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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

David John Moore

2007
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), ΣοφήSplash και τον δόο 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.
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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 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.

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    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.

CPS    Canadian Paediatric Society

CPSC   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.

DoL    Department of Labour
        New Zealand Government organisation. (See OSH below)

IEA    International Ergonomics Association
        http://www.iea.cc/
A federation of ergonomics and human factors societies from around the world.

ILO    International Labour Organisation
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.

LCE    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.

LTSA   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.
MAF  Ministry of Agriculture and Forestry
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.