



**Land Transport NZ**  
Ikiiki Whenua Aotearoa

## Approaches to pedestrian and cyclist safety in New Zealand

- Increasing use and reducing injury

Tim Hughes

# *Overview*

- Topics:
  - Strategy & Policies
  - Role of Walking and Cycling
  - Oxymoron? - Walking and Cycling Safety
  - Pedestrian issues & initiatives
  - Cycling issues & initiatives

# *Policy context*

- Promoting walking and cycling is government policy
- New Zealand Transport Strategy
- Getting there on foot by cycle
- Road safety to 2010 strategy
- Walking and Cycling Strategic Plans
- Funding from Land Transport Fund
- Part of every project

## Five key objectives:

- assisting economic development
- assisting safety and personal security
- improving access and mobility
- protecting and promoting public health
- ensuring environmental sustainability

## Vision:

- A NZ where people for all sectors of the community walk and cycle for transport & enjoyment.

## Goals:

- Community environments and transport systems that support walking and cycling
- More people choosing to walk and cycle more often
- Improved safety for pedestrians and cyclists

## Focus areas:

- Strengthening foundations for effective action
- Providing supportive environments and systems
- Influencing individual travel choices
- Improving safety and security.

Walking and cycling contribute towards economic, access and mobility, public health and environmental objectives. Public health benefits are substantial:

- up to 2600 die prematurely each year related to inactivity
- 10% increase in activity could save \$55 million direct costs, up to 600 fewer inactivity related deaths
- 241-566 people die prematurely each year from vehicle related emissions exposure

# *Size of Road Safety Problem*

Relatively small but important part of the overall road safety picture:

- pedestrians: 11% of fatalities and 8% of reported injuries
- cyclists: 3% of fatalities and 5% of reported injuries
- approx 14% of all vehicle related hospitalisations
- approx \$350m per annum in social cost
- 1 in 3 fatalities in urban areas are pedestrians or cyclists
- Two fifths of pedestrian hospital admissions are for falls in the road related environment



## Strategy aims to:

- increase walking and cycling
- reduce walking and cycling casualties

## Is this possible?

- Will more walking and cycling mean more casualties?
- Perceptions about safety of walking and cycling are important to the promotion of walking and cycling
  - - no scare tactics – e.g. cycle helmet campaign
- Improving safety provides a key to all the NZTS objectives

