



Measuring Cyclist Level of Service on Narrow Pathways

Situation

Two bridges:

- Narrow sidewalks — cyclists and pedestrians share
- Low usage — 50 to 100 cyclists/day on each bridge

Want to widen sidewalks

- Improve safety
- Encourage cycling



Situation



Situation



Situation



Situation



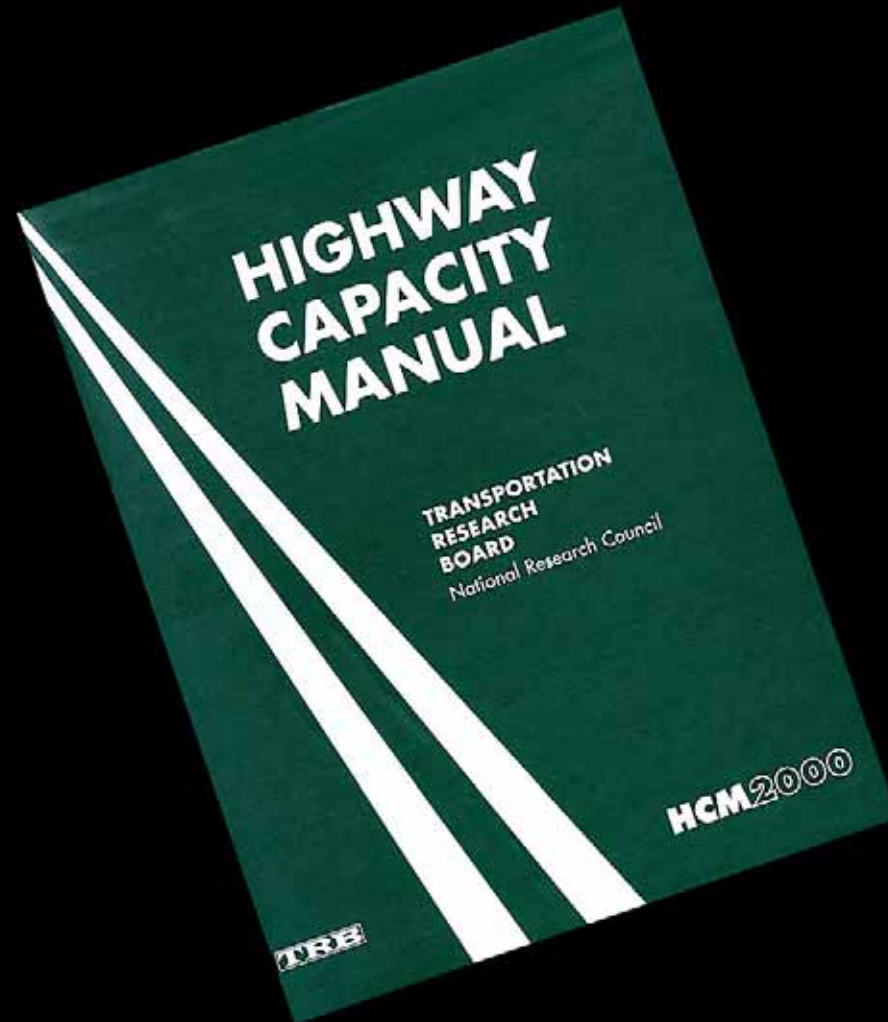
Problem

How to measure the benefits
of widening?

Need a means of quantifying
change



Problem



Problem

Highway Capacity Manual:

- 3.0 m (10 foot) wide pathway
- 2.4 m (8 foot) wide pathway

Pattullo Bridge:

- 1.8 m (6 feet)

Knight Street Bridge:

- 1.3 m (4 ¼ feet)



Theory

Highway Capacity Manual:

- ✘ Bicycle LOS based on concept of lanes and passing manoeuvres
- ✓ Automobile LOS based on concept of delay
- ✓ Delay equates to additional travel time or reduced average speed



Theory

What causes delay?

