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for Global Health

# Validation of an in-vehicle monitoring device for measuring driving exposure and deceleration events

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SYDNEY



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# Context

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## **IN VEHICLE MEASURING DEVICE :**

**Being used in a 12-month Randomised Controlled-Study to measure the impact of a safe driving program for older drivers**

**Used to measure outcomes of interest**

# Context

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## **OUTCOMES OF INTEREST:**

- 1. Safety (near misses and crashes)**
- 2. Driving exposure (speeds, time of day, routes)**

# Definitions

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## **CRASH:**

**Any contact with an object, either moving or fixed, at any speed, in which kinetic energy is measurably transferred or dissipated.**

## **NEAR-MISS:**

**rapid, evasive manoeuvre by the subject vehicle to avoid a crash**

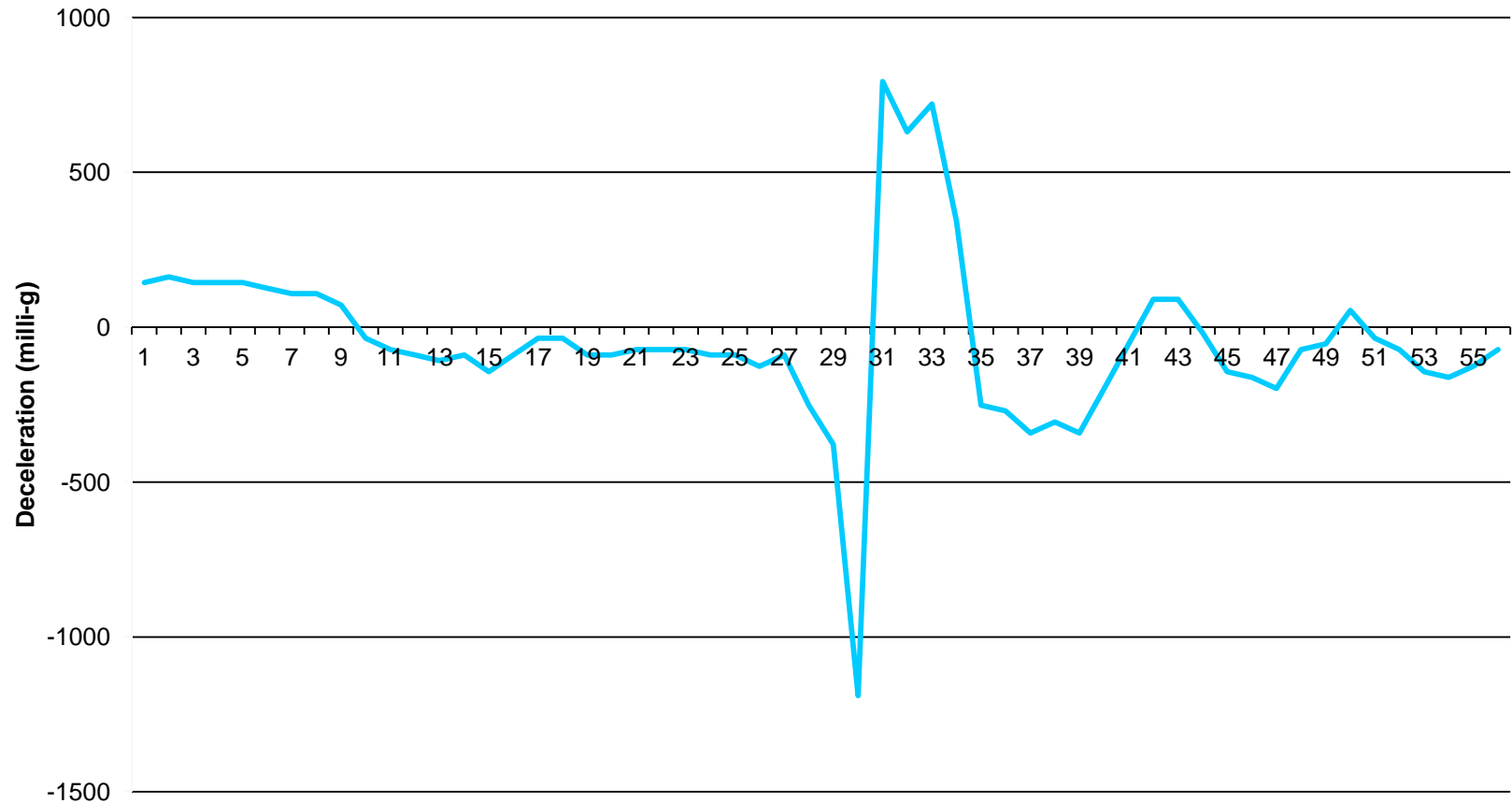
## **➤ RAPID DECELERATION EVENT**

# Rapid Deceleration Event

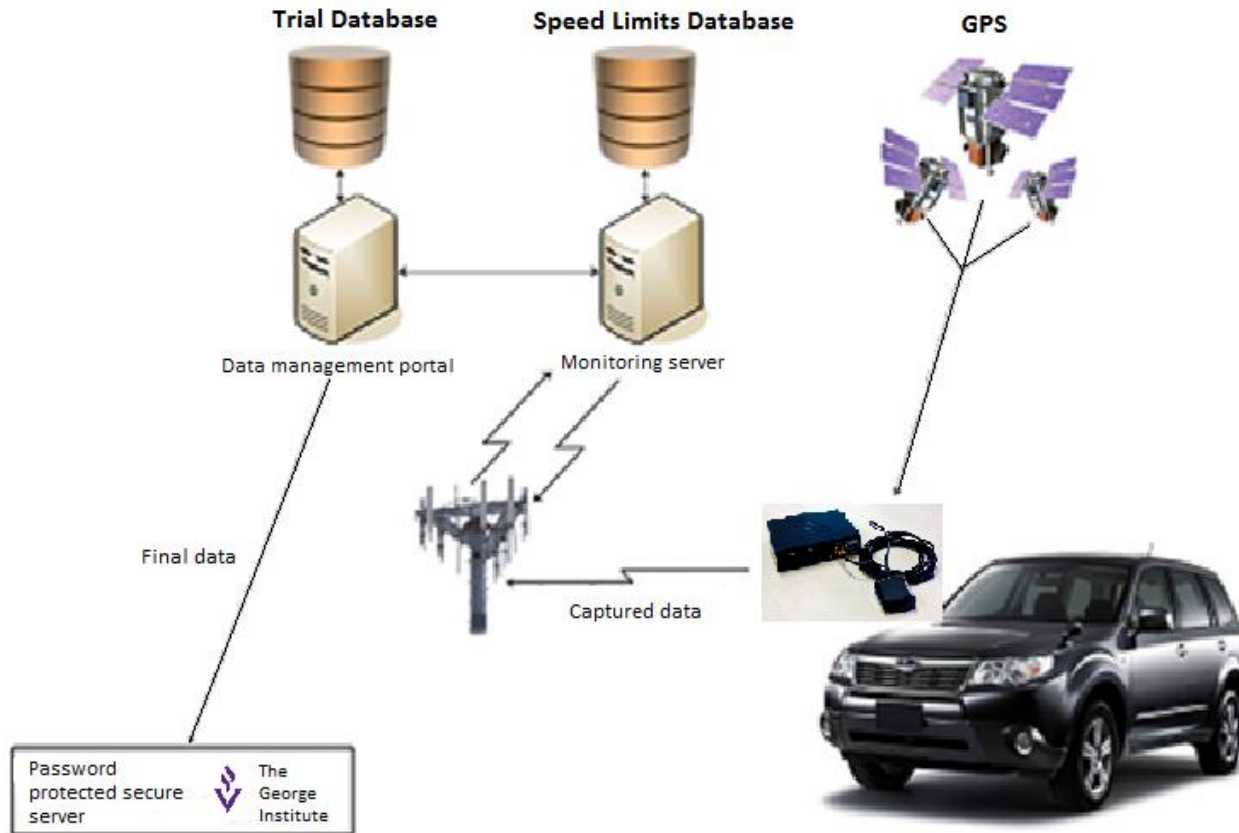
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- **Will be used to identify possible ‘incidents’**
- **A threshold must be set to alert these possible incidents**
- **Confirm if actual crash or near crash occurred by telephone call to the participant**