# *Are pedestrians and cyclists at greater risk?*

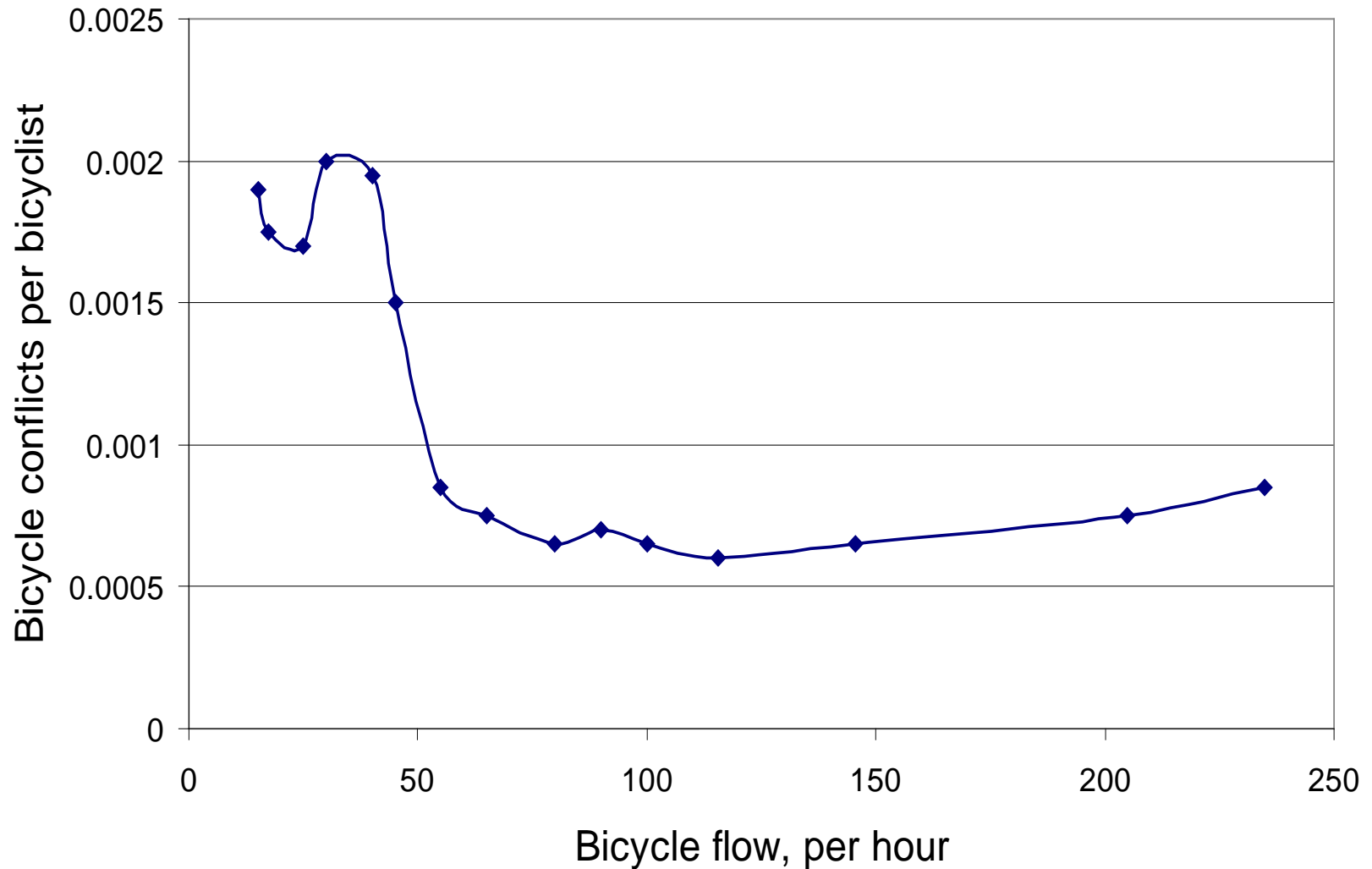
- over time measures of risk are decreasing
- risk varies with location, age group and risk measure
- risk of death from collision with a motor vehicle is similar for walking and cycling
- risk of lesser injury is higher for cycling than walking
- In urban areas, pedestrians and cyclists are at higher individual risk than as drivers or passengers of cars
- young drivers (15-19 years) tend to have higher levels of risk than other modes
- perceptions of risk and safety are important

## *Does greater individual risk mean more deaths?*

### The “Safety in Numbers” effect:

- The more pedestrians and cyclists present, the lower the risk for each pedestrian and cyclist
- Reasons? Behavioural adjustments by road users
  - power relationship: 100% increase in walking/cycling, 32% increase in casualties (Jacobsen, 2003)
  - NZ data (Turner) suggests the effect may be even more powerful at low pedestrian and cyclist numbers (up to one per minute)
  - The effect is observed on individual roads and intersections, between different towns in New Zealand and between countries

# Example of Effect – Ekman (1996)



## *Does greater individual risk mean more deaths?*

- Changes in individual risk don't always affect the total in the way expected
- The vehicle size and weight paradox:
  - The heavier the vehicle you drive the less likely that you will be seriously injured in a collision with another road user, but the more damage you do to the other party. E.g. suburban 4wd
- Pedestrians and cyclists are at the extreme end of this and rarely injure anyone else

## *Does greater individual risk mean more deaths?*

- Every person who chooses to walk or cycle for a trip:
  - Makes it safer for everyone else who walks or cycles simply by being on the route.
- If the trip is a mode substitution for a car trip:
  - removes the risk imposed by that car trip to all other road users
  - If their presence has slowed and tamed traffic: they may have reduced the risk to all road users.
- But they have still increased their own risk.

