Death on the beach:
a systems analysis of driving accidents and stakeholders on K’gari

University of the Sunshine Coast Research Week 2015
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Today

• Background to beach driving on K’gari
• Systems research approach
• Stakeholders involved
• Describe the beach driving domain
• Detail the circumstances of a fatal accident on K’gari
• Discuss the research agenda and impact
Background

- K’gari (Butchulla language - *paradise*) or Fraser Island.
- World heritage listed - the largest sand island in the world.
- Southern Queensland coast, 120km x 24km.
- Pop. < 200 + > 390 000 visitors / year.
- 80% camping in designated areas along eastern beach.
- Transport – 4WD beach driving & sandy inland tracks.
Background

- In Australia, beach driving is a necessary form of transport.
- On K’gari between 2002 and 2015 over 160 reported crashes, including 4 fatalities.
- The beach as a road presents unique challenges for drivers - It is a context unfamiliar to the majority of drivers.
- The beaches of K’gari are gazetted roads, and standard road safety interventions are being applied.
Heading over to Fraser Island?
Permits required before entering – phone 53 13 49
Be Fraser friendly:
• Drive safely, 4WD only — all road rules apply.
• Take your rubbish home with you.
• Do not bring in plants, plant materials or soil.

On the Beach
Watch for Kids
Watch Your Speed

On Fraser Island
Do not fish in tidal streams
Do not feed wild animals

On Fraser Island
Do not access tracks
Do not cycle on beach<p>
A research approach:

• The unique context of beach driving renders the standard road safety approach inappropriate.
• There is an opportunity to implement new context driven interventions.
• A first step requires that the beach driving context be described and understood.
Systems Approaches

- Systems approaches or ‘systems thinking’ have been prominent in the area of accident analysis (Leveson 2004; Rasmussen 1997).
- Including road safety issues (Salmon & Lenne 2015).
- Also prominent in other areas of systems analysis and design (Mcllroy & Stanton 2011; Stevens & Salmon 2014).
- In this research two systems approaches have been used:
  2. Accimap (Rasmussen 1997).

The philosophy is that accidents, and indeed safety, emerges from non-linear interactions between components across complex sociotechnical systems. In short, accidents are underpinned by a network of interacting, contributory factors.
Results

Utilising a systems approach this research explores:

1. The stakeholders involved:
   - Accimap: ActorMap
2. The purpose and objects of the beach as a road:
   - Cognitive Work Analysis: Phase 1 – Work Domain Analysis
3. Contributory factors in the fatal accidents:
   - Accimap: Accident Trajectory
### Beach as a Road - Actor Map

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<tr>
<td><strong>Regulatory Bodies and Associations</strong></td>
<td>Queensland Police</td>
<td>Environmental Protection Agency</td>
<td>Queensland Tourism Board</td>
<td>Queensland Ambulance</td>
<td>Qld Parks &amp; Wildlife Service</td>
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<td></td>
<td>Wide Bay Forensic Crash Unit</td>
<td>Maryborough District Traffic Branch</td>
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<td><strong>Local Government &amp; Company Management</strong></td>
<td>Fraser Island Police</td>
<td>Fraser Island Traffic Accident Committee</td>
<td>Fraser Coast Council</td>
<td>Fraser Coast 4WD Association</td>
<td>Fraser Island Accommodation Providers</td>
<td>Fraser Island Association</td>
<td>Fraser Island Natural Integrity Alliance</td>
<td>Fraser Island Defenders Organisation</td>
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<td><strong>Technical &amp; Operational Management</strong></td>
<td>4WD Hire Companies</td>
<td>Backpackers Accommodation Rainbow</td>
<td>4WD Manufacturers</td>
<td>Management of Commercial Operations</td>
<td>Large Operators</td>
<td>Telcos</td>
<td>Tag-a-long Tours</td>
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<td><strong>Physical Processes &amp; Actor Activities</strong></td>
<td>Driver</td>
<td>Passengers</td>
<td>Other Beach Users</td>
<td>Driver Training</td>
<td>Pilots</td>
<td>Island Communities</td>
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<tr>
<td><strong>Equipment &amp; Surroundings</strong></td>
<td>Driving Environment</td>
<td>Beach Management</td>
<td>Driving Infrastructure</td>
<td>Network Coverage</td>
<td>Campground locations</td>
<td>Driver related</td>
<td>Itineraries/maps/information</td>
<td>Vehicle related</td>
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Beach as a Road - Work Domain Analysis
Beach as a Road - Work Domain Analysis