- Encounters with other users:
 - Same direction cyclists
 - Opposite direction cyclists
 - Pedestrians
- Encounters with obstructions



Theory

Calculate delay:

- Estimate number of encounters
- Estimate time per encounter
- Calculate total delay
- Calculate average travel speed



Theory



Level of Service	km/h	mph
A	> 22	> 14
B	15–22	9–14
C	11–15	7–9
D	8–11	5–7
E	7–8	4.5–5
F	< 7	< 4.5

Theory

Calculations:

- Determine number of cyclists and pedestrians per hour
- HCM equations: encounters/hour
(Equations 19-5, 19-6 and 19-7)
- Divide by crossing time = average encounters/crossing
- Calculate total delay = events x delay/event
- Average speed = distance \div (free-flow crossing time + delay)



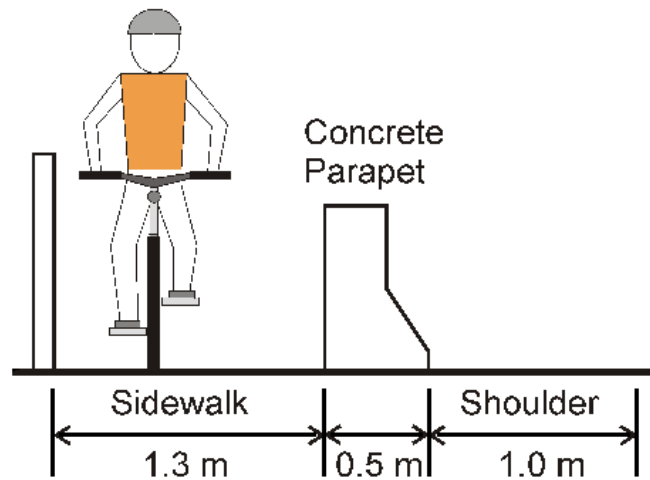
Theory



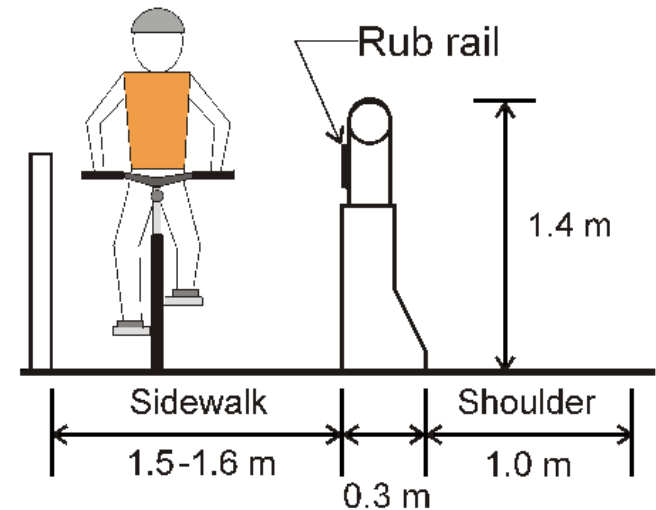
Width	Passing Speed	Delay
1.0–1.2 m	0	14.8 s
1.2–1.4 m	5 km/h	8.1 s
1.4–1.6 m	10 km/h	3.7 s
1.6–1.8 m	14 km/h	1.8 s
1.8–2.0 m	19 km/h	0.7 s
> 2.0 m	24 km/h	0

Results

Existing



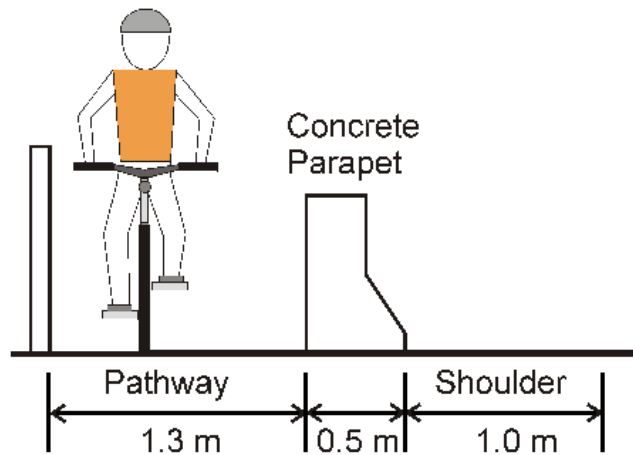
Proposed



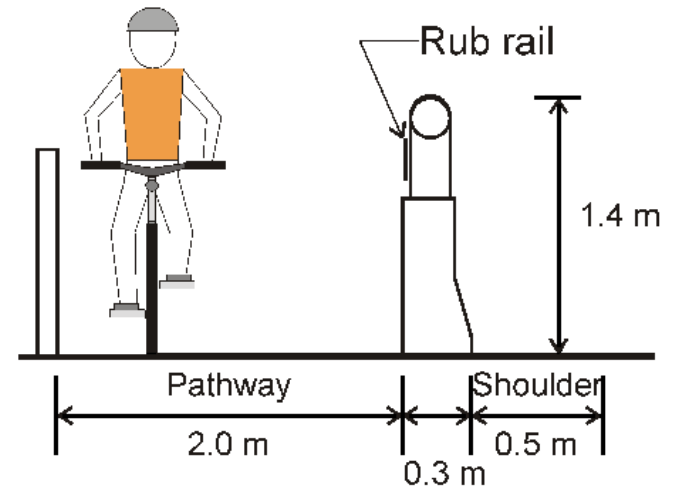
Results



Existing



Proposed

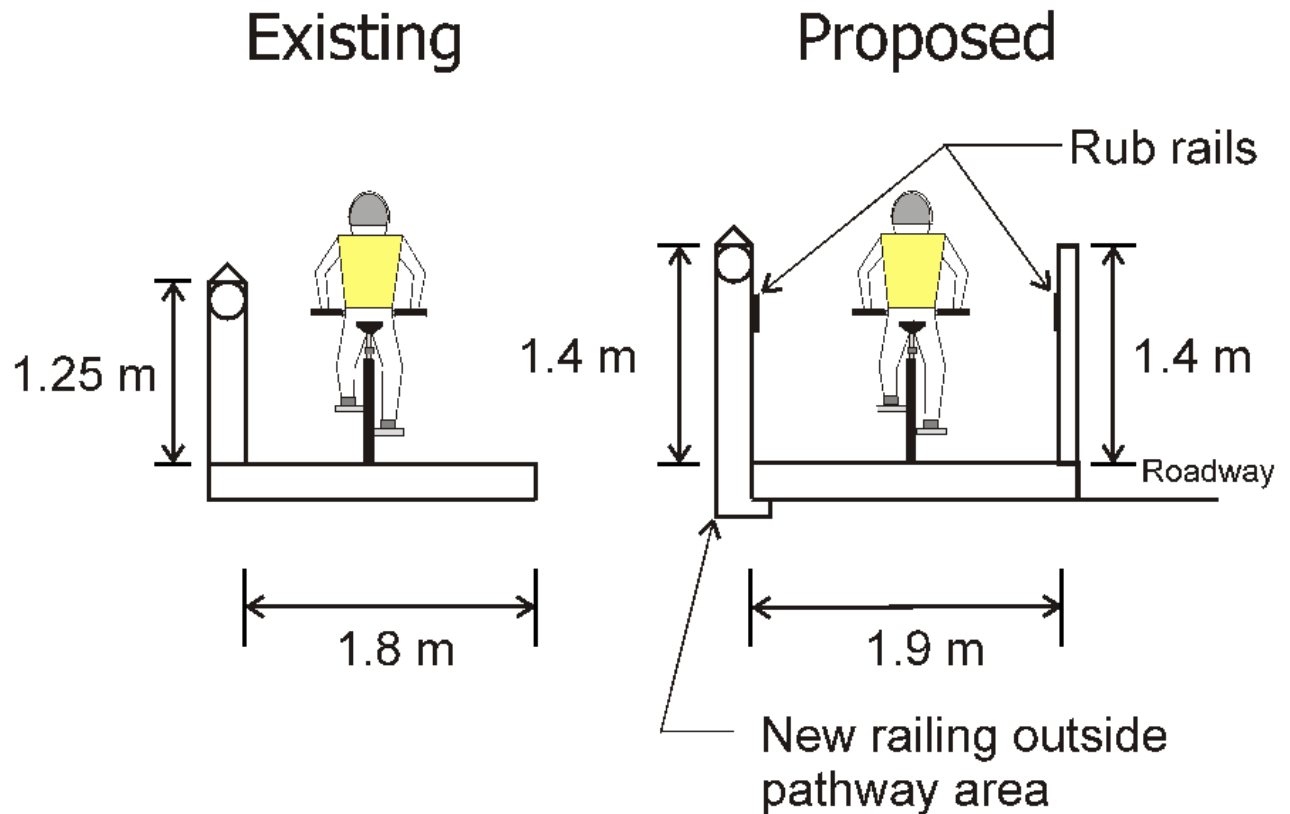


Results

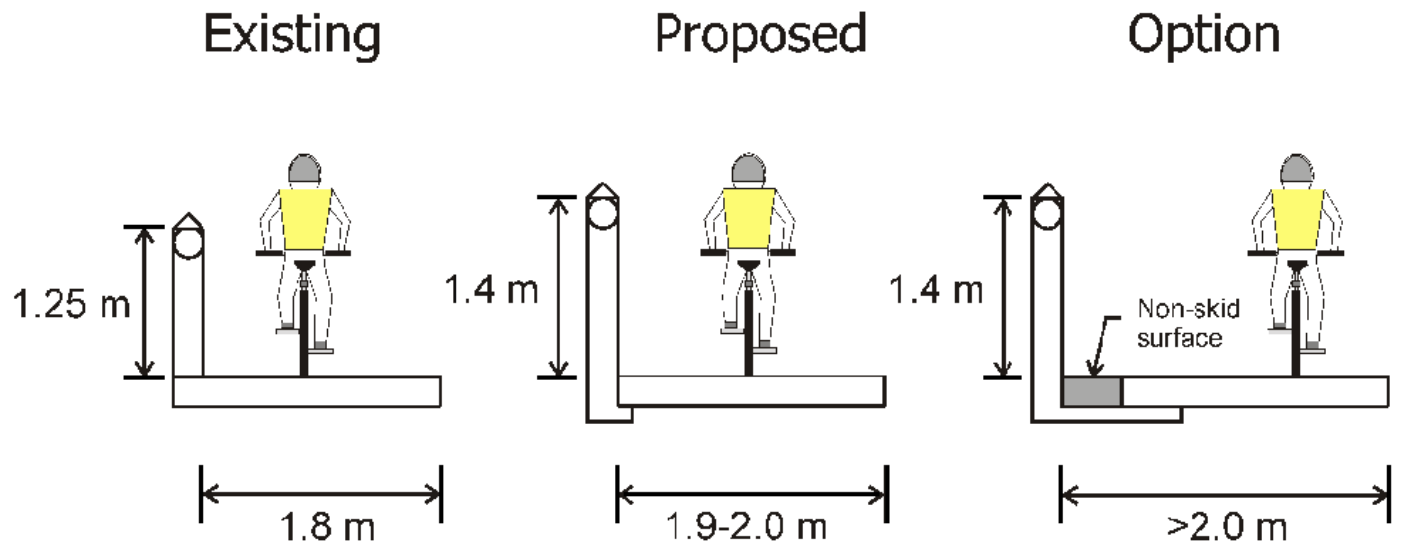
Knight Street Bridge

Width	Hourly Volume	Average Speed	LOS
1.3 m	10	22.0 km/h	B
1.6 m	10	23.5 km/h	A
2.0 m	10	24.0 km/h	A
1.3 m	30	18.8 km/h	B
1.6 m	30	22.6 km/h	A
2.0 m	30	24.0 km/h	A

Results



Results



Results

Pattullo Bridge

Width	Hourly Volume	Average Speed	LOS
1.8 m	17	23.8 km/h	A
2.0 m	17	24.0 km/h	A
1.8 m	50	23.4 km/h	A
2.0 m	50	24.0 km/h	A



Improvements

Field observations of free-flow speeds

Adjust LOS average speed ranges:

- Narrow LOS B range — e.g. 19–22 km/h
- Adjust other LOS ranges accordingly

Different delays for different types of encounters

Field tests of delay at various widths





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