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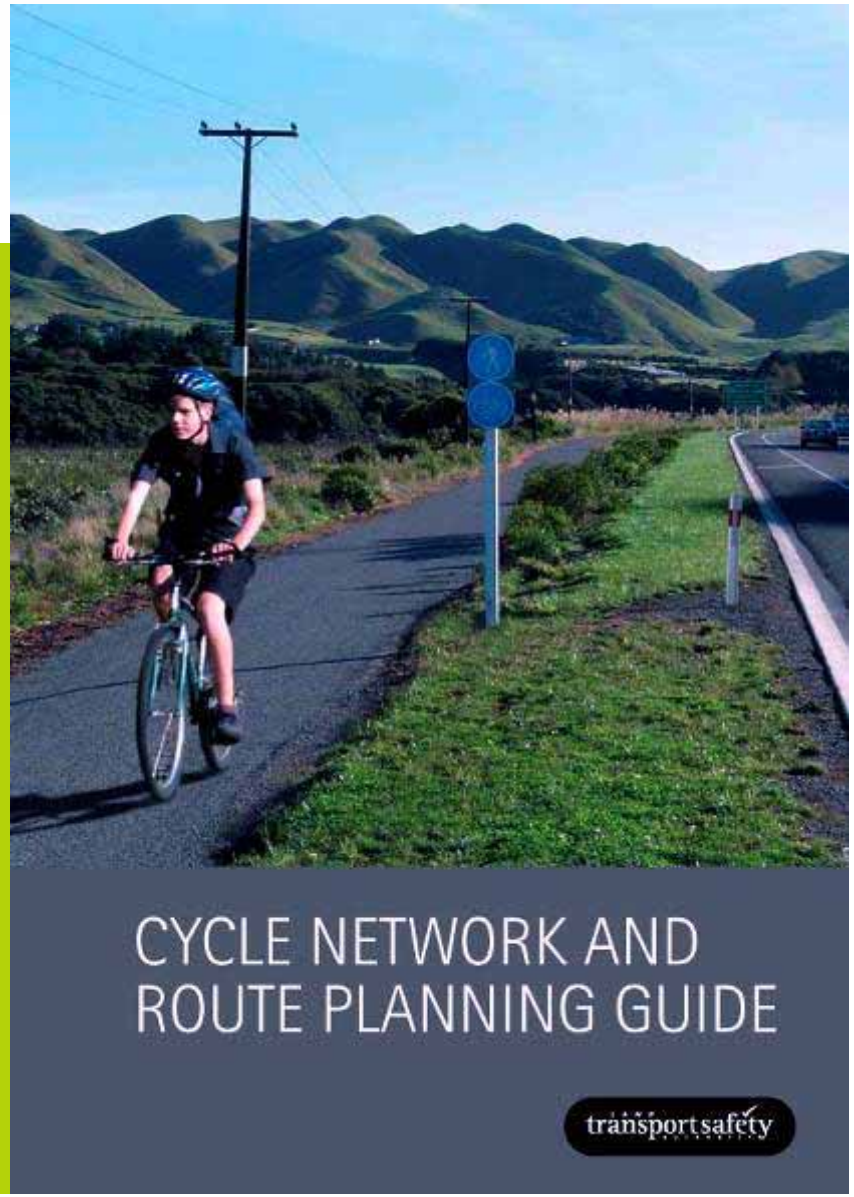
Value for Money; Level of Service tools for assessing the cycling environment

Tim Hughes



Outline of presentation

What is Level of Service?

Cycle Network and Route Planning process

Use of cycling LOS in other tools

- Strategy
- Review
- Prioritising
- Benchmarking

Cycling LOS

- Past research
- Discussion
- Current research project

Bicycling -- Levels of Quality

	A	B	C	D	E	F
	Exemplary	Excellent	Good	Fair	Poor	Hall of Shame
Wide Curb Lanes	Wide curb lanes increase comfort between motorists and bicyclists. Motorists desire to separate themselves 6.0 feet from bicyclists. Wide curb lanes give buses more space, and allow greater turning radii. Low speeds create greater comfort.						
Bike Lanes	Bike lanes define and identify bicycling locations. Widths up to 6.0 feet are most comfortable. Colorization can help. Narrow widths next to parking are least comfortable. Speeds between 25-35 mph are most comfortable.						
Paved Shoulders	Paved shoulders that are smooth and wide are most comfortable. Surfaces should be clean and smooth, with few driveways and other interruptions. Narrow shoulders can help, but are less comfortable.						
Multi-Use Trails	Multi-use trails work well in paralleling high speed roads in access controlled environments. Trails can offer more scenic, quiet, and direct routes of travel. Widths can vary, but must be designed to accommodate many users and user types.						
Crossings	Crossings with low volume streets, where there are frequent gaps, good sight distances, good lighting, and medians or refuge islands are best. In some cases signals are essential or other controls are essential.						

