Traffic – can we beat the queues?

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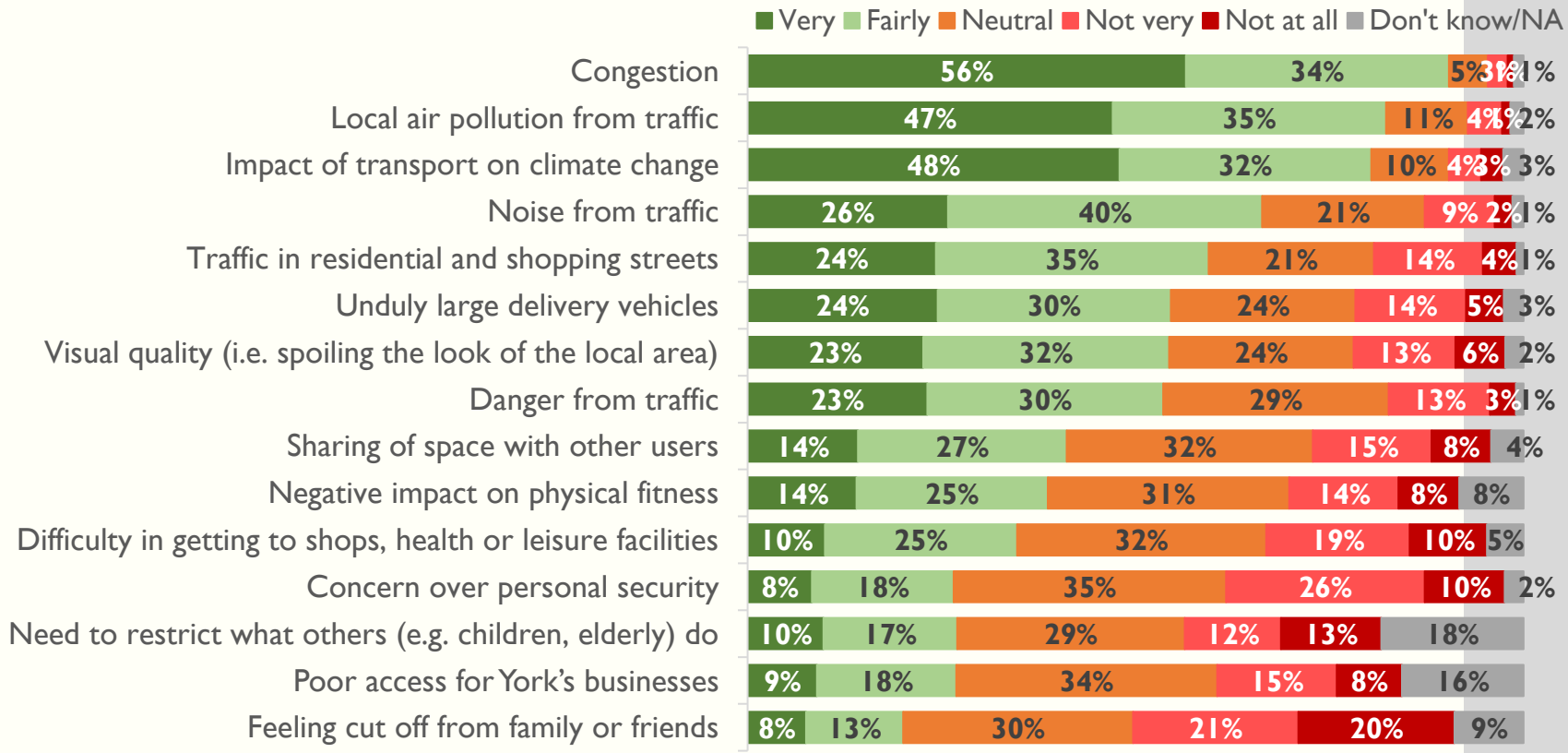
The scourge of congestion

- Delays to all users
- Unreliable journey times
- Adverse impacts
  - On bus services
  - On freight
  - On "more essential" journeys
- Estimated cost in York
  - Around £30m p.a. (2011)
- Also
  - Increased carbon emissions
  - Increased pollution, noise
- 90% consider it a serious problem in York

Our Big Conversation – Transport Strategy: Perceptions of Transport Issues in York

Please indicate how serious you think each of the problems listed below is in York
(1,114 responses)

