























System approaches for understanding crash trends

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THE 'CASUALTY PIPELINE'







Post trauma outcomes

Two system methods:

Safe System crash anaysis Socio-technical system analysis



SAFE SYSTEM CRASH ANALYSIS

Comparing fatal and serious injury crashes – AA

Pedestrian Deaths and Serious injuries - Waka Kotahi and AT

RECKLESS BEHAVIOUR VS SYSTEM FAILURE

Proportion of fatal and serious crashes involving reckless behaviour



PEDESTRIAN DEATHS AND SERIOUS INJURIES

THE OWNER



METHOD

- Analysing crashes reported in Waka Kotahi Crash Analysis System (CAS)
- NZ pedestrian crashes 2013-2017: sample of 200 serious injury cases and 100 fatalities
- Auckland pedestrian crashes 2018: all 100 serious injury cases and 13 fatalities

METHOD - PILLAR TRIGGERS

SPEED ENVIRONMENT

- Vehicle speed >30 km/h
- Travel speed + posted
 speed limit > Safe and
 Appropriate Speed

VEHICLE



- No Warrant of Fitness
- SUV, ute, van, bus, truck
- Aggressivity Rating ≥
 20% than benchmark
- Extraordinary factors

ROADS AND ROADSIDES



- Infrastructure Risk Rating medium high or high
- Extraordinary roads and roadsides factors
- If relevant:
 - No street lighting
 - No footpath
 - No crossing facilities
 - No shoulder or very narrow
 - Obstructed view

USER (pedestrian)

- Age ≤12, ≥75
- Dark clothing at night
- Hit on road within 20m of a crossing
- Distraction evident
- Poor emotional state
- Running into road
- Medical condition directly contributing to the crash
- Lying on the road
- Clearly intoxicated

USER (driver)

- Age ≤16, ≥75
- Licence issues (i.e. forbidden, disqualified)
- Clearly intoxicated
- ≤10% posted speed limit
- Medical event directly contributing to the crash
- Hit and run
- Poor emotional state
- Ran red light
- Struck ped on footpath, berm, or ped priority
- Loss of control



FINDINGS

INVOLVEMENT OF SAFE SYSTEM PILLARS

Proportion of deaths and serious injuries involving multiple system pillars – *all data*



Serious (300 cases)
Fatal (113 cases)

INVOLVEMENT OF SAFE SYSTEM PILLARS

Proportion of deaths and serious injuries triggering each pillar – all data





VEHICLE SPEED - NZ



■ Serious (155 cases) ■ Fatal (81 cases)

Proportion of DSIs triggering speed pillar - NZ 2013-2017

Proportion of serious injury and fatal cases by vehicle type

Mini car Serious 17% Fatal 15% Medium sized sedan Serious 43% Fatal 29% Bicycle or motorbike Serious 5% Fatal 4%

VEHICLES



Trailer Serious 1% Fatal 0%

Unknown Serious 3% Fatal 1%

ROADS AND ROADSIDES

Recurring themes from this research where Roads and Roadsides failed to provide an enabling and/or forgiving environment for pedestrians













DRIVERS + PEDESTRIANS

DRIVERS - NZ

Driver Pillar Triggers

- ≥10% posted speed limit
- Evidence of distraction/inattention
 - Emotional state
 - Loss of control
 - Ran red light
 - Hit and run
- Failed to give way at ped priority...
 - Clearly intoxicated
 - Age $\leq 16 \text{ or } \geq 75$
 - Licence trigger
 - Struck ped on footpath or berm
 - Medical event

Proportion of deaths and serious injuries triggering each factor – NZ 2013-2017



- ≥10% posted speed limit Evidence of distraction/inattention Driver P llar Triggers Failed to give way at ped priority... Clearly intoxicated

 - Struck ped on footpath or berm



DRIVERS - AUCKLAND

Proportion of deaths and serious injuries triggering each factor – Auckland 2018

CRASH TYPOLOGIES

NZ 2013-2017

Crossing the road mid-block with no crossing facilities	76 cases, 25.3%	Crossing the road mid-block with no crossing facilities	39 cases, 34.5%
Hit on pedestrian priority crossing	38 cases, 12.6%	Hit on pedestrian priority crossing	8 cases, 7.1%
Children under 12 playing, hit on road	32 cases, 10.6%	Children under 12 playing, hit on road	4 cases, 3.5%
Reversing vehicle	27 cases, 9%	Reversing vehicle	6 cases, 5.3%
Hit and run	$10 \cos 3.3\%$	Hit and run	$8 \cos 7.1\%$
	IU Cases, 5.570		0 Cases, 7.170
Pedestrian lying on the road	10 cases, 3.3%	Pedestrian lying on the road	3 cases, 2.7%
Other	107 cases, 35.7%	Other	45 cases, 39.8%

Auckland 2018

SUMMARY OF COMMON CRASH FACTORS





Large mass/shape vehicles



Driver distraction/ inattention



Pedestrian distraction/ inattention

SUMMARY OF COMMON CRASH FACTORS





Large mass/shape vehicles



Male drivers





Pedestrian distraction/ inattention



CRASH PRE-CONDITIONS



From contracts to crashes...Looking 'upstream'



Audio tact Contract p No provisi Audio tact Early more

- Audio tactile edge-lines
- Contract price 23% less than engineers estimate
- No provisions for reinstatement following reseals
- Audio tactile not reinstated following re-seal
- Early morning run-off road fatality

SOCIO-TECHNICAL CRASH ANALYSIS

SOCIETAL CULTURE AND VALUES

GOVERNMENT POLICY

PRACTICES AND STANDARDS

ENVIRONMENTAL CONTEXT

ROAD USERS



Vehicle risks in supply chains Cycling fatalities Pedestrian Deaths and Serious injuries

SWISS CHEESE



James Reason

Socio-technical approaches

Rasmussan's model of socio-technical complex systems (Rasmussan 1997) and associated Accimaps method



(Source: Salmon et al. 2012)

= Failures, decision, actions etc

Pedestrian fatally injured at crossing in urban environment





Conclusions

- crashes
- Socio-technical analyses
- Solutions can be mapped in response to system analyses

• Safe System crash analyses have deepened our understanding of

 Socio-technical system analyses give context or crash pre-conditions We need better data and agreed procedures for Safe System and