# *What is the effect on the road toll?*

- The safety in numbers effect is really useful, but is not sufficient on its own to stop the road toll rising at all.
- If use doubles there is still a safety gap of 10% – 30%, which must be bridged if the target of no road toll increase is met.
- If cycling and walking numbers are increased by marketing and promotion measures alone, this gap remains. New users may be less competent and less safe – hence user skills important.
- International success stories have been led by safer and better infrastructure.

# **Pedestrian issues & initiatives**



# *The design pedestrian?*

- Capable adults
- Children
- Elderly
- On small recreational wheels
- Mobility impaired;
  - sticks, wheelchairs, frames, scooters
- Vision and hearing impaired

# *Children as Pedestrian Road Users*

1. Up to age 2 children are not fit to cope with traffic in any way.
2. Between 2 and 7 years children are thinking but of the immediate task in hand – one point at a time. Vision is not fully developed.
3. Between 7 and 11 years children are capable of abstract thought. They reason about events not actually present but need experience to relate them to the task in hand. Vision fully developed by age 16.
4. Children 12 years and over have reached the stage of formal operations – have adult grasp of the principals of logical thought. They are not ready to participate at adult level.

- Cloudy/washed out vision.
- Inability to perceive details of objects under differing levels of contrast.
- Ageing result in a shrinkage in the effective field of view.
- Older drivers with 60 to 90% shrinkage in their useful field of view are 6 times more likely to have been involved in one or more crashes.
- Older adults take longer to identify relevant visual cues.
- Resistance to glare is 2.5 times greater at age 20 than at age 65.
- Over age 65 there is a higher proportion of vision and hearing impaired people.

# *Pedestrian crash types*

## **Basic types of pedestrian injury causes**

### Falls:

Falls in the road environment, cause similar hospital costs to being hit by motor vehicles

### Crossing mid-block:

hit on near side (from right): inattention

hit on far side (from left): misjudgement

### Crossing at intersections:

same as mid-block plus hit by turning traffic

turning right (mostly) or left

main type at traffic signals

### Driveways (mostly reversing vehicles)

# *Pedestrian Crash Principles*

## **Exposure to risk**

An increase in the number of pedestrians crossing the road makes it safer for each pedestrian.

An increase in the volume of traffic travelling down a road increases the risk to each pedestrian.

80% or more are on arterial and collector roads

It is the young elderly and impaired who are at greatest risk and their exposure is the most important when considering risk.

The shorter the distance to cross the less time a pedestrian is exposed to risk, and the easier it is for a pedestrian to judge a safe crossing time.

# *Pedestrian Crash Principles*

## **Speed**

Speed is critical for three reasons:

The faster the traffic the harder for the most vulnerable pedestrians to judge a safe crossing time.

The faster the traffic the further it takes for a driver to react and brake to a stop.

The faster the impact speed the more severe the injuries.

# Old NZ Warrants approach for priority pedestrian facilities

## Pedestrian Operated Signals:

- Pedestrians x vehicles > 200,000 (1 hr)
- Vehicle flow > 500 (1 hr)
- Pedestrian flow should be > 200 (1 hr)

## Zebra Pedestrian Crossings:

- Pedestrians x vehicles > 45,000 (1 hr)
- Vehicle flow > 300 (1 hr)
- Pedestrian flow should be > 100 (1 hr)

## School Patrol Zebra Crossing Points:

- Pedestrians x vehicles > 5,000 (1/2 hr)
- Vehicle flow > 100 (1/2 hr)
- Pedestrian flow should be > 50 (1/2 hr)