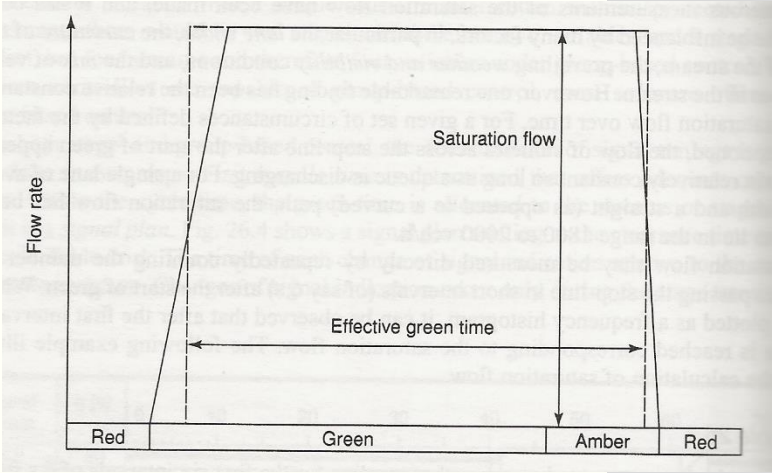


The aims of the Trust's Transport Strategy for York

- What do we want York to be like in the future?
  - And what does this mean for transport policy objectives?
- The Citizens' Transport Forum's suggestions
- **A vision for York: a city which respects its environment while enhancing quality of life, social justice and economic vitality**
- **Transport policy objectives:**
  - **Highest priority: reducing pollution, carbon emissions and congestion**
  - **Emerging priorities: improving public health and safety; supporting economic recovery**
  - **Continuing needs: enhancing equality of access, liveability, public space and heritage**

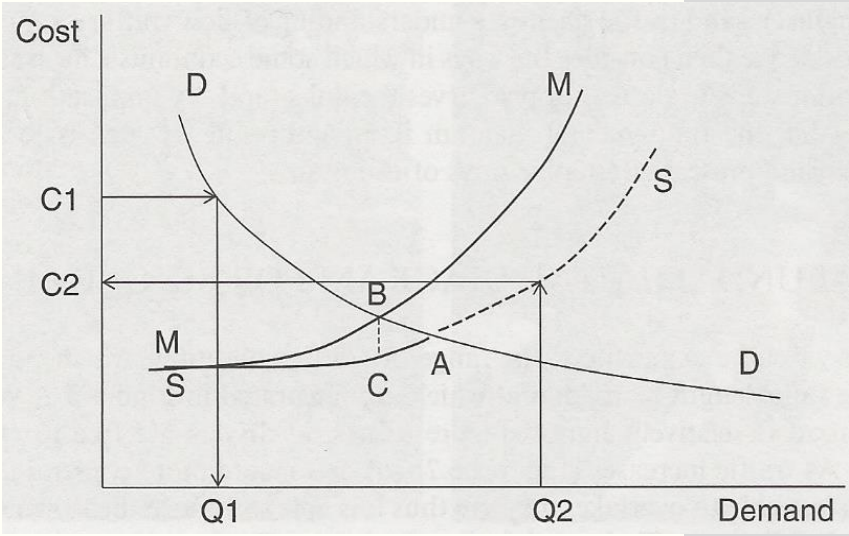
But how does congestion arise?

- Queues form when demand exceeds capacity
- Capacity is determined by (signalled) junctions
- Capacity at a signal is determined by
  - Green time for the approach
  - Lost time (c 2 sec to react)
  - Number of lanes
  - Saturation flow per lane
- Saturation flow is determined by
  - Vehicle mix
  - Turning movements
  - Gradient and lane width
  - Time headway between vehicles
- But typically 1800 passenger car units/h or 2 sec per car



Why do drivers put up with congestion?

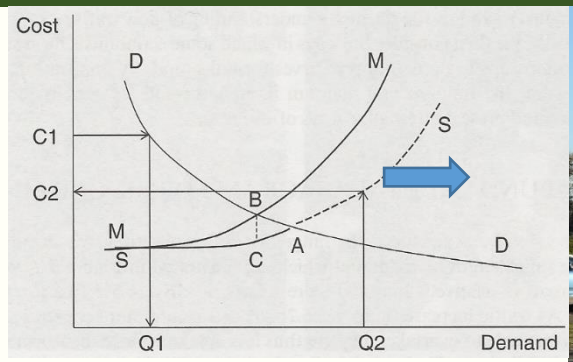
- The classic analysis of supply and demand
- As demand (flow) increases so does cost (time)
  - Curve S-S is the supply curve
- As cost (time) rises, demand falls
  - Curve D-D is the demand curve
- Point A represents the "user optimum"
  - The marginal driver is just prepared to accept the actual cost of her journey
  - Which determines the actual flow
- But each extra vehicle increases average cost
  - Which adds to the cost for other drivers
- The marginal cost of an extra vehicle
  - Curve M-M is the marginal cost curve
- Point B is the "system optimum"
  - The marginal driver is just prepared to accept the marginal cost of her journey



