# Research to improve the accuracy of economic evaluations in road safety

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## Overview of presentation

- Background to research
- Crash reduction benefit from various safety treatments
- Cumulative effect of using more than one treatment at a location
- Investigation of treatment life
- Provision of information on treatment costs
- Discussion

## Background to project

- Austroads research program on road safety engineering risk assessment
- Six years of research
- 2007/08 final year



## Background to research

- Crash rates
- Data management systems
- Integration of safety and asset data
- Crash reduction factors
- Road design and safety
- Crash costs
- Maintenance and safety
- Crash risk migration
- Rural safety
- Multiple countermeasures
- Treatment life and cost
- Automatic data capture
- Unsealed roads
- Safety database design
- Mass action programs

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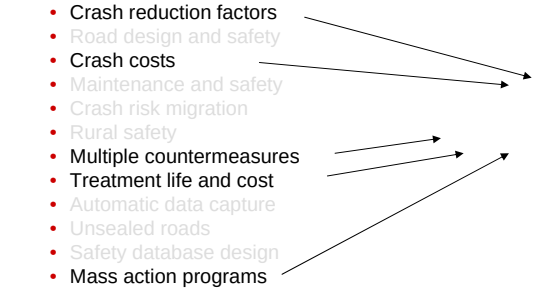


Economic evaluation of safety schemes



# Crash reduction benefit from safety treatments

- Topics covered to date:

| | |
|---|---|
| Accesses | Pavement markings - centreline |
| Clear zones | Pavement markings - edgeline |
| Delineation - RRPMs | Pavement markings - words and symbols |
| Grade separation | Pedestrian/cyclist treatments |
| Guide posts | Railway crossing improvements |
| Intersection - advanced warning | Road surface improvements |
| Intersection - left turn lane | Roundabouts |
| Intersection - linked signals | Safety barriers |
| Intersection - red light camera | Sight distance improvements |
| Intersection - right turn phase | Signs - advisory |
| Intersection - right turn lane | Signs - regulatory |
| Intersection - right turn lane (extend length) | Street lighting |
| Intersection - signal visibility | Speed change (in limit and change in mean speed) |
| Intersection - signal timing | Staggered junctions |
| Intersection - splitter and median islands | Superelevation |
| Line marking - profile edge line | Traffic calming |
| Median crossovers | Traffic signals |
| Median retrofit | Widen or seal shoulders |
| Midblock turning provision | Work zones |
| Overtaking lanes | |

# Crash reduction benefit from safety treatments

| Treatment type | % Reduction |
|---|---|
| Splitter island | 40% |
| Right turn lane | 35% |
| Rural | 35% |
| Urban | 30% |
| Overtaking lane | 20% |
| Street lighting | 35% (night only) |
| Curve warning sign | 25% |



# Crash reduction benefit from safety treatments

| Treatment type | % Reduction | Confidence |
|---|---|---|
| Splitter island | 40% | Low |
| Right turn lane | 35% | Medium |
| Rural | 35% | Low |
| Urban | 30% | Low |
| Overtaking lane | 20% | Medium |
| Street lighting | 35% (night only) | Medium |
| Curve warning sign | 25% | Low |

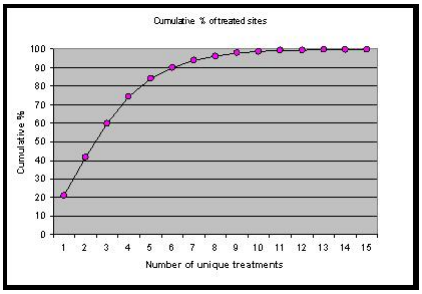
## Crash reduction benefit from safety treatments

- Over 90 crash reduction factors produced
- Weak or inadequate methodology identified in much of the research
- High levels of confidence in 7% of crash reduction factors
- 43% have medium level of confidence
- 50% have low level of confidence.



## Multiple countermeasures

- 80% of crash locations use multiple treatments (based on NZ data)
- Limited guidance on how to estimate the cumulative benefit of using more than one treatment
- Literature review
- Data analysis using NZ data




## Multiple countermeasures

- Most common method:

e.g. Assume a site where 3 treatments are proposed:
  - Treatment 1 = 40% crash reduction
  - Treatment 2 = 25%
  - Treatment 3 = 20%
  - Assume 100 crashes before

Treatment 1: 100 crashes x 40% reduction = 60 crashes after
Treatment 2: 60 crashes x 25% = 45 crashes after
Treatment 3: 45 crashes x 20% = 36 crashes after

100 crashes before, and 36 crashes after = 64% reduction in crashes
An additive approach would have an 85% reduction

This approach has not been validated in previous research



## Multiple countermeasures

- This study - data analysis of common individual treatments, and combinations of these same treatments
- Compared results of the analysis against commonly used methods
- Results - methods over-estimate benefit
- Recommend multiplying the result by 0.66

## Multiple countermeasures

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- **64% x 0.66 = 42% reduction**



## Multiple countermeasures

- Error when identifying benefit of individual treatments
- Error when trying to estimate overall benefit of combined treatments
- Research recommended on identifying crash reduction benefit on the most common ‘packages’ of treatments
- Need to address this issue, as accuracy of economic evaluation is currently reduced.