## School Patrol (Kea) Crossing Points:

- Pedestrians x vehicles > 3,000 (1/2 hr)
- Vehicle flow should be > 100 (1/2 hr)
- Pedestrian flow should be > 50 (1/2 hr)

# *Providing for pedestrians crossing roads*

## **Hierarchy of Pedestrian Solutions First Consider in this order:**

- **Reduce traffic volume**
- **Reduce traffic speed**
- **Reallocate road space (road diet?)**
- **At grade crossing facilities**
- **Grade separation**



# *Providing for pedestrians crossing roads*

## **Consider in this order:**

- **Road environment and land use context**
- **Physical aids to crossing**
- **Appropriate control**
- **Design Detail**

## **Road environment and land use context**

- **Traffic volume and composition**
  - Gaps in traffic, space needed
- **Speed of traffic**
  - Speed management / traffic calming needed,
  - Platform appropriate?
- **How many traffic lanes in each direction?**
  - What controls are possible?
- **Road surrounds: CBD, commercial, residential**
  - What will users expect here?
- **Where do they cross and to where?**
  - One place? Spread out? In a hurry?
- **Who wants to cross, how many?**
  - Age, walking purpose, school, impaired, suppressed?
- **What type of facilities are appropriate here?**

## **Road User Hierarchy**

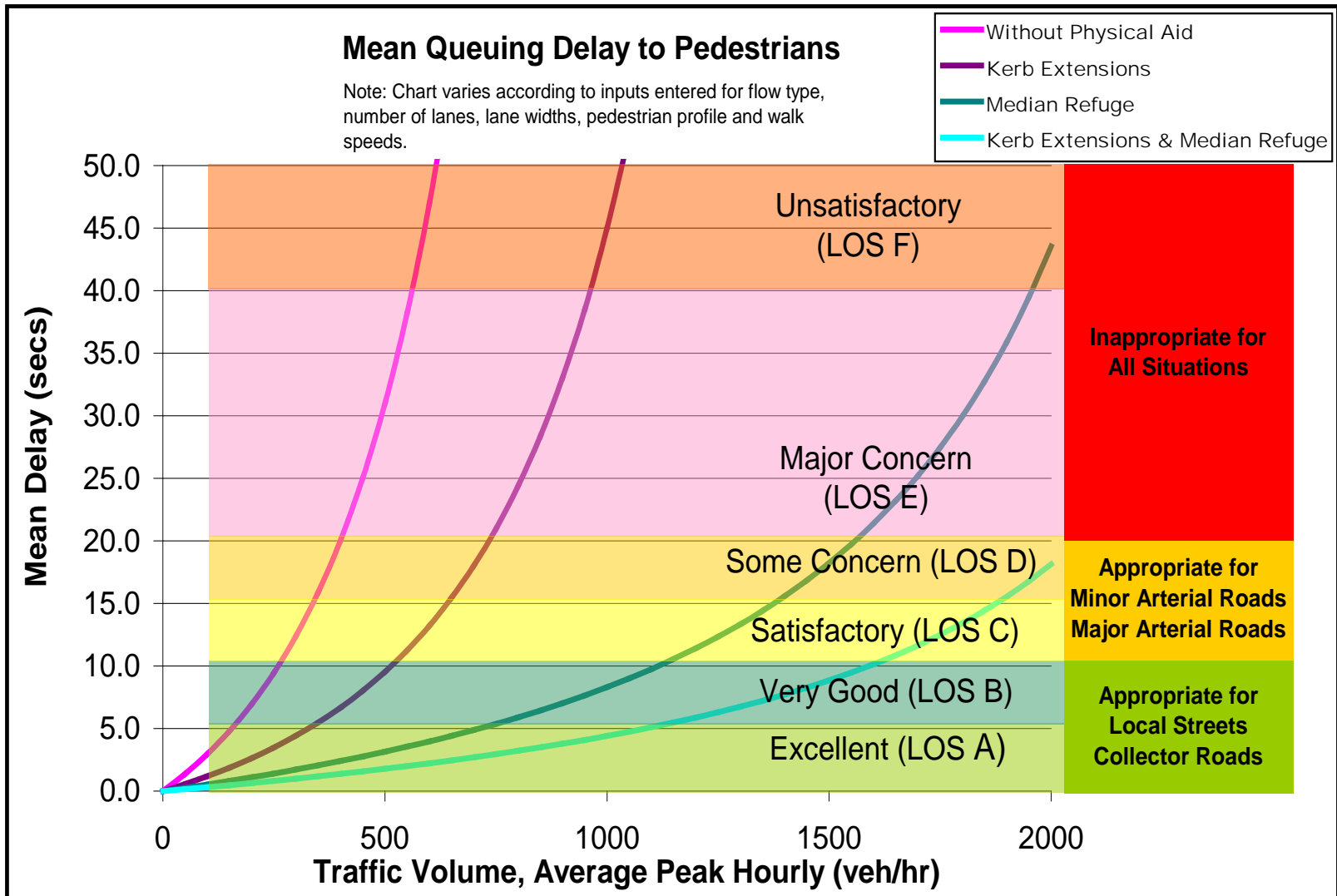
- **Mobility impaired, and wheeled pedestrians**
- **Able Pedestrians**
- **Cyclists / recreational pedestrians**
- **Public transport users**
- **Commercial/business users  
(including delivery vehicles)**
- **Car-borne shoppers**
- **Car-borne visitors**
- **Car-borne commuters**