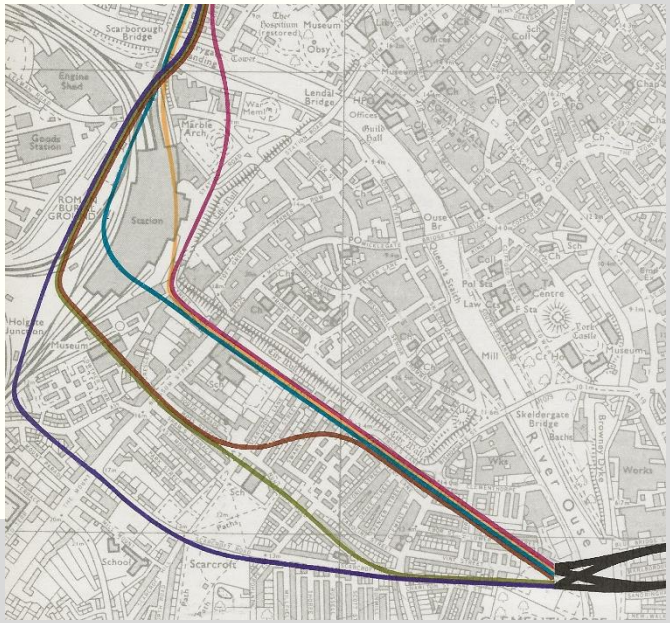
Will congestion get worse?

- The Council's Local Plan predictions
  - Travel times up by 30%
  - Delays up by 55%
- As a result of new developments by 2035
  - If no other action is taken
- In practice this is unlikely
  - Because congestion is self-regulating
- But congestion will spread
  - To other times of day
  - To other parts of the network
- So the costs of congestion will increase

What can we do to reduce congestion?
(1): Increasing capacity: new construction

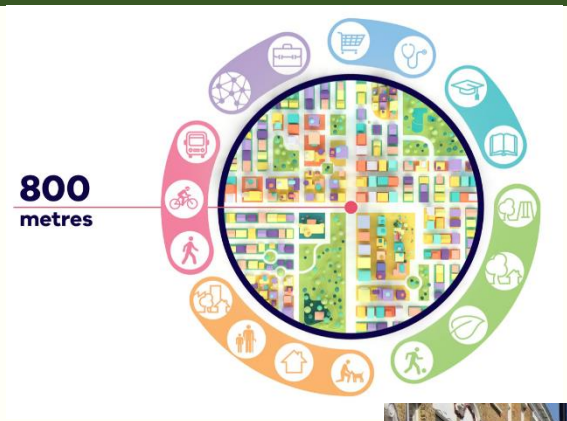


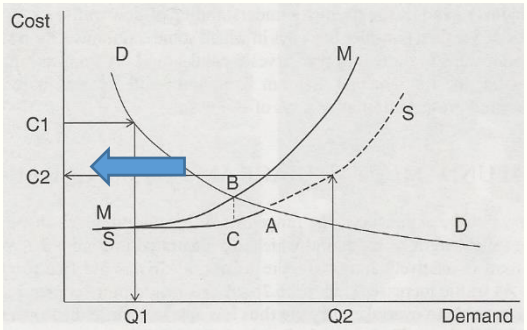
- Construction
  - Wider roads
  - Redesigned junctions
  - New roads
- These change the supply curve
  - And hence attract more users
  - E.g. Poppleton Bar roundabout upgrade
  - Traffic increased by 20% in two years
  - But still congested
- And are very difficult in inner York
  - York Inner Ring Road as proposed in 1971
  - And rejected in 1975



What can we do to reduce congestion? (2): Reducing demand: offering alternatives

- Reducing travel
  - Shorter journeys
    - The 20-minute city concept
  - Alternatives to travel
    - Online shopping, working from home
- Improving other modes
  - Walking, cycling, buses
- These change the demand curve
- And hence reduce car use
  - Resulting in reduced flows





What can we do to reduce congestion?
(3): Reducing demand: managing the road network

