Participants

- Project Leader – Dr James Freeman (QUT)
- Project Participants
- Prof Andry Rakotonirainy (QUT)
- Ms. Teodora Stevanova (QUT PhD Student)
- A/Prof Yvonne Toft (CQU)
- Ms. Maya Spiryagina (CQU Masters Student)
- Industry Partners: QR, TMR, DTEI, RailCorp

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Project Background

- Collisions at railway crossings are often calculated to be the largest cause of rail-related fatalities (Federal Railroad Administration; Sochon, 2008)

- Pedestrians and train collisions most likely to result in fatalities (Australian Transportation Safety Bureau, 2004)

- Three key high risk groups:
  - Heavy vehicle drivers
  - Older drivers
  - Pedestrians

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Project Background

- Research has overwhelmingly focused on <u>train-vehicle</u> collisions

- Errors versus Deliberate Violations
  - Not detecting crossings
  - Failing to notice approaching trains
  - Misjudging the risk of approaching trains
  - Distraction, inattention, poor knowledge, etc

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Project Background

- Much less is known about <u>pedestrians</u>
  - 50% didn't know it was illegal to cross when a train was approaching (Lloyd's Register Rail, 2007)
  - 18% unintentionally caught on a train track (Lloyd's Register Rail, 2007)
  - Most common reason (not being aware of train or second train) (Lloyd's Register Rail, 2007)

- <u>Second Train Issue</u>
  - 18% of fatalities due to second train (U.S. Study) (Federal Rail Administration, 2008)
  - 16% Victorian pedestrian sample sometimes violated rules after train crossed (Lloyd's Register Rail, 2007)

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Project Background

- Other Contributing Factors:
  - Underestimation of train speeds (CRC, 2010)
- Deliberate Violations
  - Ignoring warning signs (Federal Railroad Administration, 2008)
  - 31% crossed tracks when knew train was coming (Lloyd's Register Rail, 2007)
  - Reason was to maximise convenience
  - Habituation: avoiding negative outcomes (CRC, 2010, Davey et al., 2008)
- Errors versus Deliberate Violation??

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Who is at greatest risk?

- Males more likely to violate pedestrian rules
- Familiarity
- Deliberate risk taking
- Fatigue
- Alcohol and Drugs
- Examination of these factors has again focused on vehicle drivers (CRC, 2010)

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Pedestrians at greatest risk?

1. Males more likely to violate pedestrian rules
   - 40% versus 12%: But it is unknown why? (Lloyd's Register Rail, 2007)
   - 84% of Australian fatalities males (ATSB, 2004)
2. School children and young persons
   - Poor scanning, under-developed risk perception abilities, impulsiveness, etc (CRC, 2010)
3. People with disabilities
4. Older pedestrians
   - Slower crossing speeds, mobility aids getting stuck, etc.

There is a need for more research

1. Whether <u>errors or deliberate violations</u> cause risky behaviour;

2. The core reasons for <u>why some groups</u> are disproportionately represented in collision databases;

3. The environmental factors that increase or decrease the likelihood of risky behaviour
   – Surveillance, active versus passive, waiting times, countermeasures (education, deterrence), signal type (fixed vs flashing) vs incapacitation

There is a need for more research

1. Utilisation of appropriate psychological models
   - Reason's model of Human Error
     a) Slips and errors vs rule/knowledge-based mistakes
   - Hazard probability and risk assessment models
   - Theory of Planned Behaviour
2. Do crossings convey the necessary urgency and dangers? (Rudin-Brown, et al., 2012)
3. Leads to the development of warning signals that not only attract <u>attention</u> but <u>respect</u>

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Current Project Aims

a) Conduct an in-depth analysis of pedestrians':

    a) Decision making processes that contribute to making errors and deliberate violations; and

    b) Identify the environmental factors that increase the likelihood of risky behaviour

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Current Project

1. Timeline: 2012 – 2013

2. Methodology

   a) Focus Groups with high risk groups

   b) Quantitative analysis (N = 619) pedestrian crossing users to identify specific contributions (attitudes, motivations, etc) to risky behaviours

   c) Interviews with rule breakers (N = 40)

Students' Project

1. Teodora Stefanova (PhD QUT)
    - Title: Human factors contributing to pedestrian' risk taking at level crossings: similarities and differences between Australia and France
    - Identify human and environment factors that have greatest impact upon subsequent behaviour
    - Focus Groups, Observational Study and Quantitative Self-report Study

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Students' Project

1. Mayya Spiryagina (CQU Masters)

   - Title: Analysis of Pedestrian Behaviour at Level Crossings

   - Hazard probability study and risk identification analysis;

   - Analysis of the socio-technical system of railway crossings based on current research

   - This involved the critical analysis of existing methodologies and computer-based software products for accident prevention interventions and investment strategies and then appropriate modifications were undertaken to customise these for use with railway level crossings in the Australian environment.

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Study One: Focus Groups

- Based on findings from the literature review, focus groups were conducted with two high risk cohorts: younger and older level crossing pedestrians

- Five focus groups were undertaken with a total of 27 younger and 17 older pedestrian level crossing users (N = 44).