# Deceleration Data from a Crash Reported from an In-Vehicle Monitoring Device



# In-Vehicle Monitoring Device



# Project Outline

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**Laboratory studies and a field study were used to validate the in-vehicle monitoring devices and verify the rapid deceleration event threshold:**

- 1. Stationary device study**
- 2. Low-speed impact crash test study**
- 3. Field study**

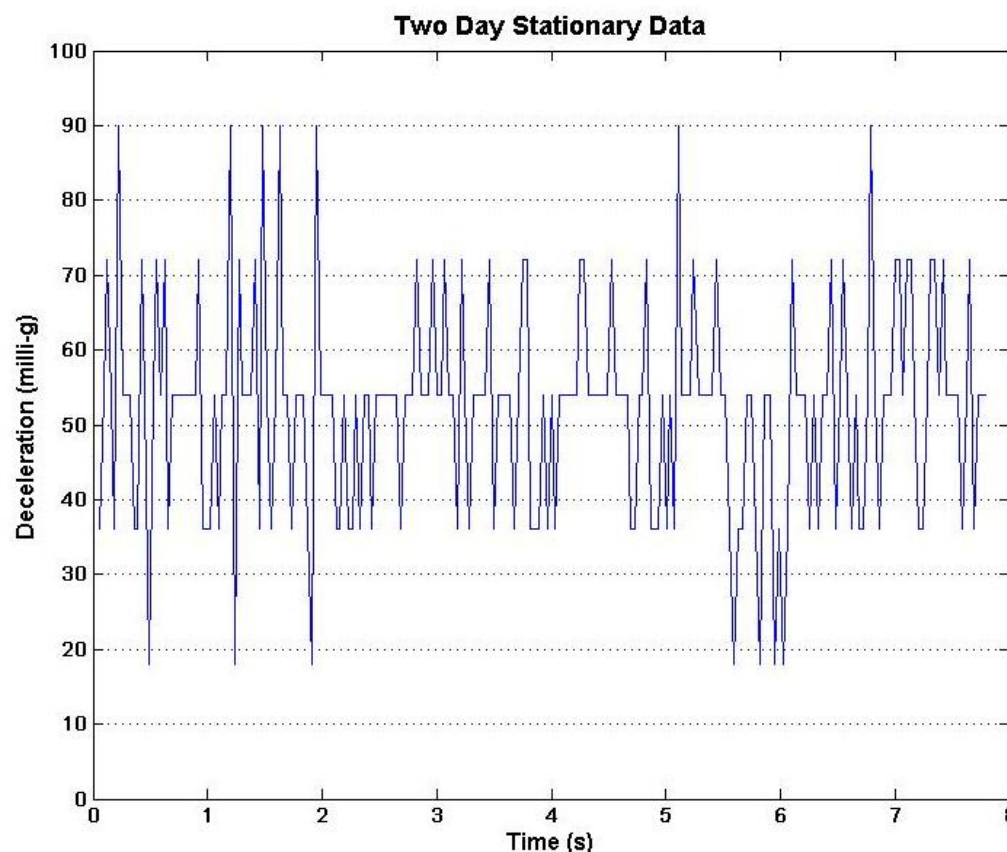


# Stationary Device Study

**AIM:** To determine whether the accelerometer experiences drift over time and validate calibration

**METHOD:** Device