- Reallocating road space to "more efficient" modes
  - Bus lanes allow buses to overtake queues
  - But do not reduce capacity
  - As long as they end before the stop line
  - So person-hours in queues are reduced, even if vehicle-hours are not
- Reallocating road space to environmental improvements
  - Low Traffic Neighbourhoods (e.g. The Groves)
  - Pedestrian streets (e.g. our extensive footstreet network)
  - Reduce capacity, and divert traffic
  - But experience suggests that around 20% of traffic in the overall area "disappears"
  - So typically little adverse impact on congestion

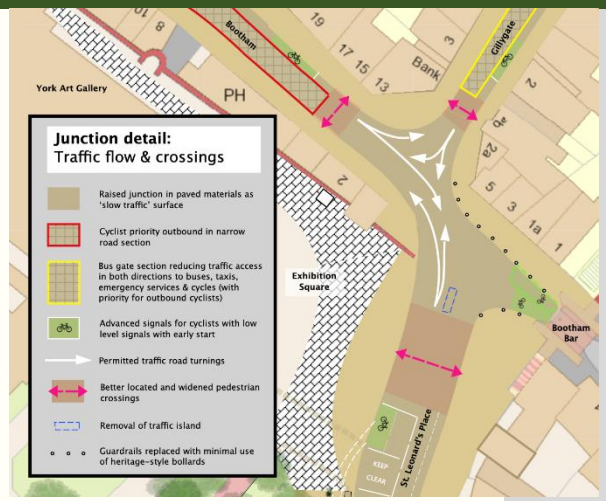
What can we do to reduce congestion?
(3): Reducing demand: managing the road network

- But closing or restricting roads
  - Will principally lead to re-routing
- And we need to be able to predict this

- Our proposal for Gillygate
  - Limits it to buses, taxis and emergency vehicles

- The map shows how traffic might re-route
  - If there is no reduction in traffic

- With impacts over a wide area
  - And much traffic moving to the Outer Ring Road



What can we do to reduce congestion? (3): Reducing demand: managing the road network

- Relocating queues to where they are less disruptive
  - The principle of "gating"
  - Traffic is held where queues can be better accommodated
  - With buses able to bypass queues (e.g. the Hull Road)
  - Reduce queue levels in the inner city
  - And will encourage switch to park and ride
- Can also be used for inner city roads
  - E.g. Gillygate, with traffic held in Clarence St and Lord Mayor's Walk
  - Reduced queueing substantially on Gillygate
  - And hence reduced pollution
- But these controls need to be maintained

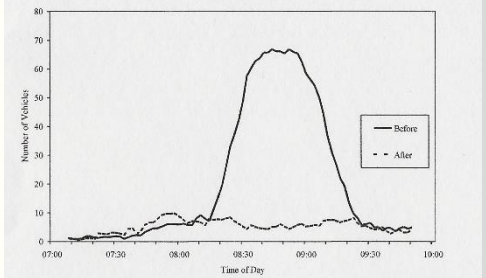
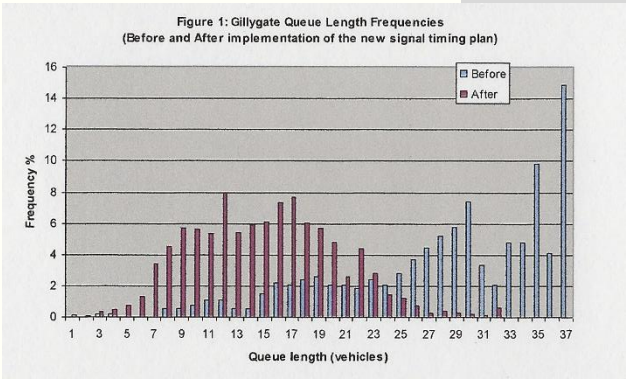
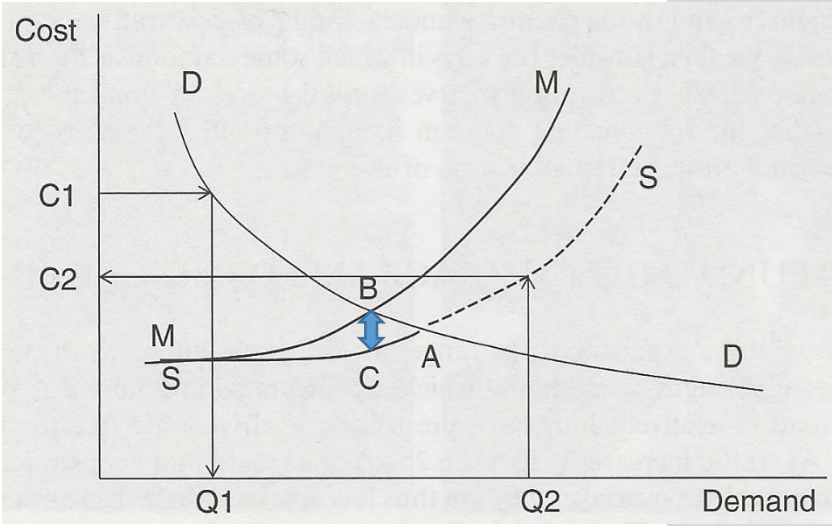