- Focus groups primarily centred on:
  - Primary reasons for unsafe behaviour,
  - Factors that deter this behaviour, and
  - Proposed interventions to improve pedestrian safety at level crossings in the future.

- Thematic analysis was utilised

1ˢᵗ Aim Origins of Behaviour: Common Themes

1. Running late

- *"I think it (likelihood of violation) depends on how late you are and what you were late for."*

- *(When running late for an exam) "If the lights were flashing and there was no train, I probably would (violate)."*

2. Fatalistic perspective

- *"Yes, it'll happen whatever you do (violation). There is no total prevention for anything."*

- *"It comes down to common sense and human behaviour."*

Violation Themes- Young People

1. Non-perception of Personal Danger
- *"I won't get hit by a train. Other people might."*
- *"It wouldn't cross my mind that 'oh, I might get hit by a train'"*

2. Impulsive Risk Taking
- *"Sometimes I just take a risk"*
- *"I don't think about it."*

3. Peer Factor
- *"Guys would be waiting at the train tracks and their friends would be 'like come on let's just go'."*
- *"I reckon some of the guys (would violate), I don't think any of the girls would do that, like show off at the train tracks."*

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Violation themes: Older Pedestrians

1. <u>Inattention – common cause of errors</u>

- *"Yes, either they're guided by the people beside them or they can't see or can't register not to walk."*

- *"They follow the other people they don't look. They just walk. They don't have good eyesight. They follow other people because they think it's safe, but isn't necessarily safe"*

- *"she was always walking with her head down, she just followed them and the train got her."*

2nd Aim: Deterrent Factors

1. <u>Perceived Danger</u>

- *"Crossing when you're not allowed to, it's not worth the risk"*
- *"We do break the rules it's just not in a way that's going to risk our lives."*

2. <u>Mobility</u> – Older Group

- *"Well that's the problem isn't it, we can't hurry if we need to"*
- *"I know I'm very careful…..I couldn't dart across"*

3rd Aim: Proposed Interventions

1. Incapacitation

- *"In the 70's they had gates, the gates were high and they went right across, so you couldn't walk across the tracks, they were better, they were tops. These boom gates, you can just walk around them."*

- *"I think the moment they shut they should be locked so you can't open them and maybe make them a bit higher"*

2. Education

- *"Yeah, you need to educate the people about the risks maybe going in doing a speech, educating like primary school kids."*

- *"Put it on the TV that you can be fined because I'd never heard of it until {name's} husband got caught."*

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3ʳᵈ Aim: Proposed Interventions

1. <u>Sensory salience</u> – Older Group

- *"Sometimes you can't hear the warning bell"*
- *"Older people would take more notice of a flashing light and might stop."*

Summary

- A range of factors influence pedestrian crossing behaviours

- *Incapacitation* and *Education* proposed as interventions

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Study Two

- Aim: Examine the strength of the relationship between key decision making factors identified in Study One and the behavioural outcomes e.g., deliberate violations and errors

- Quantitative survey implemented with level crossing users across the Brisbane metropolitan area

- N = 619

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Method

- Questionnaire: demographics, level crossing usage, knowledge and experiences with level crossings, violations and mistakes, deterrent threats, behavioural intention items, perceptions about specific interventions that could improve pedestrian safety

- Paper version or on-line

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Participants

1. Age

- 105 Minors (<18 years)
- 457 Adults (18-59 years)
- 57 Older Adults (60+ years)

2. Crossing Usage

- Daily = 14%
- Weekly = 30%
- Monthly = 30%

Knowledge

- 90% of participants answered all questions correctly (e.g., bell sounding, lights flashing, gates closed)

- No differences in age groups

- <u>Half the sample were not aware they could be fined</u>

Breaking the Rules

- 144 participants (23.5%) reported having <u>intentionally violated</u> the rules at level crossings
- Minors most likely 31.6% followed by the younger adult group 23.0%
- <u>Mistakes</u> were not a common occurrence (3.6%)
- Minors most likely to makes mistakes

Intentions to Break Rules

1. Minors most likely to report intentions to break rules in future (M = 2.1) followed by the older group (M = 1.57)

2. Predictors of Rule Breaking

- Subjective Norms (Others do it)

- Attitude (It's acceptable)

Perceived Effectiveness of Interventions

	Warning Signs		Media Campaign		Surveillance Cameras		Education Campaign		Large Barriers		Transit Officers		Police Officers	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Minors	4.55	1.63	4.52	1.64	4.91	1.91	4.69	1.77	4.89	1.94	5.48	1.70	5.89	1.67
Younger Adults	4.86	1.46	4.92	1.39	5.06	1.68	5.33	1.33	5.59	1.46	5.94	1.33	6.37	1.68
Older Adults	4.84	1.64	4.84	1.49	5.15	1.60	5.18	1.50	5.75	1.58	6.05	1.27	6.32	1.29
Overall	4.80	1.51	4.85	1.45	5.04	1.71	5.21	1.44	5.49	1.58	5.87	1.40	6.29	1.29

Summary

- People are aware of the rules and dangers

- A quarter have broken the rules

- Minors most likely to break the rules

- Rule breaking associated with subjective norms and attitudes

- Increasing the deterrence-based approach may improve safety

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Study Three

- AIM: Deeper exploration into the origins of risky pedestrian behaviour with those who break rules

- 40 interviews (phone)

- 10-20 mins

- Qualitative analyses

- Age M = 35

- 30 males & 10 females

Interview Content

(a) Why a violation occurred,

(b) Knowledge of rules,

(c) Perceived deterrent threats, and

(d) Perceptions regarding the effectiveness of various level crossing interventions.

