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**A systems analysis of quadbike loss of control events on
New Zealand farms**

A thesis presented in partial fulfilment of the requirements
for the degree of Doctor of Philosophy in Management Systems and Ergonomics
at Massey University, Palmerston North

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2007

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Citation

A systems analysis of quadbike Loss of Control Events (LCE) on New Zealand farms

The Department of Labour (OSH) have identified the 70,000 quadbikes in use in New Zealand as their single greatest area of concern in farm safety; each year there are on average seven deaths and in excess of NZ\$3.6 million was paid out by ACC for quadbike-related injuries in 2003-4.

The aims of this research were to: establish the context, scale and cost of LCE involving quadbikes on New Zealand farms, develop a methodology for off-road investigations, identify risk factors and their interactions, and generate potential interventions.

The methodology employed a systems approach, using: a modified event sequence chart drawn from the ergonomics, forensic psychology and aviation fields, plus environmental context-dependent cues and scale models to assist recall. An interactive quadbike LCE model was also developed for analysis.

Interventions were identified relating to: farm management, work organisation, regulation, vehicle design, and rider awareness; which it is anticipated will reduce injuries in the future.

Dave Moore

Abstract

A systems analysis of quadbike Loss of Control Events (LCE) on New Zealand farms

There are an estimated 70,000 quadbikes (also called All-Terrain Vehicles, four-wheelers or ATV) in use within the farming community in New Zealand, and these have been linked to approximately seven deaths per year since 1997. ACC paid compensation in excess of \$3.6 million on new and on-going quadbike-related claims in 2003-4, and the Department of Labour (OSH) have identified quadbike use as their single greatest area of concern in farm safety.

The main aims of this series of studies were to: establish the scale and cost of LCE involving quadbikes as well as their context of use on New Zealand farms, develop an investigative methodology suitable for off-road application, identify risk factors for LCE and their interactions, and generate potential interventions.

The research comprised a literature review and three studies. The first was an epidemiological analysis of ACC claims data for serious quadbike-related injuries in the year to July 2001, identified individually through the free narrative text in the ACC database. The second study explored the context of farm quadbike use through data gathering with multiple industry sources including users at the 55 farms visited for the third study. This final phase consisted of investigations at the scenes of 156 LCE. Data on the event sequences and contributory factors were captured and analysed using a modified event sequence chart developed from established methods in the ergonomics, forensics psychology and aviation literature. Environmental context-dependent cues and scale models of quadbikes and implements were used to assist the subjects recall event details. An interactive quadbike LCE model incorporating information processing features was developed as a further analysis tool.

Potential interventions were identified acting at various system levels. These included changes in: farm management, work organisation, regulation, vehicle conceptualisation, detailed quadbike design and modification, rider awareness and training.

Acknowledgements

The research reported in this thesis was funded from a number of sources: ACC, Foundation for Research Science and Technology, and SCION (previously known as the Forest Research Institute of New Zealand). Support of other kinds was provided by a large number of individuals and organisations in the industry, and via the Agricultural Health and Safety Council which comprises members from fourteen separate key bodies: Accident Compensation Corporation (ACC), Agriculture Training Organisation (Ag ITO), Central Amalgamated Workers Union, Deer Farmers, Farm Forestry, Federated Farmers, FarmSafe, Land Transport, Ruralwomen, Department of Labour, Police and Young Farmers Clubs.

My thanks to the many people working on farms and elsewhere in the agricultural industry who gave their time and ideas so generously, in particular Kevin Richards from the Waikato and Roger Barton from Federated Farmers. Thanks also to my excellent academic supervisors at Massey University, Professor Antonios Vitalis of the Department of Management Systems, and Dr Timothy Bentley of the Department of Management and International Business.

This PhD would not have been started without the inspiration provided by Tony Vitalis and Professor Byron Mikellides (Oxford School of Architecture), Σας οφείλω και των δύο πολύ ouzo; and the thesis would not have been finished without the help of my family and friends nor the support, enlightened collusion and relentless encouragement of colleagues Richard Parker, David Tappin, Liz Ashby, Marion Edwin and Sophie Hide at the Centre for Human Factors and Ergonomics.

Finally, to my children Scott, Logan and Kate; thanks for putting up with your old man - the ice creams are on me.

Table of contents

	Page
List of tables	xii
List of figures	xiv
Glossary of acronyms	xvii
Chapter One. Introduction	
1.1 Introduction	2
1.2 Problem statement	4
1.3 Safe Family Fun: a short history of quadbikes	5
1.3.1 Usage	8
1.3.2 Concerns with quadbikes	9
1.4 Approach of the research	13
1.4.1 Systems approach	13
1.4.2 Participatory methods	13
1.4.3 Intervention development	14
1.5 Aims of the research	15
1.6 Structure of the thesis	16
1.7 Ethical considerations	18
1.7.1 Working with ACC claims data	18
1.7.2 Interviewing ACC claimants	19
1.7.3 Conducting site visits and interview	19

Chapter Two. Literature review

2.1 Introduction	22
2.1.1 Overview	22
2.1.2 Review methods	25
2.1.2.1 Process	25
2.1.2.2 Search strategy	25
2.1.2.3 Inclusion – exclusion criteria	27
2.1.2.4 Potential sources of bias	27
2.1.2.5 Sifting for relevant material	28
2.2 Quadbike LCE on New Zealand farms	30
2.2.1 The scale of the problem in New Zealand	30
2.2.1.1 Contradictions in perceptions and acceptance of risk	32
2.2.2 Costs	34
2.2.3 Context	36
2.2.3.1 The joint Federated Farmers / OSH study	37
2.2.3.2 The media	39
2.2.3.3 Industry data	40
2.2.4 LCE risk factors and their interactions	41
2.2.4.1 The Southland OSH study	41
2.2.4.2 Federated Farmers and OSH survey 1998	43
2.2.4.3 Child passengers	44
2.2.4.4 Department of Labour (OSH) Accident Investigation Reports	45
2.2.4.5 Media reports	47
2.3 The context and nature of quadbike LCE overseas	51
2.4 Interventions	57
2.4.1 Interventions in New Zealand	58
2.4.1.1 Intervention approaches	60
2.4.2 Interventions for farm quadbike LCE overseas	62
2.4.2.1 Intervention approaches	65
2.5 Discussion	67
2.5.1 Scale	67
2.5.2 The context and nature of LCE in New Zealand	67
2.5.3 The context and nature of LCE overseas	69
2.5.4 Interventions	70
2.6 Conclusions	72

	Page
Chapter Three. Epidemiological study	
3.1 Introduction	75
3.2 Methodology	76
3.2.1 General approach	76
3.2.2 ACC data	77
3.3 Findings	80
3.3.1 Employment status	80
3.3.2 Occupational group	80
3.3.3 Scene of incident	80
3.3.4 Region	81
3.3.5 Month of incident	82
3.3.6 Age and gender distribution	83
3.3.7 Diagnosis and body region injured	84
3.3.8 Activity immediately preceding the incident	84
3.3.9 Incident event sequences for major activity categories ..	85
3.3.10 Injury agency	88
3.3.11 Use of implements	88
3.4 Discussion	89
3.4.1 Limitations	93
3.5 Conclusions	94
Chapter Four. Context study	
4.1 Introduction	96
4.2 Methodology	98
4.2.1 Industry consultation	98
4.2.2 Data collection on farms where LCE have taken place	105
4.2.2.1 Design	105
4.2.2.2 Sample	106
4.2.2.3 Procedure	106
4.2.2.4 Quadbike assessment	108
4.2.3 Participatory methods	109
4.3 Findings	112
4.3.1 Tasks	113
4.3.1.1 Introduction	113
4.3.1.2 Primary usage	113
4.3.1.2.1 Mustering, moving or checking stock	115
4.3.1.2.2 Fencing	118
4.3.1.2.3 Collecting cows for milking	120
4.3.1.2.4 Commuting and dog transport	123
4.3.1.2.5 Spraying chemicals	125
4.3.1.2.6 Maintenance tasks	129
4.3.1.2.7 Feeding out [dry matter]	131
4.3.1.2.8 Moving firewood with trailer	132
4.3.1.2.9 Checking irrigation systems	133
4.3.1.2.10 Calf feeding [wet] using 'calfeteria'	133
4.3.1.2.11 Spreading	133
4.3.1.2.12 Hunting and pest control	134
4.3.1.3 Design for the task	135
4.3.1.4 The economic importance of quadbikes to farmers	138

Chapter Four (4.3 Findings) continued..

	Page
4.3.2 Quadbike users	141
4.3.2.1 Introduction	141
4.3.2.2 User population on the 53 farms	141
4.3.2.3 National population and trends	141
4.3.2.4 Employment status and gender	143
4.3.2.5 Exposure	146
4.3.2.6 Age and experience of users	147
4.3.2.7 Training	148
4.3.2.8 Adherence to manufacturers' guidelines	149
4.3.2.9 New rider induction	151
4.3.2.10 Personal Protective Equipment	153
4.3.3 The quadbikes	155
4.3.3.1 Introduction	155
4.3.3.2 Age of quadbikes	155
4.3.3.3 State of repair	157
4.3.3.4 Modifications	161
4.3.3.5 Trailers and other implements used with quadbikes	163
4.3.3.6 Rollover protective structures	165
4.4 Discussion	168
4.5 Conclusions	174

Chapter Five. Loss of Control Event (LCE) investigations

5.1 Introduction	176
5.2. Background and theoretical approach	178
5.2.1 Causation theories	179
5.2.1.1 The Domino Theory	179
5.2.1.1.1 International Loss Control Institute (ILCI) Model	181
5.2.1.2 Epidemiological models	181
5.2.1.3 Human error models	183
5.2.1.4 Interactive models	186
5.2.2 Problems with recall of events	190
5.2.2.1 Optimising recall	192
5.3 Methodology	195
5.3.1 Sample design	195
5.3.1.1 Recruitment	196
5.3.1.2 Recency	198
5.3.1.3 Severity	198
5.3.2. Site procedure	199
5.3.2.1 Preliminaries	199
5.3.2.2 Location of investigations	199
5.3.2.3 Use of models	199
5.3.2.4 Use of photography and sketches	202
5.3.2.5 Use of video/audio	204
5.3.2.6 Triangulation of data	204
5.3.3 Investigation method development	206
5.3.3.1 Event charting	206
5.3.3.2 Event charting and analysis design	208
5.3.4 Intervention development	212
5.3.4.1 Intervention development approach	212
5.3.4.2 Stepped iteration design	214
5.3.4.3 Intervention matrix	215
5.3.4.4 Iterative refinement	216
5.3.4.5 Consultation on farm-specific action plans	216

	Page
5.4 Findings	218
5.4.1 Rider/individual factors	219
5.4.1.1 Employment status	219
5.4.1.2 Exposure	219
5.4.1.3 Gender	221
5.4.1.4 Age and experience	222
5.4.1.5 Injuries by types and body region	223
5.4.1.6 Isolation	224
5.4.2 Temporal and seasonal factors	225
5.4.2.1 Time of day	225
5.4.2.2 Time of year	226
5.4.3 Terrain/ground factors	228
5.4.3.1 Ground conditions	228
5.4.3.2 Terrain	229
5.4.4 Task-related factors	230
5.4.4.1 Activity immediately preceding the event	230
5.4.4.2 Ancillary implements attached during the LCE	233
5.4.4.3 Injury agency	235
5.4.5 Events	236
5.4.5.1 Event sequences	236
5.4.6 Risk factors	238
5.4.6.1 Risk factors in LCE involving animals	238
5.4.6.2 Risk factors in spraying	244
5.4.6.3 Risk factors in fencework	247
5.4.7 Risk factors in serious injury cases	249
5.4.7.1 Serious injury LCE event sequences	249
5.4.7.2 Common factors – haste and secondary visual tasking	252
5.4.7.3 Risk factor combinations and serious injury	253
5.4.8 Interventions	255
5.4.8.1 Introduction	255
5.4.8.2 Countermeasures	257
5.4.8.3 Pre-LCE (Primary)	258
5.4.8.4 During LCE (Secondary) and Post-LCE (Tertiary)	260
5.4.8.5 Task-specific interventions	261
5.5 Discussion	264
5.5.1 Investigation method	264
5.5.1.1 ACC records	265
5.5.2 Risk factors and event sequences	267
5.5.2.1 Rider/individual factors	267
5.5.2.2 Temporal and terrain/ground factors	269
5.5.2.3 Vehicle performance factors	270
5.5.2.4 Task-specific risk factors	273
5.5.2.4.1 Tasks involving interaction with animals	273
5.5.2.4.2 Spraying	273
5.5.2.4.3 Fencing	274
5.5.2.5 Serious injury LCE	275
5.5.3 Interventions	276
5.6 Conclusions	277

Chapter Six. Conclusions	
6.1 Introduction	279
6.2 Review of key findings	281
6.2.1 The scale and cost of the problem of loss of control events	281
6.2.2 The context of quadbike LCE on New Zealand farms	283
6.2.3 Development of the investigative methodology	286
6.2.4 Risk factors for LCE and their interactions	289
6.2.5 Interventions	295
6.3 Directions for future research	298
6.4 Contribution of the research	301
6.5 Conclusion	302
References	305
Bibliography	321
Appendices	329
I) Information and consent forms	
II) Interview schedule for on-farm context study and LCE investigation chart template	
III) Event Chart examples: mustering, spraying and fencing	
IV) Conference and journal papers	

List of Tables

	Page	
Table 2.1	General inclusion and exclusion criteria.	27
Table 2.2	Comparison of the relative likelihood of death or injury from average quadbike usage and average car use.	31
Table 2.3	Incident outcomes by injury vehicle 1986-1991 (derived from data in Marshall et al. 1996).	33
Table 2.4	Total ATV-related entitlement claims by year. Source: ACC industry presentation 2004.	34
Table 2.5	Analysis of OSH investigation cases by scenario.	46
Table 2.6	Incidents reported in the New Zealand media 2001-2006.	50
Table 2.7	Comparisons of quadbike model types listed in marketing material.	52
Table 2.8	Interventions implemented for machines used in New Zealand farming.	58
Table 3.1	Activities immediately preceding the quadbike -related injury.	84
Table 4.1	Industry consultation – by system level.	99
Table 4.2.	Industry consultation (by organisation, in alphabetical order).	101
Table 4.3	Modified Participatory Ergonomics Framework (PEF).	110
Table 4.4	User opinions on how to improve quadbike functionality.	136
Table 4.5	All quadbike users by gender by employment status.	144
Table 4.6	(Exposure) hours of quadbike riding per week.	146
Table 4.7	Age and experience of quadbike users.	147
Table 4.8	Quadbike training received by type.	148
Table 4.9	Induction strategies reported for new riders to the farm.	152
Table 4.10	Roll Over Protective Structures - types used.	165
Table 4.9	Summary of comments in favour of, and against, the use of ROPS.	167
Table 5.1	Basic Haddon matrix.	181
Table 5.2	Haddon 10 Countermeasures list.	182
Table 5.3	Sampling by regional groupings.	196
Table 5.4	Sources and main areas of intervention interest.	213
Table 5.5	Intervention matrix.	215
Table 5.6	Employment status of quadbike users.	219
Table 5.7	Hours of quadbike use per week.	220
Table 5.8	Gender of rider.	221
Table 5.9	Age and experience of all riders and those being seriously injured.	222
Table 5.10	Body region by injury types for all LCE (n=156).	223
Table 5.11	Serious LCE injuries by body region (n=37).	223
Table 5.12	Working in isolation and severity of injury.	224

	Page	
Table 5.13	Activity immediately preceding the incident.	230
Table 5.14	Activity preceding LCE, in comparison to primary use of the quadbikes.	231
Table 5.15	Attitude of quadbike travel at time of LCE – by task.	232
Table 5.16	Implements in use during an LCE - by task.	233
Table 5.17	Direction of rollovers in serious injury cases – by terrain.	250
Table 5.18	Most common pairs of risk factors and severity of injury.	253
Table 5.19	Most common combinations of 3 factors in an LCE that appear in at least 5 LCE or 2 Serious injury cases (156 LCE in total).	254
Table 5.20	Findings summary - potential interventions.	256
Table 5.21	Haddon 10 Countermeasures list and potential interventions for farm quadbike LCE.	257
Table 5.22	Potential interventions that act Pre-LCE.	258
Table 5.23	Interventions for reducing severity of injury during and following an LCE.	260
Table 6.1	Directions for future research.	299

List of Figures

	Page
Figure 1.1	The original 1970s Honda ATV trike. 5
Figure 1.2	1976 model trike still being used for towing on the Coromandel peninsula, North Island. 5
Figure 1.3	Transtruck 6x6, still in use on a Canterbury farm. 6
Figure 1.4	Sports models such as this one are lighter and more manoeuvrable. 7
Figure 1.5	Early two-wheeled drive 250cc model – very easy to steer by comparison to heavier more recent 4WD quadbikes. 8
Figure 1.6	Late model 4WD Honda on a large South Island sheep station. 9
Figure 1.7	Diagram showing sequential progression of studies. 16
Figure 2.1	Total numbers and costs in NZ\$ of new and ongoing ACC claims. 35
Figure 2.2	USA - hunting (Utility) model. 52
Figure 3.1.	Regional distribution of claims and claim incidence rates by region. 81
Figure 3.2	Distribution of quadbike-related claims by month. 82
Figure 3.3	Age by sex distribution for quadbike-related claims. 83
Figure 3.4	Taxonomy of incident event sequences. 86
Figure 3.5	Taxonomies of getting on/off and manual handling injury events. 87
Figure 3.6	Cases involving trailers. 88
Figure 4.1	Primary task for which each quadbike is used. 114
Figure 4.2	Trailer modified to carry lambs in exposed hill country in Southland. Live ones in need of warmth are stowed in the cut-down plastic containers for transport back to the farmhouse. 116
Figure 4.3	Home-made containers for tools and materials. 117
Figure 4.4	Typical terrain for remote farm with previously un-ploughed grazing. East coast of Wairarapa, North Island. 117
Figure 4.5	The researcher demonstrating the system which allows the rider to place fencing support poles in the ground, without leaving the quadbike seat. 118
Figure 4.6	Home-made quadbike-mounted fencing system. 119
Figure 4.7	Quadbike that regularly crosses the public road. 122
Figure 4.8	Honda with home-made dog tray. 123
Figure 4.9	Typical small un-compartmented dog trailer. 124
Figure 4.10	CEDAX front mounted spray tank system with DIY spray hose extension using a domestic hose reel. 125
Figure 4.11	The spray boom clips to the rear rack. Promotional photo of a new boom spraying system provided by CDAX Ltd, but with fluid still located above the centre of gravity of the quadbike. 125

	Page	
Figure 4.12	Promotional photo of a new boom spraying system by CDAX Ltd, with fluid weight loading onto the ground through trailer wheels.	126
Figure 4.13	Home-made stowage frame for the spray hose with exposed spikes that could cause very serious puncture-type injuries in a rollover.	126
Figure 4.14	Typical low-lying country in the North Island. The dredgings are pulled out by a digger and form the stop banks, making these ridges very unstable for riding on.	128
Figure 4.15	One tonne bale on a car trailer.	131
Figure 4.16	Taranaki quadbike with spotlight for shooting rabbits.	134
Figure 4.17	Number of other vehicles needed if quadbikes were unavailable.	138
Figure 4.18	Farm activity types in this study, in comparison to the 1999 Agricultural census findings.	139
Figure 4.19	Employment status.	144
Figure 4.20	Age distribution of all users by occupation percentage.	147
Figure 4.21	Personal Protective Equipment (PPE) worn.	153
Figure 4.22	Early model 250cc Kawasaki.	156
Figure 4.23	Age of working quadbikes.	156
Figure 4.24	Inspection of front wheel bearings for wear.	158
Figure 4.25	State of repair - all machines.	159
Figure 4.26	State of repair - machines over three years old.	159
Figure 4.27	Combination of modifications. Sheep and beef farm Otago.	161
Figure 4.28	Home-made ply sheet dog tray.	161
Figure 4.29	Modifications to the quadbikes.	162
Figure 4.30	Honda fitted with extended mudflaps, 270° bullbars and a custom-made weather cover using heavier gauge tubing than the retail versions.	163
Figure 4.31	The purposes of light trailers used with quadbikes.	164
Figure 4.32	Home-made T-Bar ROPS.	166
Figure 5.1	Model of Injury Causation for Forestry Work. (Redrawn from Slappendel, 1995:241.).	187
Figure 5.2	An information processing model for STF analysis. Redrawn from Bentley (submitted).	188
Figure 5.3	Key steps in Event Recall (adapted from Loftus & Ketchum, 1991).	191
Figure 5.4	Scale (1:32) model of Honda utility quadbike with trailer and trailed spreader hopper.	200
Figure 5.5	Scale (1:24) model of Yamaha quadbike with articulated rider.	201
Figure 5.6	Example of an LCE reconstruction using models and props, on a farm in the Auckland region.	202
Figure 5.7	South Island LCE site with analysis overlay sketch.	203
Figure 5.8	North Island LCE site with analysis overlay sketch.	203
Figure 5.9	Example sequence of events chart (redrawn from Haslam and Bentley, 1999).	206

	Page	
Figure 5.10	Example events and causal factors chart (adapted from Haslam and Bentley, 1999).	207
Figure 5.11	Modified chart (sequence boxes only) with example data showing post-injury events.	209
Figure 5.12	Event and Causal Factors chart for quadbike LCE (example) final version.	210
Figure 5.13	Sequential progression of studies.	212
Figure 5.14	Hours of quadbike use (exposure) per week, by percentage.	220
Figure 5.15	LCE by severity and time of day.	225
Figure 5.16	Loss of Control Events by severity and time of year.	226
Figure 5.16	All LCE and those resulting in serious injuries by ground conditions.	228
Figure 5.17	All LCE and those resulting in serious injuries by terrain type.	229
Figure 5.18	LCE scenarios involving trailers (n=33).	234
Figure 5.19	Most common injury agencies (n=122).	235
Figure 5.20	Taxonomy of all events where machine was being ridden at the time of the LCE.	237
Figure 5.21	Taxonomy of events for LCE while doing tasks involving interaction with animals.	239
Figure 5.22	Interactive and information processing model of quadbike LCE on farms.	241
Figure 5.23	Interactive model showing risk factors in the 76 LCE involving animals.	243
Figure 5.24	Interactive model showing risk factors in the 10 spraying LCE.	245
Figure 5.25	Interactive model showing risk factors in the 10 fencing LCE.	248
Figure 5.26	Taxonomy of the 37 serious injury LCE sequences.	249
Figure 5.27	Key interventions (numbered) plotted on model for tasks involving interaction with animals.	262
Figure 5.28	Key interventions (numbered) plotted on model for spraying tasks.	263

Glossary of acronyms

The brief descriptions of the functions of the organisations are based on information provided on their websites as of August 2007.

- ACC Accident Compensation Corporation
<http://www.acc.co.nz>
A Crown entity that administers New Zealand's accident compensation scheme providing personal injury cover for all New Zealand citizens, residents and temporary visitors to New Zealand. In return people do not have the right to sue for personal injury, other than for exemplary damages. The ACC responsibilities include injury prevention, buying health and disability support services to treat, care for and rehabilitate injured people, and advising the New Zealand Government.
- AGITO Agriculture Industry Training Organisation
<http://www.agricultureito.ac.nz/RP.jasc?Page=Home>
AGITO offer nationally recognised and New Zealand Qualifications Authority (NZQA) registered qualifications in industry sectors ranging from dairy, sheep and cattle to rural servicing, wool harvesting and water industry services.
- AHSC Agricultural Health and Safety Council
<http://www.acc.co.nz/injury-prevention/safer-industries/WCM001757>
A group formed as part of an ACC programme that brings together representatives and stakeholders from specific industry sectors with the aim of identifying common causes of injury and finding ways to reduce these within their sector.
- ATV All Terrain Vehicle
The term 'all-terrain vehicle' is now used internationally to cover a range of open-topped motorised buggies and three-wheelers designed for off-road use. The American National Standards Institute (ANSI) defines an ATV as a single rider vehicle that travels on low pressure tyres, has a straddle seat and handlebars for steering rather than a wheel or other means. The four-wheeled versions are known as "quads" or "quadbikes" in New Zealand; "ATVs", "four-wheelers" or "quads" in Australia, the United States and English speaking Canada; and "quadrimotos", or more commonly "vehicules tout-terrain (VTT)" in French speaking countries. They are sometimes also bracketed as Off Highway Vehicles (OHV) or Off Road Vehicles (ORV).

CAA	<p>Civil Aviation Authority http://www.caa.govt.nz/ The New Zealand CAA establishes civil aviation safety and security standards, and monitors adherence to those standards. The CAA also carries out accident and incident investigations and collates this material to establish an industry-wide safety picture.</p>
CPS	<p>Canadian Paediatric Society</p>
CPSC	<p>Consumer Product Safety Commission (USA) http://www.cpsc.gov/ The U.S. Consumer Product Safety Commission is charged with protecting the public from unreasonable risks of serious injury or death from consumer products.</p>
DoL	<p>Department of Labour New Zealand Government organisation. (See OSH below)</p>
IEA	<p>International Ergonomics Association http://www.iea.cc/ A federation of ergonomics and human factors societies from around the world.</p>
ILO	<p>International Labour Organisation http://www.ilo.org/global/lang-en/index.htm The International Labour Organization (ILO) is devoted to advancing opportunities for women and men to obtain decent and productive work in conditions of freedom, equity, security and human dignity. Its main aims are to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue in handling work-related issues.</p>
LCE	<p>Loss of Control Event LCE are defined for the purposes of this research as those situations where the riders on a moving vehicle find themselves unable to prevent either personal injury or damage to the machine from occurring.</p>
LTSA	<p>Land Transport Safety Authority http://www.landtransport.govt.nz LTSA is a Crown entity formed to promote land transport sustainability and safety, and allocate government funding for land transport.</p>

MAF	Ministry of Agriculture and Forestry http://www.maf.govt.nz/mafnet/index.htm NZ Government Ministry
MSD	Musculoskeletal disorders
NZCTU	New Zealand Council of Trade Unions
NZIPS	New Zealand Injury Prevention Strategy http://www.nzips.govt.nz/ A government initiative to enhance the infrastructure that supports injury prevention activity. News, policy and injury statistics.
NZMDA	New Zealand Motorcycle Distributors Association Body representing quadbike dealers notably Honda, Kawasaki, Suzuki , and Yamaha .
NZQA	New Zealand Qualifications Authority http://www.nzqa.govt.nz/ The New Zealand Qualifications Authority quality-assures secondary and tertiary qualifications and education providers, evaluates overseas qualifications and administers the New Zealand Register of Quality Assured Qualifications and the National Qualifications Framework, including the NCEA
OSH	Occupational Health and Safety http://www.osh.govt.nz/ A section of the Department of Labour (DoL) which provides best practice information and guidance to assist New Zealand businesses with health and safety in the workplace. The Department of Labour also inspects workplaces to check on safety and health arrangements, investigates accidents at work, and makes sure employers and employees comply with health and safety legislation. We are responsible for regulating the storage and use of hazardous substances, explosives and dangerous goods, and for the safety of amusement devices.
PEF	Participatory Ergonomics Framework (Haines, Wilson, Vink & Koningsfeld, 2002: 324).
PPE	Personal protective equipment Boots, gloves, helmets, overalls, goggles etc.
ROPS	Roll Over Protective Structures
TVNZ	Television New Zealand
USC	Unpredicted surface change

- VTT Vehicules tout-terrain
French speakers version of 'all-terrain vehicle' (see ATV).
- WOF **Warrant of Fitness.** Vehicle condition checks carried out by qualified mechanics to government-set standards. It is mandatory in New Zealand to hold a current warrant for road vehicles (renewed at 12 or **6** month intervals), not required for quadbikes.