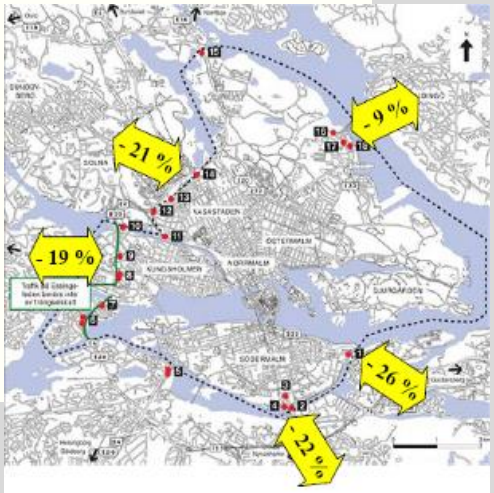
Figure A3: Before and after inbound queue at Melrosegate junction during the morning peak period



What can we do to reduce congestion? (4): Reducing demand: managing car use

- Parking controls and charges
  - Demand falls as charges rise
  - But only around 50% of parking can be controlled
- Road pricing
  - Which ideally charges the marginal cost
  - BC is the optimal charge
  - And road pricing should in principle be the most efficient means of reducing congestion
  - Typically the optimal charge reduces traffic by 15% to 25%
  - As in Stockholm
  - Which is roughly what we experienced in mid 2020





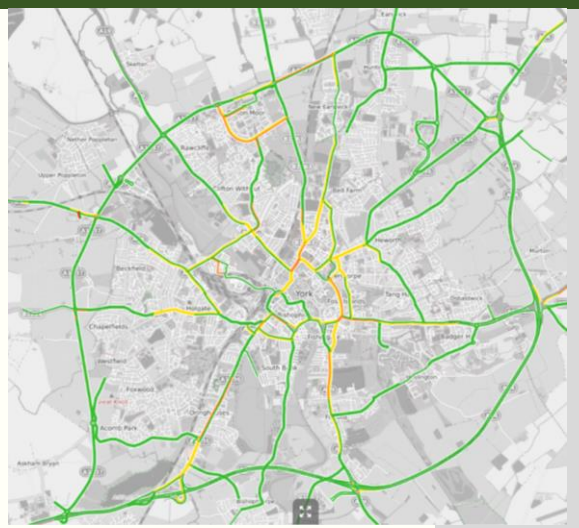
What can we do to reduce congestion?
(4): Reducing demand: managing car use

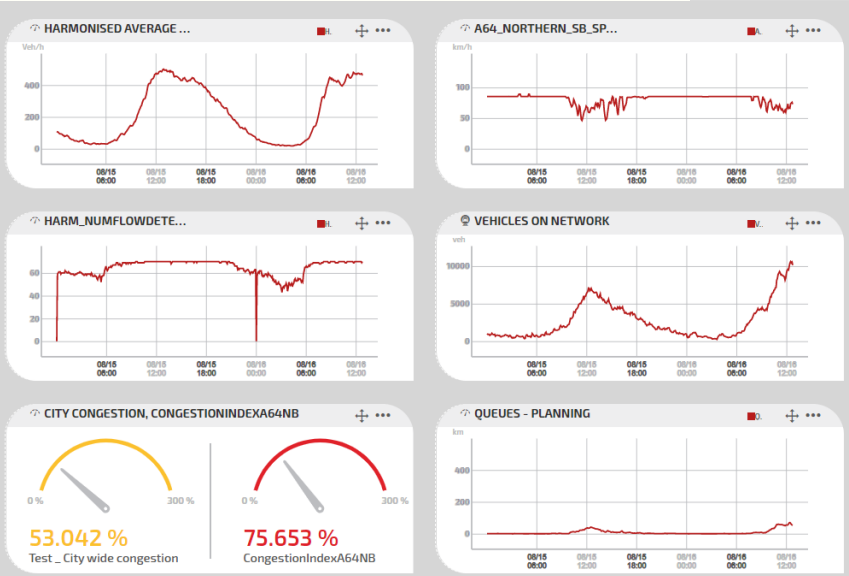
- Road pricing has achieved significant reductions in emissions
  - 13% to 21% for CO_2
  - 8% to 18% for NOx, PM_{10}
- Exemptions for low emission vehicles can intensify these effects
  - But may detract from the focus on congestion relief

