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Shared surfaces: Travel demand unmanaged

TDM2008, Semmering , Austria

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Segregation: Buchanan (1963)

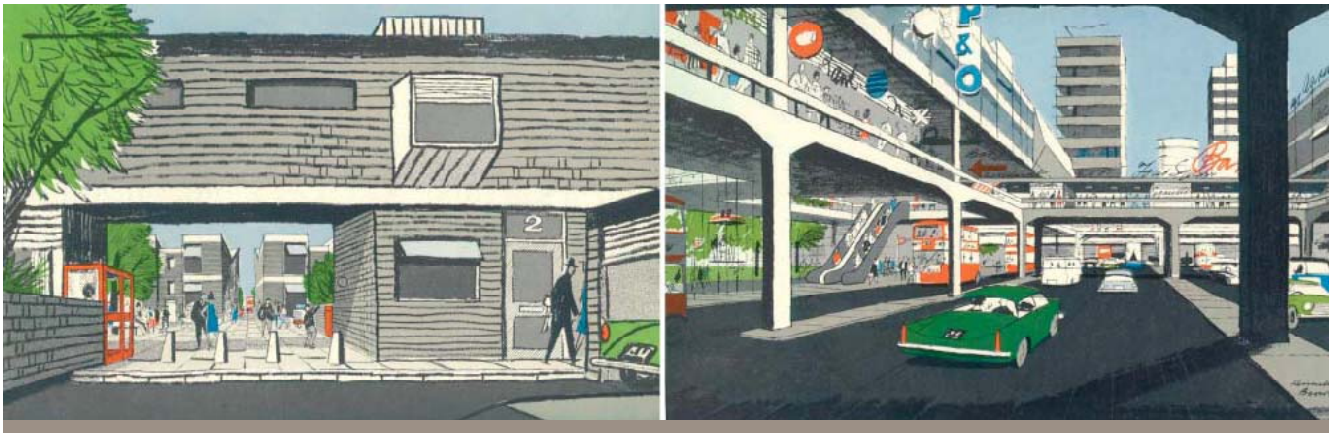


Fig. 4. Illustrations from Colin Buchanan's seminal 1963 report *Traffic in Towns*, showing vehicles segregated from pedestrians (Crown copyright)

- Division of the public realm into parallel universes
- Emphasis on freedom of movement for the vehicle (hence *Traffic in Towns*)
- Orthodoxy widespread at the time

Desegregation: Kensington High St

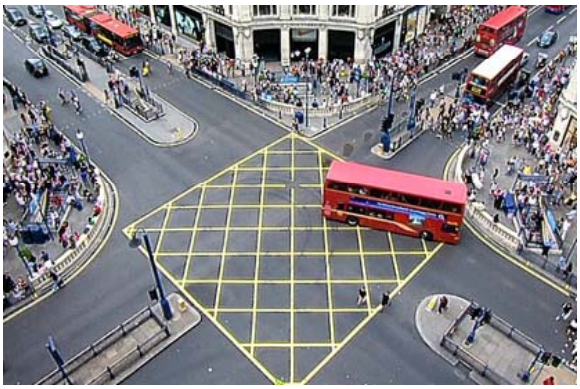
Ben Hamilton-Ballie, 2006

- Functional for vehicles
- Pedestrians forced to make large detours
- Vehicles over-guided
- What does this say about society?

Designing Streets for People, 2003

- Pedestrians not imprisoned by railings
- and invited to share the road
- Vehicles restrained by signals

Desegregation: Oxford Street



- Pedestrians penned in by railings
- and either making big detours
- or crossing in non-designated areas
- Yellow box excludes pedestrians as well as vehicles

- Pedestrians are invited to share the centre of the junction
- and to cross diagonally