# Treatment life

- Definition: “the length of time that the treatment is expected to remain in place, and be of a sufficient standard to continue providing a safety benefit”.
- Forms a component of economic evaluation
- Little guidance in Australasia
- Inconsistent information
- Project to assess available information and provide advice
  - literature review
  - survey of safety experts
  - survey of asset managers.



# Treatment life

Survey of safety experts

| Treatment | Treatment life (years) | | | | | | |
|---|---|---|---|---|---|---|---|
| | NSW | VIC | QLD | WA | SA | TAS | Rounded mean |
| Roundabout | 20 | 20 | 15 | 10 | 20 | 20 | 20 |
| Median island at intersection | | | 15 | 5 | 15 | 20 | 15 |
| Sealed shoulder | 20 | 20 | 10 | 10 | 20 | 20 | 15 |
| Overtaking/climbing lanes | 20 | 20 | 15 | 10 | | 20 | 15 |
| New signing | 10 | | 5 | 5 | | 10 | 10 |
| RRPMs | 5 | 5 | | 5 | 5 | | 5 |
| Edgelines - rural road | 5 | | 5 | 5 | 5 | | 5 |

**Possible maximum treatment life (years)**

| Treatment type | Safety survey | Literature review | Asset survey | Possible Maximum |
|---|---|---|---|---|
| Grade separation | 20 | n/a | 45 | 50 |
| Realign curve | 20 | n/a | 35 | 35 |
| Stagger or realign intersection | 20 | n/a | 35 | 35 |
| Roundabout | 20 | n/a | 30 | 30 |
| Median barrier | 15 | n/a | 30 | 30 |
| Shoulder sealing or widening | 20 | n/a | 25 | 25 |
| Add or widen lane (including over taking lane) | 20 | n/a | 25 | 25 |
| Provide acceptable superelevation | 15 | n/a | 25 | 25 |
| Railway level crossing barriers | 15 | n/a | 20 | 20 |
| Median island (or other island) | 15 | n/a | 25 | 20 |
| Guardrail (roadside) | 15 | n/a | 20 | 20 |
| Street lighting | 15 | n/a | 35 | 20 |
| Remove roadside hazard (trees, pylons, etc.) | 20 | n/a | 15 | 20 |
| New traffic signals (hardware and/or software) | 15 | n/a | 20 | 15 |
| Improve sight distance by removing impediment on main road | 15 | n/a | 10 | 10 |
| Edge marker posts (guideposts) | 10 | n/a | 10 | 10 |
| Skid resistant surface | 5 | n/a | 10 | 10 |
| Signs (advisory, warning, parking, speed limit, etc.) | 10 | 1-20 years, but generally 10 years or less | 15 | 10 |
| Linemarking (paint and thermoplastic) | 5 | 1-5 years | 5 | 3 and 5 |
| Raised reflectorised pavement markers | 5 | 1.5-5 years | 10 | 5 |



# Treatment life

- Maximum value only
- Little reliable research on this topic
- There is a need to collect data on this
- Adoption of new figures has implications for funding
  - Generally BCRs will be higher
  - Some projects will have a higher benefit in relation to others if these figures are adopted

## Treatment cost

- Also forms a component of BCR
- Little guidance on this issue – obviously differs by situation
- Survey of jurisdictions
  - only two jurisdictions provide advice
- Analysis based on NZ data
  - range of costs
  - when errors occur



## Treatment cost

- Average cost error quite low (NZ$4,000)
- Some estimates high, some low – masked individual cost errors
- A third of sites underestimated costs (by average of $20,000, or a doubling of costs)
- Two thirds of sites overestimated costs ($20,000, or a third of actual value)
- Most commonly used treatments associated with overestimates
- Uncommon treatments associated with underestimates

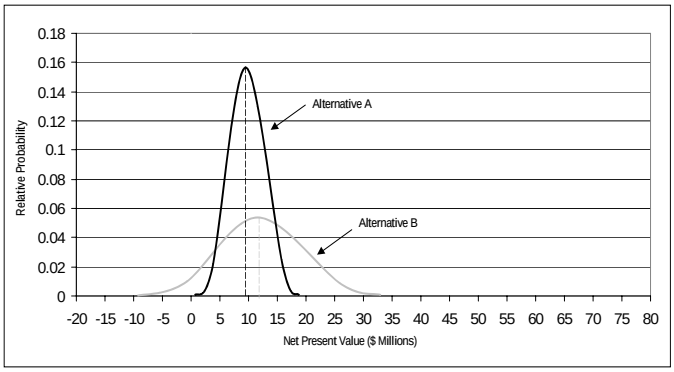
## Discussion

- Many points at which error can occur
- Economic evaluation not as accurate as it appears on the surface
- Not previously a problem, as previously high returns
- More care needs to be taken in future – diminishing benefits
- Use of sensitivity testing
- Use of distributions



## BCR – use of ‘distributions’

- Alternative A has a lower BCR than B, but more certainty
- For some projects, A may be a better option, as in some circumstances, B may provide a negative BCR



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