Cycle Network Planning Process:

- *Cycle Strategy; vision & objectives* — *Target LOS*
- *Assess cycle demand: (how many? Where?)* — *DEMAND*
- *Identify existing and potential cycle routes* — *LOS*
- *Evaluate options (How good are they?)* — *REVIEW, LOS*
- *Develop Cycle Network plan*
- *Prioritise route development* — *DEMAND, LOS*
- *Implement* — *AUDIT*
- *Monitor* — *Outcome BENCHMARKING*

- *Overall Policy and Process* — *Policy audit BENCHMARKING*

Components

Mid-block

- Kerbside cycle lanes
- Cycle lanes next to parking
- Contra-flow cycle lanes
- Wide kerbside lanes
- Sealed shoulders
- Bus lanes
- Transit lanes
- Mixed traffic

Paths

- Exclusive
- Shared
- Separated
- Beside roadway
- Unpaved

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Components

Intersections

- More important than mid-block
- Greatest challenges and greatest opportunities.
- Least studied and understood

Develop & assess route options

- *How friendly is the current provision?*
- *How will cyclists perceive improvements?*
- *Who would use it?*
- *How good does it need to be?*
- *How do my options compare?*
- *Tools for assessing*
  - *cycle friendliness*
  - *bicycle LOS / LOQ*
  - *bikeability / cyclability*

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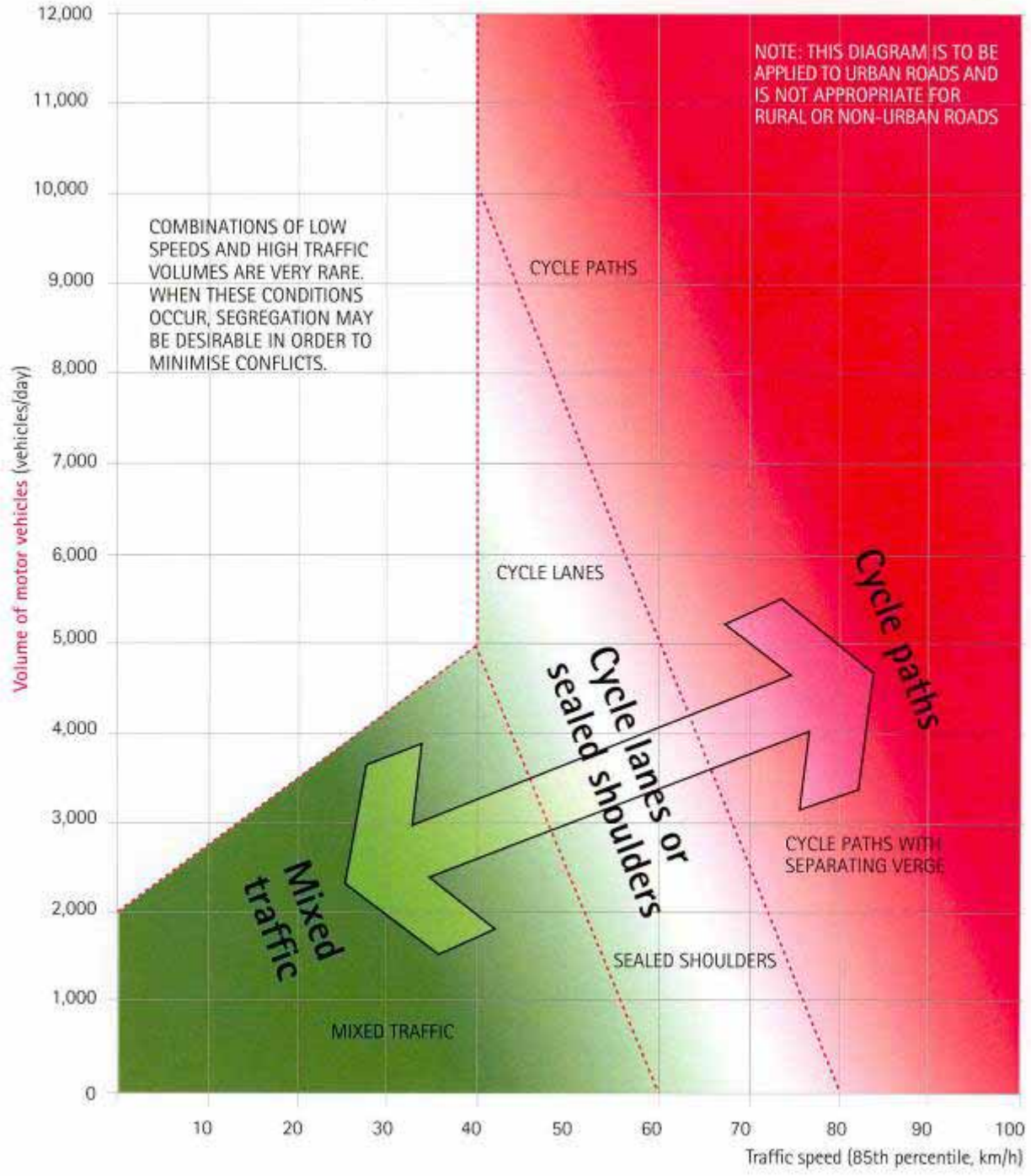
Facility selection based on LOS B (moderately satisfied) ? or LOS C (a little satisfied?)