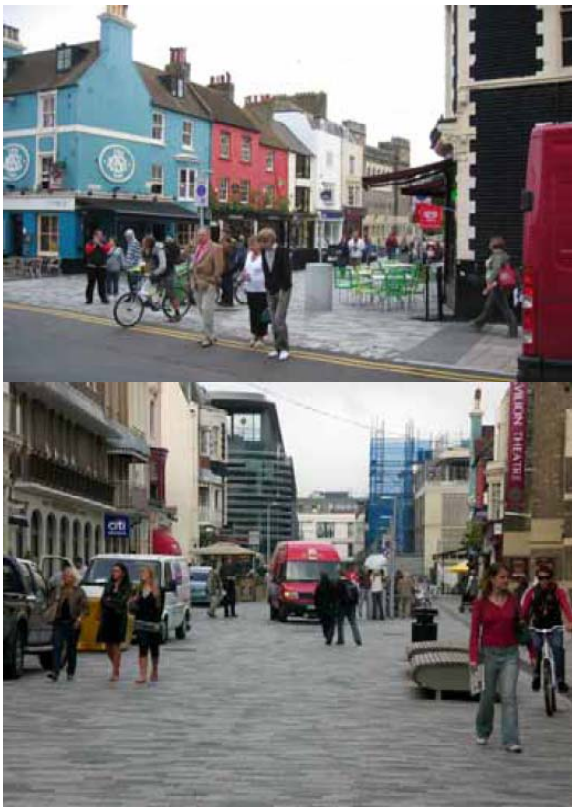
Evening Standard, 10/7/08

“Naked streets”: The concept

- Attributed to the late Hans Monderman, who
  - Believed in the anti-social consequences of segregation
  - Designed first “naked streets” in the Netherlands, where vehicles and pedestrians share the road and where traffic lights, barriers and signs are stripped out

Issues: New Road, Brighton

- Pedestrians reclaimed the street
- Vehicles give ways to pedestrians
- Road safety audit (MVA) identified problems with
  - Blocking tactile strip
  - Risk of collision with seating
  - Lighting



The balanced view

- Advantages
  - Traffic calming effect
  - Hazards clearly visible
  - Aesthetics (looks better?)
  - Health (encourages walking and cycling)
- Disadvantages
  - Difficult for people with handicaps
  - Safety for children
  - Equity (can elderly cross?)
  - Pedestrian exposure to emissions

Blackett Street, Newcastle

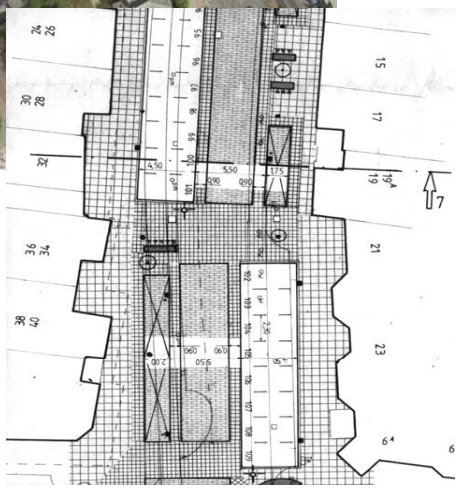
- Key features
  - High pedestrian density
  - Paving
  - Blister paving
  - Low kerbs

Source: Graham Smith

Willem Straat, Rijswijk

- Key features
  - Linked zones
  - Discontinuous carriageway, not obviously aligned
  - Footway shielded by parked vehicles

Source: Graham Smith



Rijstraatweg, Haren

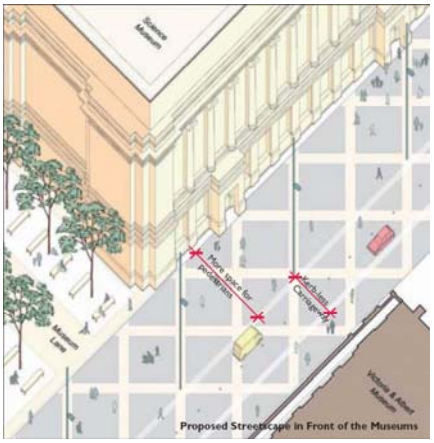
- Key features
  - Carriageway alignment bounded by trees, lighting columns and railings
  - Zebra stripes offering some protection to pedestrians

Source: Graham Smith

Exhibition Road, London

Exhibition Road, design

- Design issues
  - Provision for disability, children, elderly?
  - Channel for vehicles?
  - Designated crossing areas?
  - Sustainable traffic and pedestrian flows?



- Design issues (cont)
  - Materials, signage and traffic signals?
  - Use of ITS?
  - Provision for buses

Towards a shared surface theory

- Pedestrians need gaps in the vehicle flow to cross
- Vehicles need gaps in the pedestrian flow to proceed
- Traffic will be calmed by pedestrians

Open questions

- How do pedestrians affect vehicle speed?
- How is pedestrian gap acceptance affected by vehicle speed?
- At what level of vehicle flow does the surface cease to be shared?