## **Maximise visibility**

- **Minimise crossing distance**
- **Keep at right angles to kerb**
  - **Narrow roadway by kerb protrusions**
    - **Average pedestrian delay below 15 seconds up to 300 vehicles per hour each way (600 2 way)**
    - **Safety benefit 36% crash reduction**
- **Divide crossing into two parts**
  - **Central raised islands**
    - **Average pedestrian delay below 15 seconds up to 900 vehicles per hour each way or (1800 two way)**
    - **Crash reduction 18%**
    - **Delay reduction - awesome !!!**

# Physical crossing aids

## – uninterrupted flow



## Zebra Crossings

- Never use across two lanes of traffic in the same direction.
- Extra vehicle delay is usually greater than reduced pedestrian delay. (assuming road is first narrowed as accords with best practice)
- There are no safety reductions from zebra installation, often the converse.
- So, consider only where pedestrian delay is unacceptably high, physical aids are provided but not sufficient and vehicle delay less important than pedestrian delay (user hierarchy).

# Traffic Signals

- Traffic Signals are the only at grade control option on multi-lane roads.
- Because they usually involve a sub-standard level of service to both pedestrians and traffic, always compare the level of service with a central raised island.
- They are an effective safety measure when used: however badly compromised by the lower safety of people who won't wait and cross near by.
- Carefully consider options for reducing pedestrian delay to increase compliance.

**(Article on Leeds in TE&C)**

# *Typical safety benefits*

<b>Measure</b>	<b>reduction</b>	
	<b>pedestrians</b>	<b>overall</b>
<b>Kerb extensions</b>	<b>0.36</b>	
<b>Raised Median Island</b>	<b>0.18</b>	
<b>Kerb ext + Island</b>	<b>0.32</b>	
<b>Kerb ext at existing zebra</b>	<b>0.44</b>	
<b>Zebra plus Platform</b>	<b>0.88</b>	
<b>Midblock traffic signals</b>	<b>0.64</b>	<b>0.35</b>
<b>Zebra only</b>	<b>- 0.28</b>	<b>- 0.26</b>
<b>School patrols</b>	<b>0.35</b>	



# *Typical safety benefits*

<b>Measure</b>	<b>reduction pedestrians</b>	<b>overall</b>
<b>Intersection signals - parallel phase</b>	<b>-</b>	<b>-</b>
<b>Intersection signals – exclusive phase</b>	<b>0.29</b>	<b>0.22</b>
<b>Cycle lanes</b>	<b>0.30</b>	<b>0.30</b>
<b>Roundabouts</b>	<b>0.48</b>	<b>0.35</b>
<b>Flush medians</b>	<b>0.30</b>	<b>0.19</b>