left stationary for two days with data recording

**RESULTS:** No drift experienced, however there was an offset on each three axis and noise in the signal



# Low-Speed Impact Crash Test Study

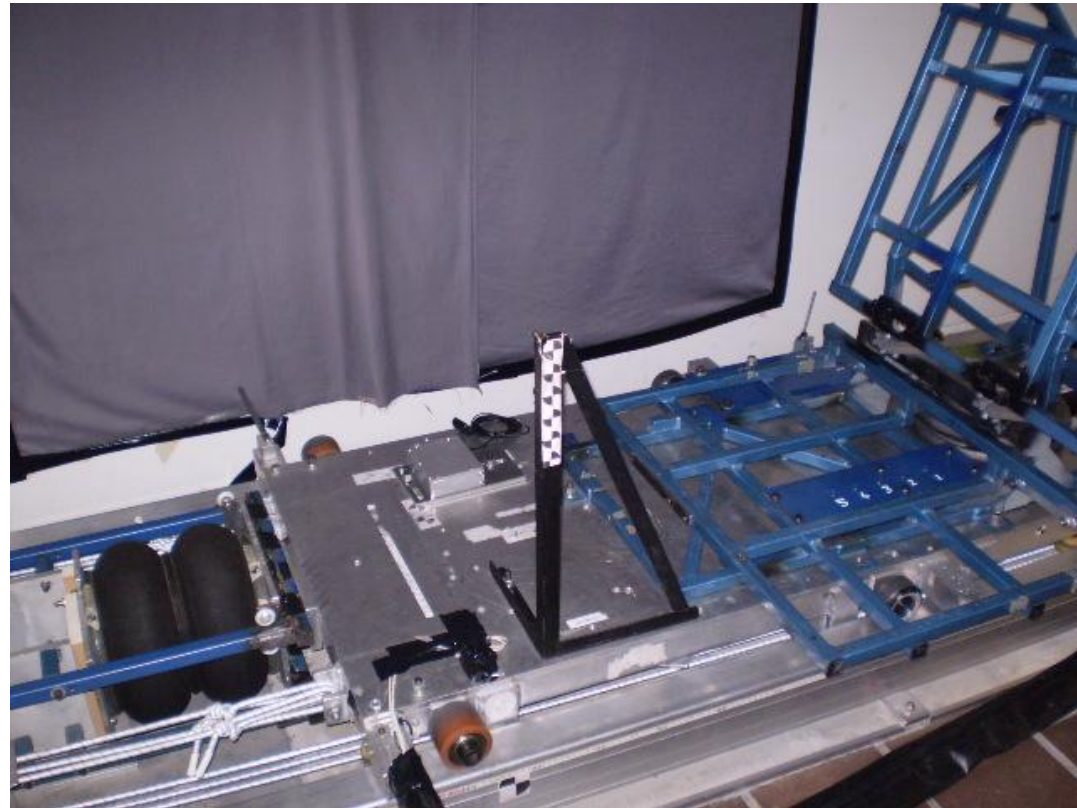
## **AIMS:**

1. Model different types of acute deceleration events which may be experienced by the participants and investigate drift and change in calibration after a series of impacts.
2. Review the data output in terms of magnitude of deceleration measured and duration of events from the black box device in relation to the testing matrix and measured deceleration.