City	CO_2	NOx	PM_{10}
London	-16%	-13%	-15%
Milan	-14%	-17%	-18%
Rome	-21%	NA	-11%
Stockholm	-13%	-8%	-13%

What can we do to reduce congestion?
(5): Increasing capacity: improved vehicles and drivers

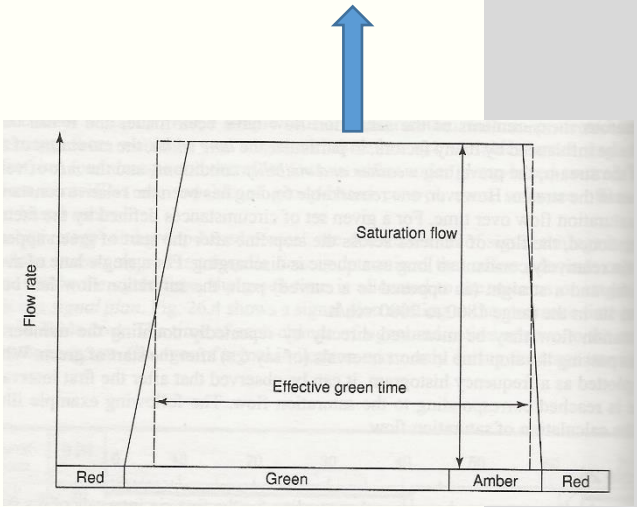
- Connected vehicles
  - Exchange information between vehicle and system
  - Help improve real-time traffic control
  - And suggest alternative routes
- CYC's Smart Transport Evolution Programme
  - Collects data:
    - Flows from 100 count sites
    - Signal settings 150 traffic signals
    - Speed from TomTom sat navs
    - Highway condition from operators
  - Provides information:
    - To traffic controllers on delays, high flows
    - To drivers on green time at signals
    - To the public on congestion
- But will this reduce congestion?



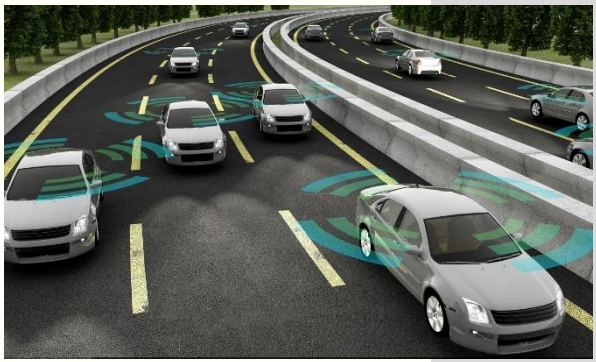


What can we do to reduce congestion?
(5): Increasing capacity: improved vehicles and drivers

- Autonomous vehicles
  - Increase safety and driving comfort
  - Reduce time headway between vehicles
  - So increase saturation flow
  - Expand the population able to use cars
- Uncertainties
  - Removes the driving task
  - Lower value of time driving may increase car use
  - With resulting reductions in public transport, walking and cycling
  - And potentially increased urban sprawl
  - Empty returns to base may increase traffic levels further



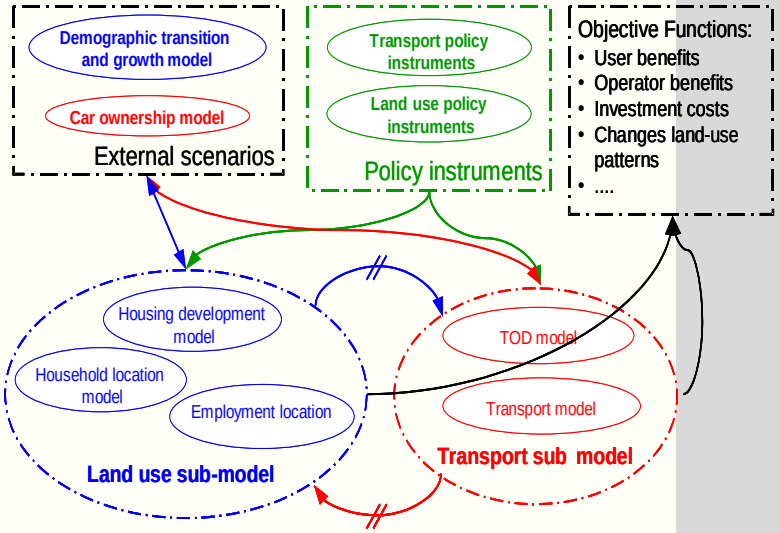
What the literature says on autonomous vehicles