# Cycling issues & initiatives

## Cyclist Skill levels

- Child Novice
  - Prefer quiet streets, off-road paths.
- Basic Competence
  - Most straightforward single lane urban situations OK.
  - Not fast or very busy traffic
  - Not multi-lane roundabouts and roads,
  - won't defend a narrow lane
- Experienced
  - Vehicular cyclists – mix it with laned traffic
  - Defend a narrow lane
  - Struggle with larger multi-lane roundabouts

## School cycle training

- On-road important –
- NZ best practice follows Bike Ed
- Bike Ed- about 40% on – road
- On-road part often missed out
- NZ has just reviewed
- Recommending UK approach – 70% on road
- Need outside expert trainers

People feel vulnerable on a bike.

- Based in part on actual risk.
- Fear of matters outside cyclists' control
  - unpredictable driver behaviour
  - road surface condition
- Affects whether to ride - hazards on route.
- Affects how cyclists ride
  - (fear of hit from behind).

- Cyclist falls off
  - 40% of adult injury
  - Over 80% of child injury
  - Less severe
- Engineering issues
  - Surface: debris, slippery, drains, kerbs, tramlines, potholes, roadworks.

## Most at intersections (& driveways)

- **Driver fails to give way**
  - Most common crash
  - Low severity: slow speed of motor vehicle
- Engineering issues
  - Markings that position cyclists where seen.
- **Cyclist fails to give way**
  - Less common crash
  - Severe: high speed of motor vehicle
- Engineering issues
  - Slow traffic speed
  - Reduce conflict area

## Same direction one turns

- **Driver turns left**
  - Severe if Heavy Vehicle
- Engineering issues
  - Markings: Cyclists to right of left turn lane
  - Truck mirrors and skirts
- **Cyclist turns or merges right**
  - Severe: depending on relative speed.
- Engineering issues
  - Markings encourage early merge across
  - Hook turns
  - Slow traffic speed



## Same direction

- **Driver crowds while overtaking**
  - Severe if Heavy Vehicle
- Engineering issues:
  - Make space or calm traffic and share space
- **Cyclist hit from behind**
  - Rare in lit urban areas
- Driver opens car door
  - Severe if run over by following vehicle:
- Engineering issues
  - Markings to cycle further right
- **Cyclist hits parked car**
  - Markings to cycle further right

- Half of all cycle deaths are on rural roads
- Yet only a small proportion of cycling
- Rural crashes are nearly always severe
  - **Hit from behind / crowded** - one third
  - **Cyclist veers right into path of following motor vehicles** - one quarter
  - **Cyclist fails to give way crossing from side road or driveway** - one tenth but most rural child deaths
  - **Cyclist into rear of stopped vehicle**
- Engineering issues: room, room, room
  - Separated path is best – where cycle numbers warrant.
  - Wide shoulders: (few fatalities on state highways)
  - Pinch points: e.g. bridges, narrow stretches in difficult terrain.

Consider in this order:

- Reduce traffic volumes
- Reduce traffic speeds
- Address intersections
- Re-allocate road space
- On-road cycle lanes/ off-road paths

If you have enough room:

- Put cyclists where they are safest
  - just left of through traffic
  - sufficient clearance to parked cars
- Mark cycle lanes there.
- Exclusive turn lanes at busy intersections
- Cycle lanes between through and turn lanes
  - usually the best option for motor vehicles too

# *Managing road space*

## Options when there is insufficient room

- Recognise cycle convenience is compromised and cyclists will be deterred.
- Try your hardest to get more room.
- Don't mark cycle lanes if they don't fit.
- Can you remove parking, vehicle lanes etc. ?
- Compromise, provide for main movements only.

