7 - Level of MSD	109
8.2.8 - MSD and crash involvement	109
8.2.9 - Variables correlated with MSD.....	110
8.2.10 - Safety climate and crash involvement.....	113
8.2.11 - Safety climate and other main variables	113
8.2.12 - Mediation effects amongst the main variables	114
8.4 - Demographic and descriptive variables	115
8.5 - Utility of findings.....	120
8.6 - Limitations.....	122
8.7 - Future research.....	128
8.8 - Conclusions	131
References.....	133

Appendices

Appendix 1

Aberrant driving behaviours amongst New Zealand truck drivers	148
---	-----

Appendix 2

The impact of transport company safety climate on truck crashes.....	164
--	-----

Appendix 3

The role of attitudes and reported driving behaviour in truck crashes	174
---	-----

Appendix 4

Errors, lapses and violations in the drivers of heavy vehicles	183
--	-----

Appendix 5

Questionnaire.....	191
--------------------	-----

Appendix 6
Structured interview questions200

Appendix 7
Cover letter.....203

List of Figures

Figure 1	
	<i>Multiple regression testing mediation of crash involvement on mild social deviance by violation score.....</i>
	93
Figure 2	
	<i>Multiple regression testing mediation of crash involvement on mild social deviance by risky driving score.....</i>
	94
Figure 3	
	<i>Multiple regression testing mediation of crash involvement on risky driving by violation score.</i>
	95
Figure 4	
	<i>Multiple regression testing mediation of violations on MSD by risky driving score.....</i>
	96
Figure 5	
	<i>Multiple regression testing mediation of violations on safety climate by risky driving score.....</i>
	97
Figure 6	
	<i>Pictorial representation of the mediation relationships.....</i>
	97

List of Tables

Table 1	
<i>Descriptive and demographic variables</i>	71
Table 2	
<i>Means and standard deviations of the DBQ items</i>	73
Table 3	
<i>Factor analysis of the DBQ items</i>	75
Table 4	
<i>Mean scores on the MSD items</i>	76
Table 5	
<i>Means and standard deviations of the driver selfishness items</i>	78
Table 6	
<i>Factor analysis of the driver selfishness items</i>	79
Table 7	
<i>Mean scores on the safety climate scale</i>	81
Table 8	
<i>Correlations amongst the main variables</i>	83
Table 9	
<i>Prediction of crash involvement using the DBQ factors</i>	86
Table 10	
<i>Prediction of crash involvement using MSD</i>	87

Table 11	
<i>Prediction of crash involvement using the driver selfishness factors</i>	88
Table 12	
<i>Prediction of violations score using MSD</i>	89
Table 13	
<i>Prediction of safety climate using MSD</i>	89
Table 14	
<i>Prediction of driver selfishness factors using MSD</i>	91
Table 15	
<i>Prediction of violations score using safety climate</i>	92
Table 16	
<i>Prediction of risky driving using safety climate</i>	92
Table 17	
<i>Prediction of crash involvement using the four main variables</i>	98
Table 18	
<i>Comparison of the item means on the DBQ</i>	101