Cycle Review

Cycle Review:

- *analyses deficiencies in order to develop and evaluate potential solutions*
- *It is a systematic process to ensure the full range of options are considered*
- *The result is well considered project brief for design of the favoured option*

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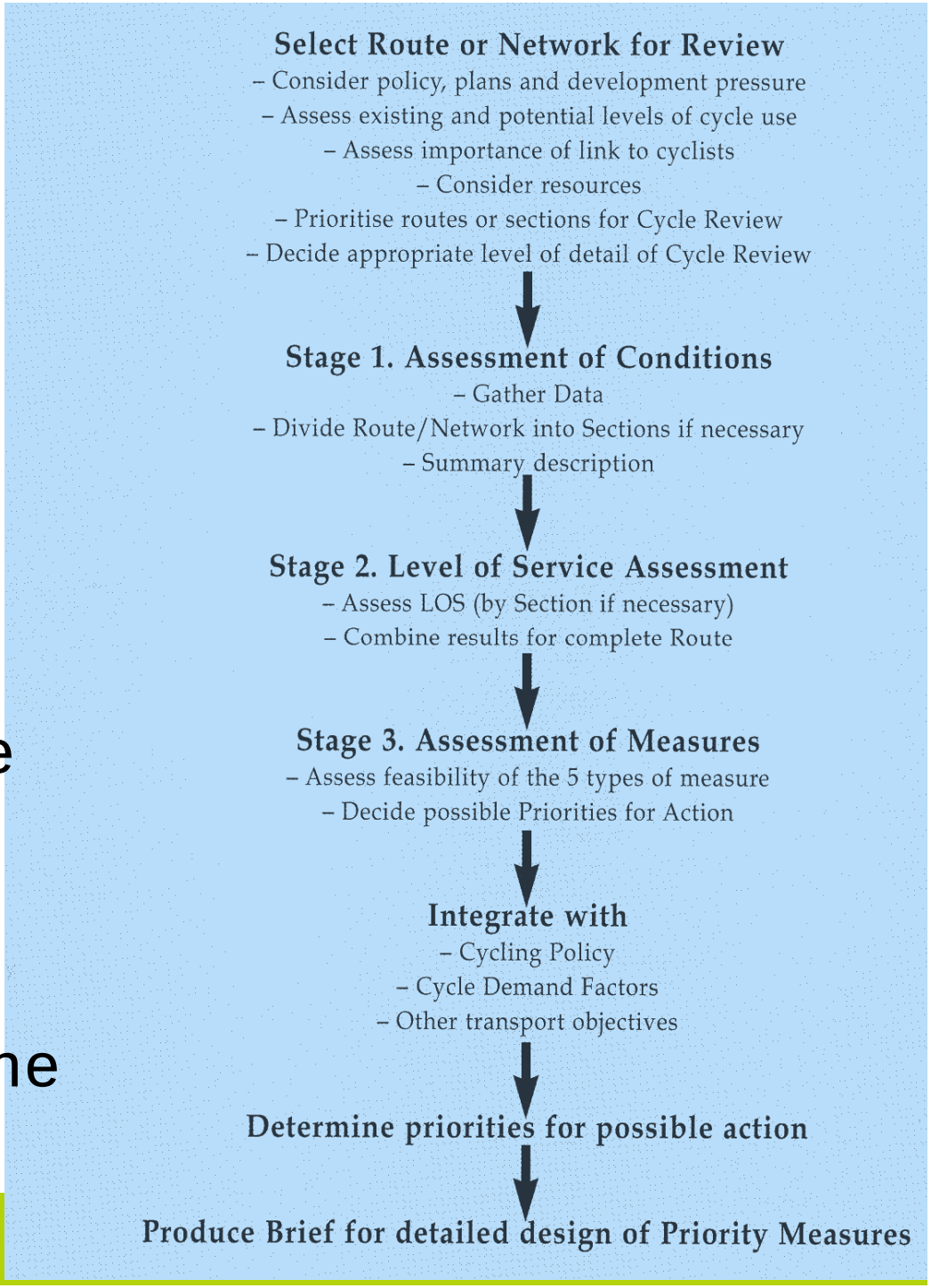
Cycle Review