## Sharing the space.

- Unconfident cyclists will be deterred.
- Traffic speeds must be lower.
  - Roundabouts
  - Short lanes at intersections.
- Longer shared lanes,  
not working, how should we mark them?
- Culture of sharing the road

## Heavy Vehicles.

- Driver vision
- Side protection

## All Motor Vehicles

- No leg breaking protrusions (Bull Bars)
- Soft surfaces.

## *Strategies should ensure*

- We define and adopt best practice for:
  - Engineering design and maintenance
  - Planning of facilities
  - Education of cyclists and drivers
  - Vehicle design
  - Road rules
  - A culture of sharing the road



# *Competence & Confidence*

- Realistic perception of risk (currently unreal).
- Care is needed, false confidence is unsafe.
- Improving Riding skills
- Improve general cycling environment
- Remove hazards
  - intersections
  - squeeze points
  - crossing fast and busy roads.

# *New Guidance documents*

- *Austrroads guide part 13: Pedestrians*
- *Mobility and vision impaired pedestrians*
- *Pedestrian planning and design guide*
- *Austrroads guide part 14 Bicycles*
  - *NZ Supplement*
- *Cycle network and route planning guide*
- *Non motorised user audit and review*
- *Local authority benchmarking*
- *Walking and cycling friendly ratings*

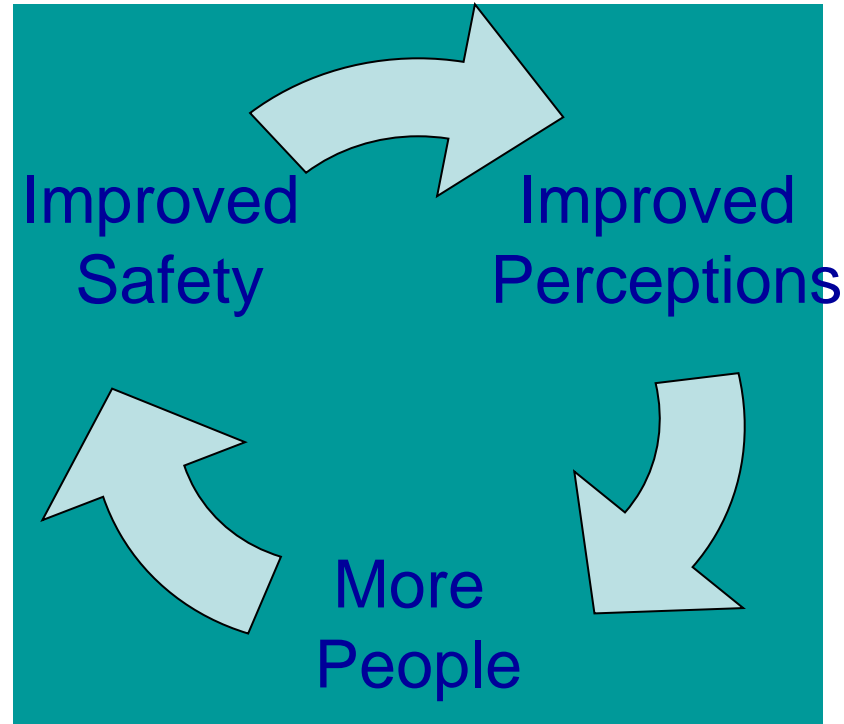
# Addressing Safety

Pedestrian and Cycling safety can be improved by:

- addressing vehicle speeds especially in urban areas
- investing in safe infrastructure
  - road crossings (esp arterials/collectors)
  - intersections/junctions and driveways
- education and training of users
- vehicle design – including heavy vehicles
- increasing the numbers (flow) of pedestrians and cyclists (i.e. “Safety in Numbers effect”)

# Conclusions

Safety is essential to promotion



- We can achieve more walking and cycling and reduce the road toll if we do it the right way.

# What Speed Limits Should We Set?