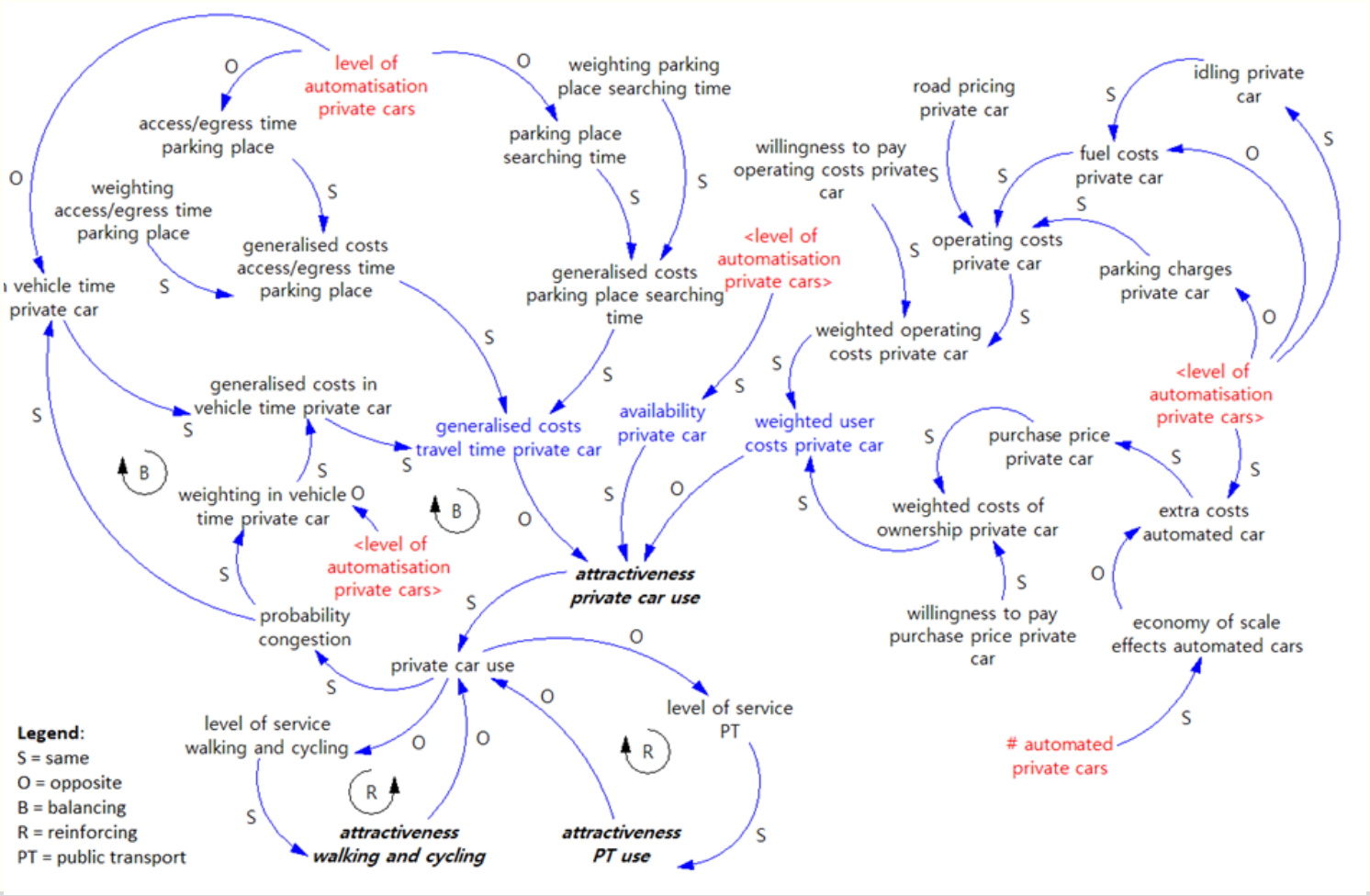
- Reduced vehicle headways increase capacity
  - 2 second reaction time reduced
  - So saturation flow rises
  - 100% fleet share increases capacity by 40% - 50%
  - But 40% fleet share only achieves up to 8%
- Potential demand effects
  - In-vehicle values of time could fall by between 5% and 50%
  - Time spent finding parking spaces and walking to and from them would be avoided
  - Allowing all adults to drive could increase car use by 2% to 10%