Hierarchy of measures:

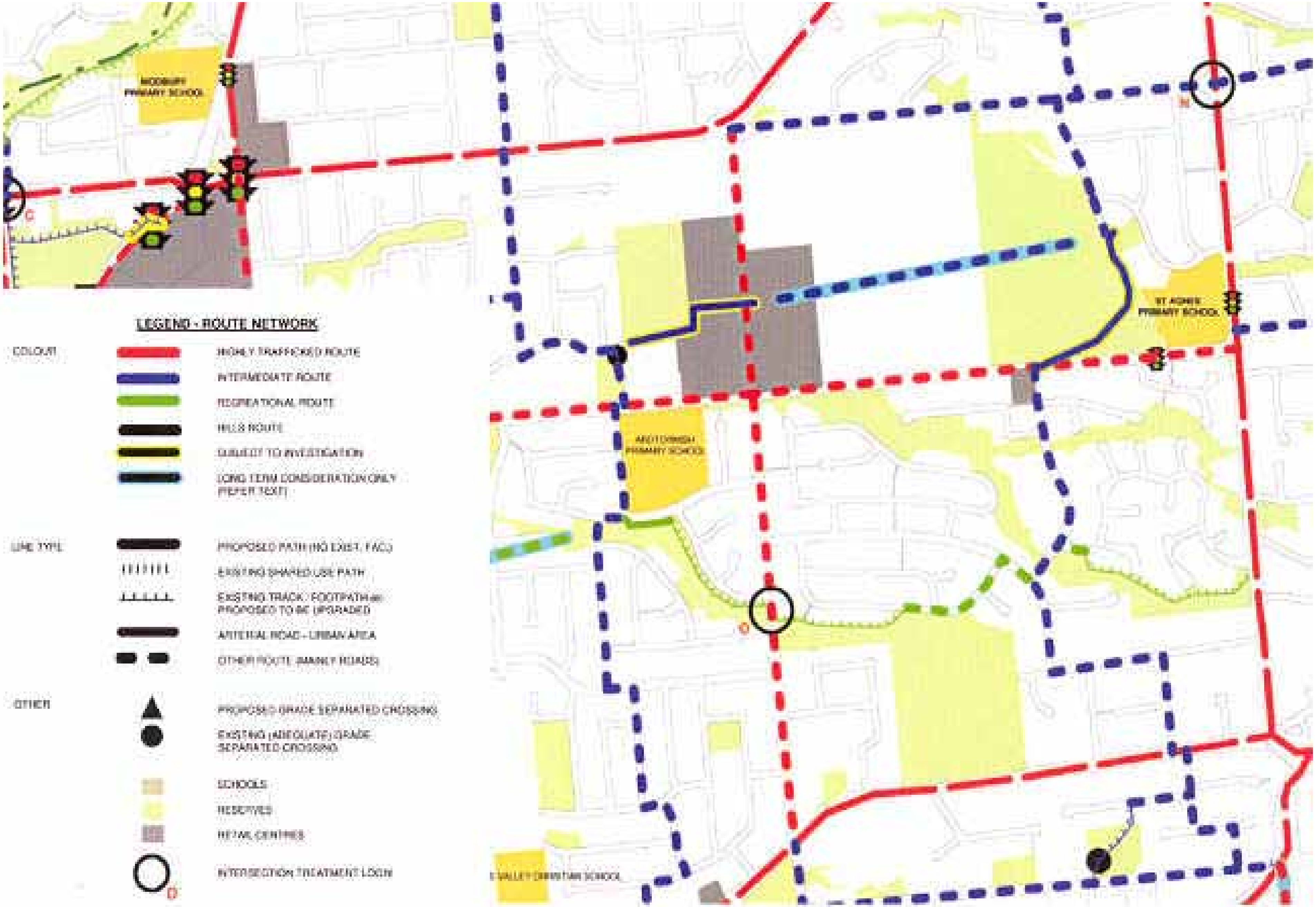
- Reduce traffic flows
- Reduce traffic speeds
- Improve junctions
- Redistribute road space
- Paths

- How much better are the options than existing.