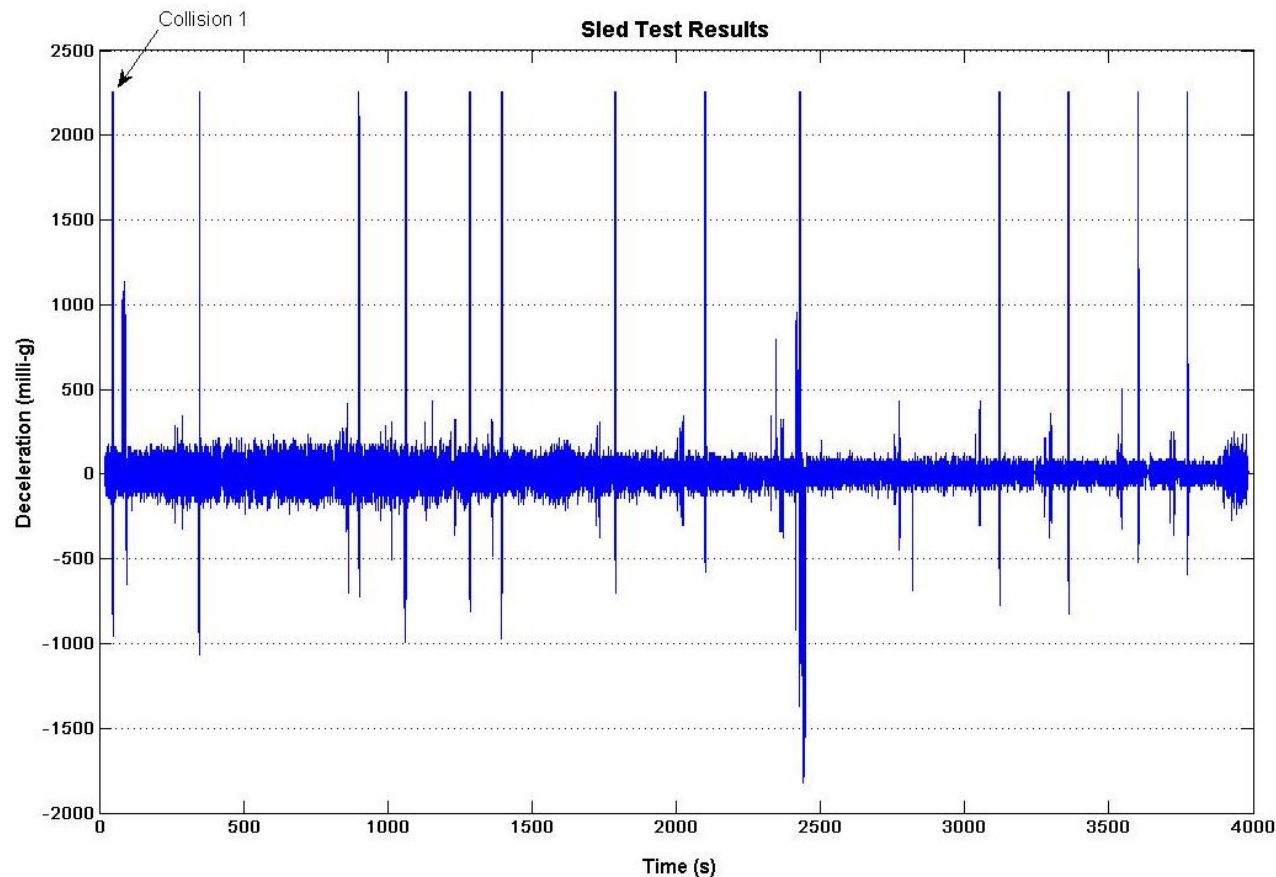
# Low-Speed Impact Crash Test Study

## METHOD:

Different deceleration events modelled using different sled mass, air spring pressure and sled run distance



# Low-Speed Impact Crash Test Study - Results



# Field Study

**AIM:** Test a custom Matlab program during regular driving to field test the threshold for identification of rapid deceleration events.

**METHOD:** A black box was installed in the vehicles of three older driver participants and data was continuously captured. Rapid deceleration event thresholds set at 550 milli-g, 600 milli-g and 650 milli-g. These thresholds were chosen based on thresholds used in literature but allowing for system noise.

# Field Study - Results

	Participant 1	Participant 2	Participant 3
Age (years)	81	84	83
Gender	Male	Male	Female
Total trips	21	31	9
Longest trip distance (km)	18.19	10.27	6.53
Longest trip duration (min)	25.16	33.10	13.02
Furthest radius from home (km)	15.5	5.97	3.76
Total distance driven day (km)	62.04	53.49	21.7
Total distance driven night (km)	0.04	49.82	0
Number of events $\geq 550$ milli-g	10	5	1
Number of events $\geq 600$ milli-g	2	1	0
Number of events $\geq 650$ milli-g	2	1	0



# Field Study - Results



# Discussions and Limitations

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## **INITIAL DEVICE TESTING:**

Determine the offset of each device prior to instalment into each participants car

## **RAPID DECELERATION EVENT THRESHOLD:**

Set to a higher level (+50milli-g) than expected to account for the fluctuations

Subset of events over 1000milli-g may represent more significant events

Device limitation- cannot measure over 2000milli-g, however, only needs to measure the presence of an event



# Discussions and Limitations

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## **LATERAL THRESHOLD:**

Was not investigated as it involves complex mechanisms and potentially more than a simple threshold

This is a limitation of the study as there is events such as swerving which occur in the lateral direction

Further investigation needed

## **EXPOSURE DATA:**

In-vehicle monitoring device provides a valid method for measuring changes in driving behaviour

# Future Work

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- **Completion of the field testing**
- **Two black boxes in a car**
- **Driving with a log book**
- **Filtering data to minimize noise**

# Conclusion

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- **The validity of using an in-vehicle monitoring system for measuring the specified outcomes has been demonstrated**
- **Care is needed when using this technology and several factors need to be accounted for:**
  - Accuracy of calibration
  - signal noise
  - validity of events being recorded

# Collaborations and Partnerships



**Australian Government**

**Australian Research Council**



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