[Diagram showing a network of relationships and processes related to beach as a road, including functional purpose, values and priority measures, purpose-related functions, object-related processes, and physical objects.]

- **Functional purpose**: Safe vehicle access to coastal destinations, Limit the need for roadway infrastructure.
- **Values and priority measures**: Minimise trauma and collisions, Minimise compliance, Minimise environmental damage, Safe passage / movement of vehicles, Maximise regulations, Minimise costs.
- **Purpose-related functions**: Determine Path, Behave appropriately, Provide transport / transit corridor, Coordination / cooperation between drivers, Separation of drivers and other beach users, Enforcement, Maximise subjective / recreational experience, Maintain infrastructure, System performance, monitoring and education.
- **Object-related processes**: Affordances related to beach as surface e.g. surface for mobility; surface for housing; animal habitat, Affordances related to route & route direction; provision for access; direct path, Affordances related to roadway designation e.g. test for alcohol; measure speed; financial penalty, Affordances related to standards, training and guidelines e.g. Store information on procedures; provide rules about behaviour.
- **Physical objects**: Ocean side objects e.g. wetting lines; waves; hard/soft sand; pools & pathways, Beach objects e.g. soft/dry sand; undertones; people; vehicles; crowd/wastewater, Dune side objects e.g. vegetation; dunes; traffic controls; speed signage; industrial waste sites, Standards, regulation and guidelines e.g. permit; road rules; driver training; finance & budget, Unique beach as roadway objects e.g. monuments; shipwrecks; wildlife (sharks, marlin, birds); exposed rocks.
# Accimap – Accident Trajectory

<table>
<thead>
<tr>
<th>Category</th>
<th>Issues</th>
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<tr>
<td>Government Policy &amp; Budgeting</td>
<td>Failure to respond to ARRB report</td>
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<tr>
<td>Regulatory Bodies and Associations</td>
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<tr>
<td>Local Government &amp; Company Management</td>
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<tr>
<td>Technical &amp; Operational Management</td>
<td>Inadequate driver training, Miscommunication about driver roles, Driving paperwork</td>
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<tr>
<td>Physical Processes &amp; Actor Activities</td>
<td>Lack of driver training, Driver inexperience, Vehicle speed, Driver ignores request to slow down, Inadequate reaction to wave, Sharp turn, Vehicle rollover, Injury and deaths</td>
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<tr>
<td>Equipment &amp; Surroundings</td>
<td>Waves, Soft sand, Luggage, Lap belts, Tyre pressure, Troop carrier 4WD seat configuration, Mobile phone network</td>
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Discussion

• The analyses confirms a complex environment.
• Standard road safety approaches to accident analysis and prevention are not appropriate.
• A research agenda has been established with two main aims:
  1. Undertake appropriate systems modelling of driving safety in beach and unsealed roadway environments.
  2. Establish appropriate crash data systems to reveal the full network of contributory factors involved in beach driving and unsealed roadway crashes.
Discussion

• This will reveal more than a safety approach to beach driving on K’gari.
• Through this lens there will be lessons for a range of national and international loose surface driving and 4WD safety contexts.
• Australia where more than half of the 820,000km of roads are unsealed.
• Internationally, where some countries unsealed roadways may constitute more than 75% of the network.
References