Prioritising projects

- *Greatest number / demand*
- *Crash records*
- *Remove blocks*
- *Easiest and cheapest*
- *Quality demonstration projects*
- *Area completion*
- *LOS improvement for greatest number*



LEGEND - ROUTE NETWORK
COLOUR
HIGHLY TRAFFICKED ROUTE
INTERMEDIATE ROUTE
RECREATIONAL ROUTE
HILLS ROUTE
SUBJECT TO INVESTIGATION
LONG TERM CONSIDERATION ONLY (REFER TEXT)
LINE TYPE
PROPOSED PATH (NO EXIST. FAC.)
EXISTING SHARED USE PATH
EXISTING TRACK / FOOTPATH etc PROPOSED TO BE UPGRADED
ARTERIAL ROAD - URBAN AREA
OTHER ROUTE (MAINLY ROADS)
OTHER
PROPOSED GRADE SEPARATED CROSSING
EXISTING (ADEQUATE) GRADE SEPARATED CROSSING
SCHOOLS
RESERVES
RETAIL CENTRES
INTERSECTION TREATMENT LOCN

Benchmarking

- *Benchmarking is a process for motivating organisations to measure and improve their performance, by sharing information using common indicators to enable the best performers to become the standard to which the other aspire.*
- *The secret of successful benchmarking programs is to dig behind the figures to understand performance differences and identify what leads to excellent performance*.

Benchmarking

Peer Review

- CTC UK regional project
  - Team up ten local bodies
  - Spend a day in each

Policy and Process

- Bypad
- Velo.info self assessment on web
- English regions bicycle bell ratings

Outcomes

- Dutch cycle balance


laat
de fiets schitter
in Europa
Fietsersbond
mortfiets

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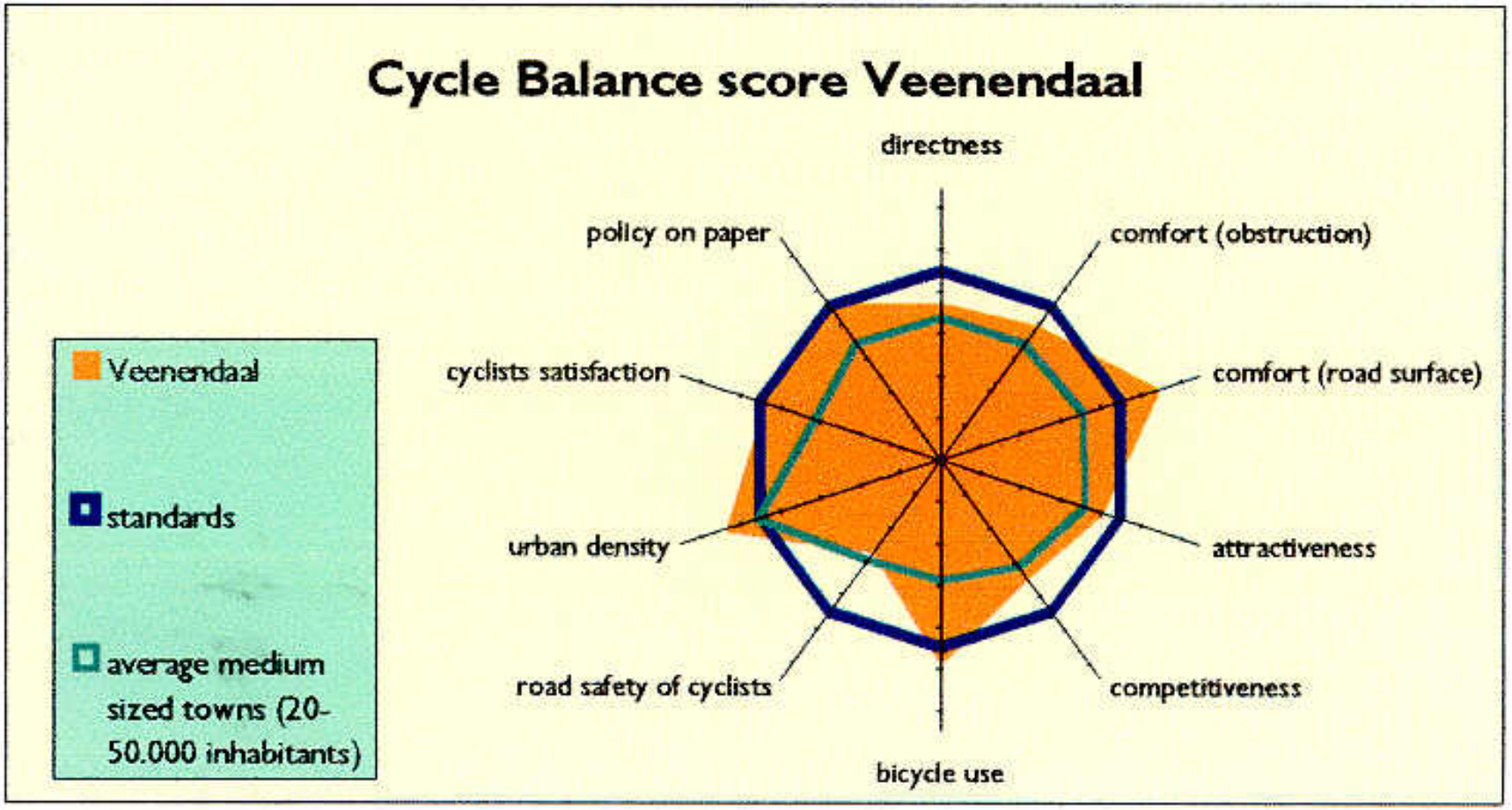
Dutch Cycle Balance



Cyclist Level of Service

***Cyclist LOS or Bikeability ratings*:**

- measure or predict cycle friendliness.
- can be applied to existing situations and design proposals for components of the network.
- Can be applied to wider network
- Can be measured by user surveys.
- Can be predicted by formula.

Cyclist Level of Service

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Methods available:

- Bikeability toolkit – deficiency checklist
- Bicycle Path – US HCM, theoretical delay based
- Bicycle compatibility index – video based
- Florida multi-modal LOS – real time rides
- Cycle Review LOS – expert judgement
- UK Transport Research Laboratory –real time
- Florida – video / real time validation
- Denmark – video based
- Current NZ research project

Bikeability toolkit

- Bicycle Federation of Australia
- Users identify list of deficiencies based on checklist.
- Passes and fails are added to give a deficiency score.
- No attempt to validate with user perceptions.

Bicycle Path LOS

- Hein Botma (1995) – US HCM 2000
  - Theoretical delay to cyclist due to interaction with other users.
- Hummer (2005) developed further- same basis but requires survey counting user interactions by a floating cyclist.
  - Cannot be applied at design stage
  - Only counts delay
  - Not comparable with on-road methods.

Bicycle Compatibility Index

- David Harkey (1998)– University North Carolina
- Users rated mid-block sections by watching videos.
- Developed simple prediction equations

Florida multi-modal LOS.

- First real time perception surveys –(1997)
- Takes into account surface condition, HV proximity etc –better than video.
- Used volunteers for a Saturday event.
- Surveyed mid-block links.
- 2nd survey of straight through traffic light intersections (2003)
- Each participant wore a numbered jerkin.
- Used many video recorders to record traffic conditions at each site experienced by each participant.
- Developed prediction equations

Florida multi-modal LOS.

- Experienced cyclists rate more harshly
  - They are more aware of potential hazards

Key factors:

- Bike lane or shoulder
- Proximity to traffic
- Traffic:
  - Volume
  - Speed
  - Heavy Vehicles
- Pavement condition
- On-street parking

Cycle Review LOS

- Cycle Review LOS (Davies 1998).
  - Comprehensive – includes paths and intersections
  - criticised as difficult and based on expert opinion
  - Not validated by surveys
- Developed survey form
- Produced additive prediction equations

UK – Transport Research Laboratory

- TRL staff with varying experience rode a 9 km route on very narrow roads near the laboratory
- Each rode the same instrumented bike
- The passing distances were recorded by a side facing video recorder.
- Bicycle computer mounted on the bike
- Users rated 12 items on a ten point scale

UK – Transport Research Laboratory

Most important rating factors contributing to overall satisfaction in order:

- Overall pleasure (non-safety)
- Overall safety
- Bumpiness

- Gender and experience appeared to affect but did not significantly improve model

UK – Transport Research Laboratory

Significant variables for mlr model:

- Vehicle speeds
- Lane widths
- Frequency of side turnings
- Gradient
- Explains 30% of individual cyclist ratings

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Danish Research

- Intended to use real time data
- Switched to video data to include dangerous conditions.
- Mid-block links only
- Used a wide range of conditions
- Statistically rigorous design

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Danish Research

Most important:

- Width - space available for cycling
- Degree of separation from motor traffic and pedestrians

Important

- Traffic volume, speed, parking and bus stops all decrease ratings.

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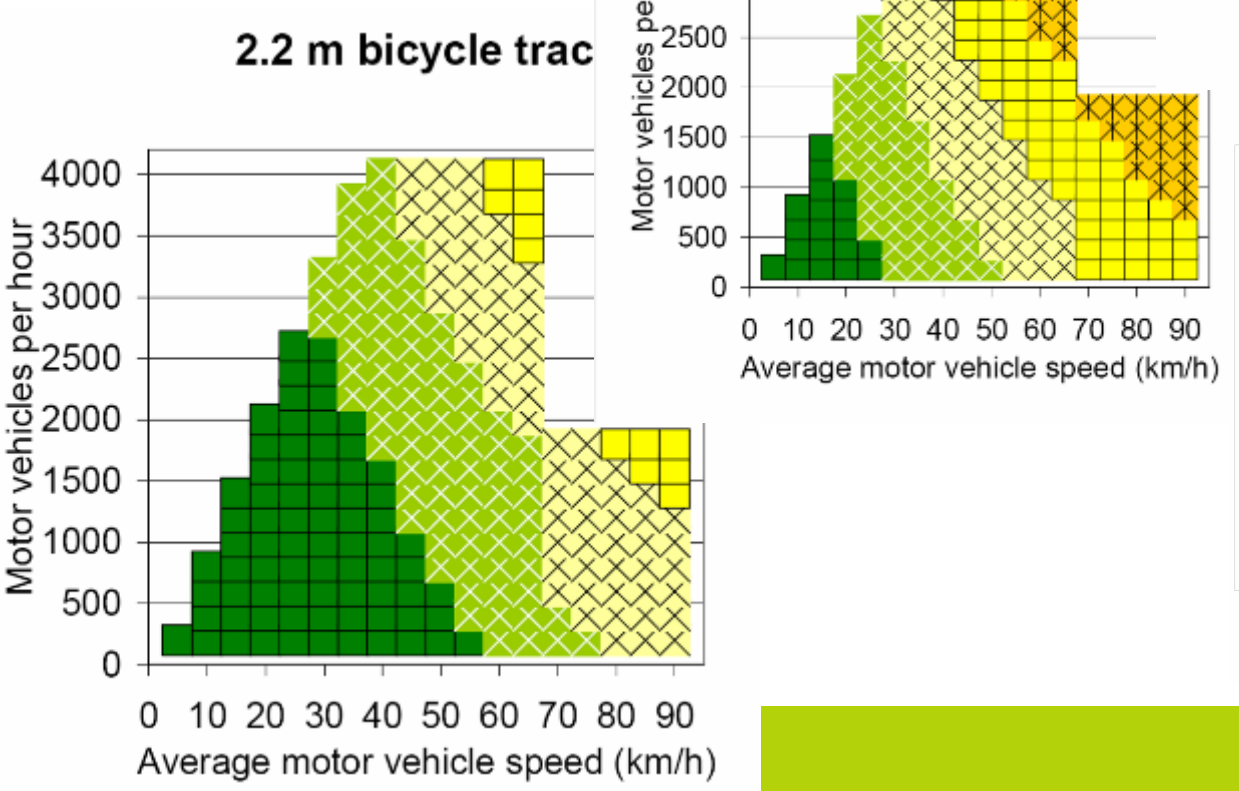
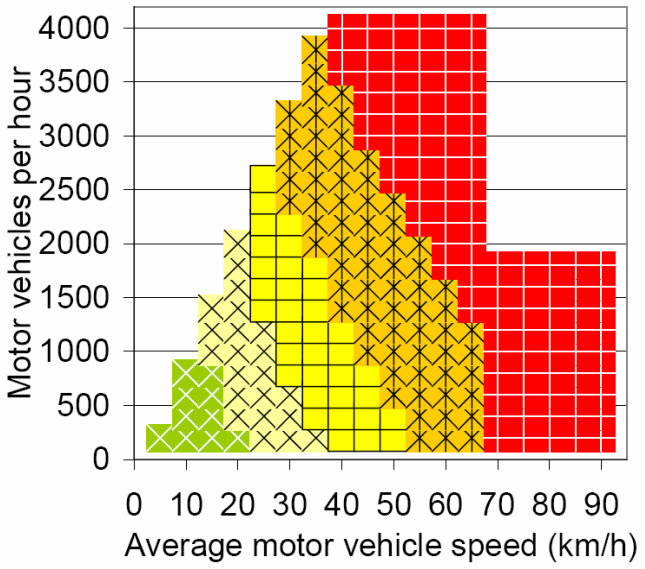
Mid-block model





A	very satisfied
B	moderately satisfied
C	a little satisfied
D	a little dissatisfied
E	moderately dissatisfied
F	very dissatisfied

NZ Cycle for Science

- Cycling environment perceptions research
  - Performed by MWH NZ under contract

Introduction

- Develop a Predictive Level of Service Model to Assess Cycle Facilities in New Zealand
  - Users responses to a variety of cycling facilities and traffic conditions
  - Perception of cyclists with differing age, gender, cycling experience and engineering/technical background
  - Influencing environment factors

Ultimate Goal

- **"… to research cyclist perceptions of the cycling environment with a view to providing a tool for rating how well provision for cyclists meets their needs".**

Cycle for Science

- Cycling environment perceptions research
  - Commenced in May 2004
  - Similar to projects in UK, USA & Denmark.
  - “Cycle for Science” 1st ride 26 June 2004
  - 3 more Christchurch routes completed
  - Additional Survey in Nelson completed.
  - 108 sites in data base.
  - On road: mid-block, straight through intersections, right turns, paths

= Intersection

Participant Name: **Number:**

Please grade each section of the route based on your own previous cycling experience. Grade from -3 to +3.

Section	Overall Perception (-3 Very Poor … +3 Very Good)	Delay (-3 Extreme Delay … +3 No Delay)	Surface Quality (-3 Very Poor … +3 Very Good)	Traffic Safety (-3 Very Dangerous … +3 Very Safe)	Attractiveness (-3 Very Unpleasant … +3 Very Pleasant)	Have you cycled this section before? Never	Occasionally	Frequently	Section
• Start/Finish – Tahunanui Beach (outside Nellie Nightingale Library)					Briefing Confirmed:				
1	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	1
2	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	2
3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	3
4	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	4
• Checkpoint A – Rutherford Park at Trafalgar Centre Bridge					Checkpoint A marshal to initial:				
5	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	5
6	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	6
7	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	7
8	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	8
9	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	9
10	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	10
11*	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	11*
• Checkpoint B – Quarantine Road / Whakatu Drive					Checkpoint B marshal to initial:				
12	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	12
13	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	13
14	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	14
• Checkpoint C – Railway Reserve near Songer Street					Checkpoint C marshal to initial:				
15	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	15
16	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	16
17*	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	17*
18	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	18
19	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	-3 -2 -1 +1 +2 +3	❑	❑	❑	19
• Checkpoint D – Quarantine Road / Whakatu Drive					Checkpoint D marshal to initial:				

Participant's Co
- Were there any other factors overall perception?
- Was there a special way you section (eg dismounted or s right from the left of the road)
- Were there any unusual incl circumstances that affected

(pw) (pw)

Sport (competition or training) ☐ km (pw)

c. If "Other", please specify

Cycle for Science – initial results

	Effect of variables
Cycling advocate	lower
Technical background	lower
Riding Ability	lower
Frequency	lower
Age	young and old higher
Gender	female higher
Off-road Path width	higher
Parking Occupancy	lower
Cycle lane width	higher
Short term parking	lower
% Heavy Vehicles	lower
On street parking provision	lower
Effective width	higher
AADT & 15 min Vol	lower

Conclusions

- Cycling LOS tools are useful in many phases of cycle strategy, planning, options development, prioritisation and monitoring
- A variety of cycling LOS tools are available
- Comprehensive methods suffer from a lack of user perceptions validation
- Validated cycling LOS tools only cover a narrow range of situations and may not be applicable to NZ conditions
- Previous validation attempts have revealed that the relationships are complex and simple methods insufficient.
- Data collection needs to overcome co-correlation due to site selection- more orthogonal design

Method issues

Event style:

- many riders in short succession.
- Difficulty economically recording traffic conditions for each cyclist
- Weekends or evenings- less traffic fewer HVs
- Good for cyclist experience variety
- Not suitable for more difficult routes
- Repeated measures power

Method issues

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Intercept surveys:

- Each cyclist only rates one site - so bigger user sample required.
- User profile bias
  – difficult sites only have experienced riders
  – paths only have less experienced
- Need to collect user characteristics for many more users
- No opportunity to train users in method and rating scale or to account for any learning effect.
- Time consuming at quiet sites
- Good for collecting data at out of the way sites

Method issues

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One instrumented bike:

- Real time traffic conditions are collected for each cyclist
- A small number of users can re-ride many routes under different traffic conditions – so powerful for understanding effect of changed conditions
- User profile can be controlled by rider selection and rating pattern of different users compared
- Instrumented bike could also be used for outcome benchmarking

Research method

- Check with overseas researchers for any research updates: Florida and Demark - done
- Identify deficiencies with NZ data - done
- develop site selection criteria - done
- find sites with required characteristics.
- Develop analysis technique that will separate user and site variation – part done.
- Trial the intercept survey method on some existing sites and compare results with CfS - deferred
- Scope a bike instrument system - if feasible build and trial – built - under trial.
- Collect more data until adequate
- Check fit of past models and develop new model forms for each of the facility types – starting with mid-block links


GIANT