Mutual gap acceptance

$$\Pr(accept_p) = \Pr(gap_c > crit_p) = e^{-\lambda_c crit_p}$$

$$\Pr(accept_c) = \Pr(gap_p > crit_c) = e^{-\lambda_p crit_c}$$

λ_c = Flow of vehicles [veh/s]

λ_p = Flow of pedestrians [ped/s]

$crit_c$ = Critical gap for vehicles [s/veh]

$crit_p$ = Critical gap for pedestrians [s/ped]

$$\lambda_p = \lambda_c e^{-\lambda_c crit_p}$$

$$\lambda_c = \lambda_p e^{-\lambda_p crit_c}$$

Pedestrian queue

$$\Pr(a_p = 1) = \Pr(crit_p < gap_c < crit_p + ex_p) = e^{-\lambda_c crit_p} - e^{-\lambda_c (crit_p + ex_p)}$$

$$\Pr(a_p = 2) = \Pr(crit_p + ex_p < gap_c < crit_p + 2ex_p) = e^{-\lambda_c (crit_p + ex_p)} - e^{-\lambda_c (crit_p + 2ex_p)}$$

etc.

$$\lambda_p = \lambda_c (\Pr(a_p = 1) + 2\Pr(a_p = 2) + 3\Pr(a_p = 3) + ...)$$

$$= \lambda_c e^{-\lambda_c crit_p} (1 + e^{-\lambda_c ex_p} + e^{-2\lambda_c ex_p} + ...) = \frac{\lambda_c e^{-\lambda_c crit_p}}{1 - e^{\lambda_c ex_p}}$$

λ_c = Flow of vehicles [veh/s]

λ_p = Flow of pedestrians [ped/s]

$crit_p$ = Critical gap for pedestrians [s/ped]

ex_p = Time required for an extra pedestrian to cross

Pedestrian waiting time

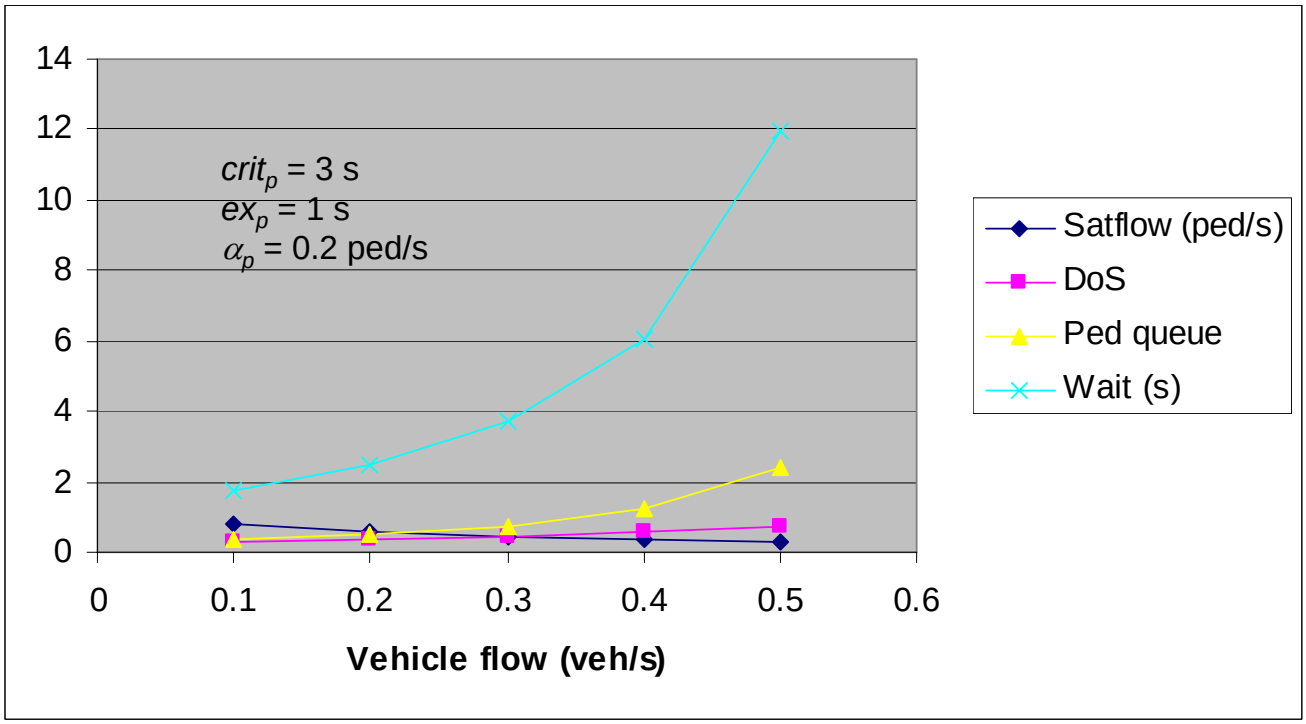
α_p = Pedestrian arrival rate

$\sigma_p = \frac{\alpha_p}{\lambda_p}$ = Pedestrian degree of saturation

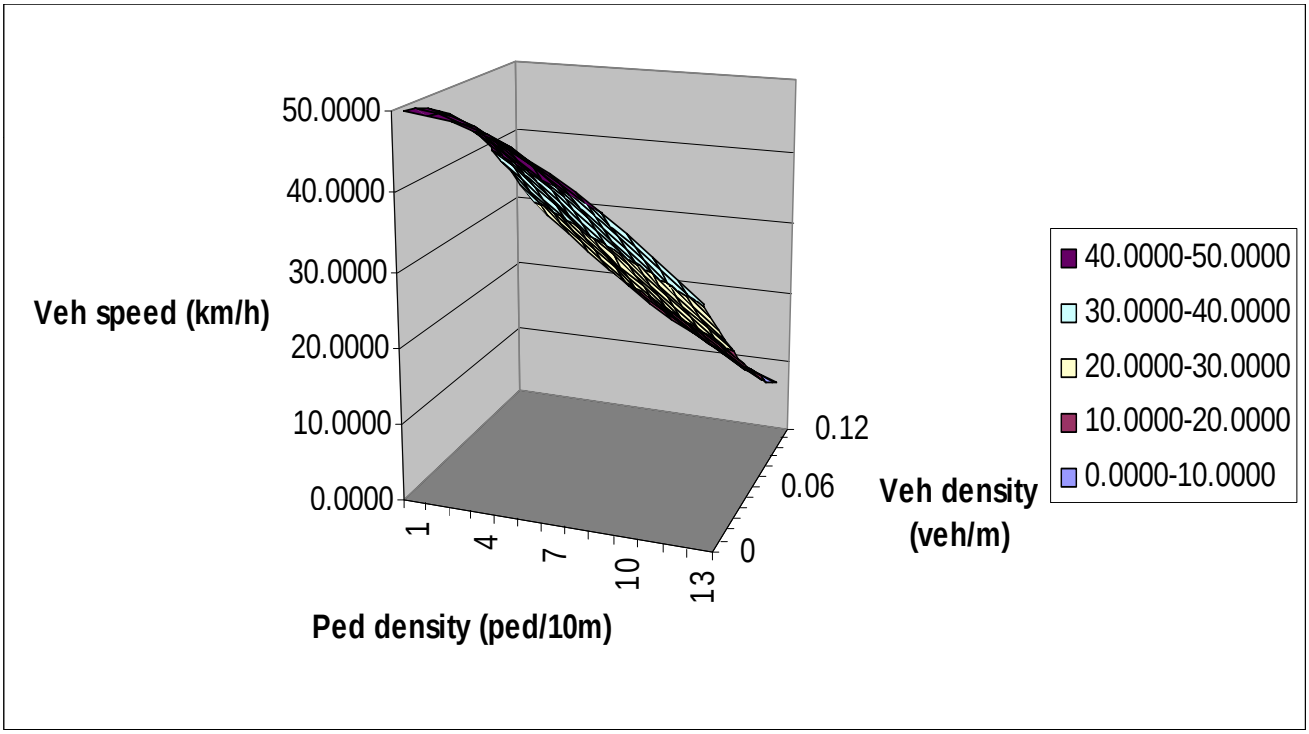
$q_p = \frac{\sigma_p}{1-\sigma_p}$ = Mean pedestrian queue size

$w_p = \frac{q_p}{\alpha_p}$ = Mean pedestrian wait

How difficult is it to cross?



How do pedestrians affect vehicle speeds?



Conclusions

- There is a case for the “naked street”, but there is a spectrum of nakedness
- There are important design issues still to be resolved
- There are limits to the applicability of shared surfaces
- Important traffic engineering relationships need to be researched