Why Violate the Rules?

1. <u>Deliberate violations again most common</u>

- *"I wouldn't say I've ever unintentionally done it. It's always been intentional…From my point of view I break the rule because there's no alternative, other than waiting"*
- *"As a pedestrian it wouldn't have been a mistake, it was intentional…Even a blind man would know that [when] the warning devices are activated the gates were closing. You'd have to be awful dumb to go through by mistake"*

2. <u>Errors still Occur</u>

- *"startled…that I'd missed the fact that there was the warnings going …lights flashing and they're dinging… that was probably what scared me more…Other than an 'Oh, sh_t' moment that could have been really nasty"*

Why Violate the Rules?

3. <u>Risk Taking Behaviour</u>

- *"I even know exactly what time these gates close, to the minute…if I can't see the train, I'll cross the line"*

- *"So the bells are ringing but the gates are still open, I know it's about to soon close but then I cross"*

4. <u>Running Late/Impatience/Bus Connections</u>

- *"Nick across, because generally you're in a hurry, mainly"*

- *"If I'm in a hurry and if I can see that it's safe, which obviously means if it is clear [as] you can see in both directions…"*

- *"long times between trains poor connection times for the next one where it results in 45, 50 minutes between… if you miss the next bus connection then it's a longer time for the next one"*

Why Violate the Rules?

5. Subjective Norm

- *"I can judge my own safety, I can see that there's no danger for me to cross so I'll use a bypass gate to go around the closed level crossing gate and cross the line. As do several other people every time I do it."*

- *"Whilst one shouldn't do things like that I've seen plenty of other people who flaunt it a lot more recklessly than what I ever did ."*

Deterrents

6. <u>Fines</u>

- *"I received a fine when I crossed the tracks and I never did it again after that"*
- *"Got caught, about three or four months ago and fined. I won't do it again, it cost me $220"*
- Similar to Study Two, most participants did not know they could be fined.

7. <u>Surveillance – Police and QR Staff</u>

- *"If there was a greater presence of police, that would be a great deterrent"*
- *"If there was police or if there were some traffic officers or train officers I wouldn't have done it.*

Deterrents

8. Surveillance – Cameras

- *"If there was actually a video camera there. That would definitely stop me from breaking the rules"*

- *"If there was more surveillance systems or staff around, both of those things would certainly be a deterrent…if there was a camera there and you knew that you were recorded… just if there was some more active surveillance…To me that's a deterrent"*

- *"Draconian measures, like cameras, or you know policeman standing there watching or anything like that. It's not worth saving 30 seconds"*

Deterrents

9. Barriers

- *"I guess the gate for me is the real physical barrier, and I guess symbolic barrier, that you definitely shouldn't cross. Whereas the lights and the bell are more of a softer barrier, if you know what I mean?"*

- *"Physical barriers would be a deterrent [but] not all level crossings have the physical barriers"*

- *"Barriers work – it's simple."*

Summary

- Origins - deliberate violations
- The issue of *time* is a common denominator
- Fines are a deterrent
- Surveillance is a deterrent
- Barriers believed to prohibit entry

Output: Publications

- Freeman, J., Rakotonirainy, A., McMaster, M., Stefanova, T (2013) Understanding pedestrian behaviour at railway level crossings: Is there a need for more research? *Road and Transport Research Journal*, *22*(3), pp. 29-39

- Freeman, J., McMaster, M., Rakotonirainy, A., Stefanova, T (under review). The origins of younger and older pedestrians' risky behaviours at train level crossings: a thematic analysis. *Safety Science*

- McMaster, M., Freeman, J., Kiata-Holland, E., Darvell, M., Daley, L., Spiryagina, M., Stefanova, T., Rakotonirainy, A. Final Report for Understanding Pedestrian Behaviour at Rail Level Crossings (R2.120). CRC.

Final Conclusions

1. Violations are mostly deliberate
    a) Calculated risks
    b) The young influenced by peer and age related factors
    c) Elderly make errors
2. 25% of the sample violated
3. Good knowledge of crossing rules
4. Half not aware they could be fined

Conclusions

5. Police and Transit Officers presence the greatest deterrent

6. Barriers, surveillance and education may also improve safety

7. The origins are multi-factorial and the solution is likely to be multi-method

8. In essence, people deliberately break the rules