An assessment of possible impacts in Leeds

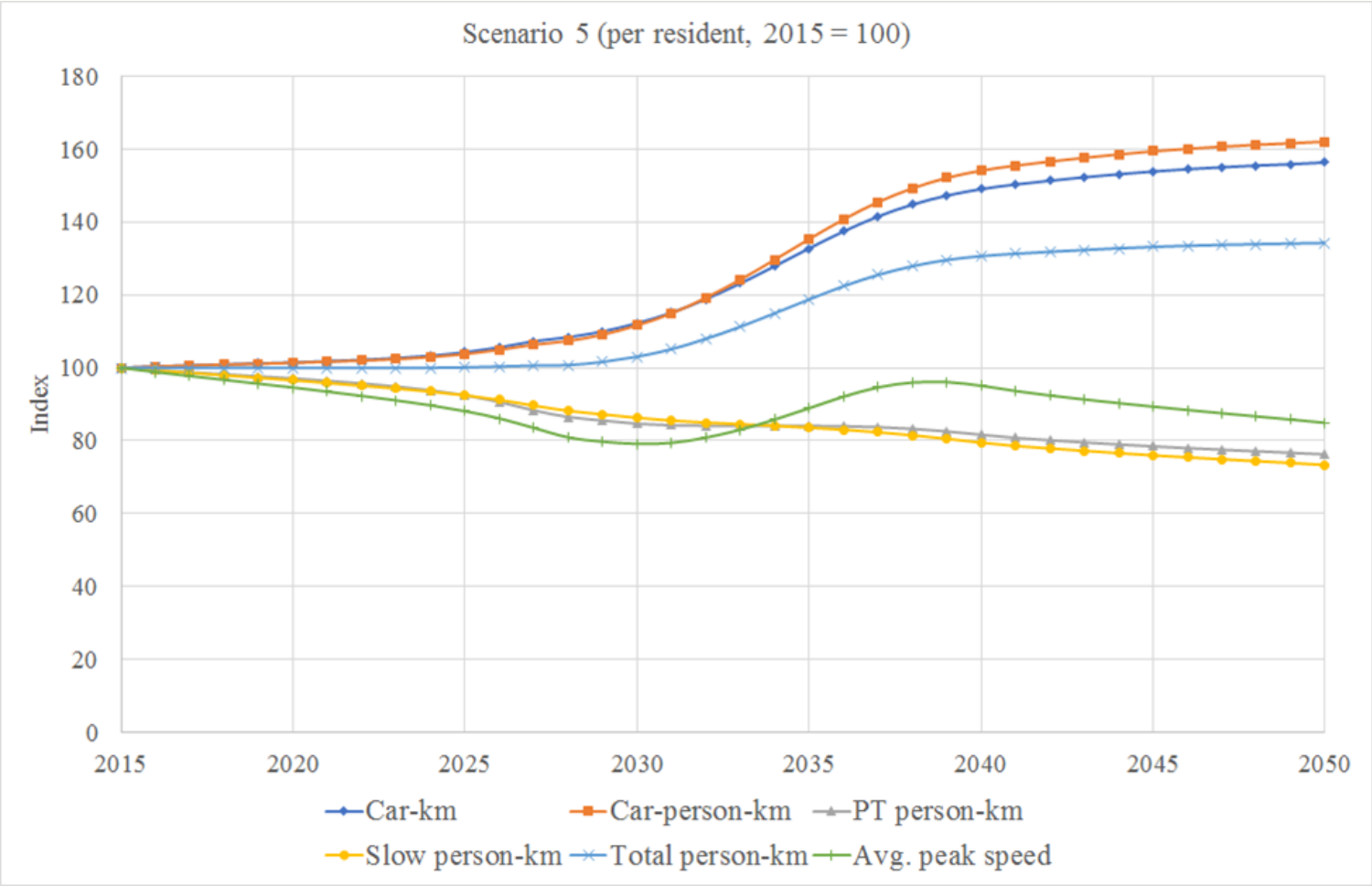
- The assumptions tested
  - Market share: 100% by 2040
  - Fleet share: 90% by 2050
  - Capacity: increases with fleet share
  - Parking: zero time cost at destination
  - Value of in-vehicle time: 50% lower than now
  - