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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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## 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.



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## 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  <a href="http://www.caa.govt.nz/">http://www.caa.govt.nz/</a>  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)  <a href="http://www.cpsc.gov/">http://www.cpsc.gov/</a>  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  <a href="http://www.iea.cc/">http://www.iea.cc/</a>  A federation of ergonomics and human factors societies from around the world.</p>
ILO	<p>International Labour Organisation  <a href="http://www.ilo.org/global/lang-en/index.htm">http://www.ilo.org/global/lang-en/index.htm</a>  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  <a href="http://www.landtransport.govt.nz">http://www.landtransport.govt.nz</a>  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 <a href="http://www.maf.govt.nz/mafnet/index.htm">http://www.maf.govt.nz/mafnet/index.htm</a> NZ Government Ministry
MSD	Musculoskeletal disorders
NZCTU	New Zealand Council of Trade Unions
NZIPS	New Zealand Injury Prevention Strategy <a href="http://www.nzips.govt.nz/">http://www.nzips.govt.nz/</a> 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 <b>quadbike</b> dealers notably Honda, Kawasaki, <b>Suzuki</b> , and <b>Yamaha</b> .
NZQA	New Zealand Qualifications Authority <a href="http://www.nzqa.govt.nz/">http://www.nzqa.govt.nz/</a> The New Zealand Qualifications Authority quality-assures secondary and tertiary qualifications and education providers, evaluates overseas <b>qualifications</b> and administers the New Zealand Register of Quality Assured Qualifications and the National Qualifications Framework, including the NCEA
OSH	Occupational Health and Safety <a href="http://www.osh.govt.nz/">http://www.osh.govt.nz/</a> A section of the Department of Labour ( <b>DoL</b> ) 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 <b>etc.</b>
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.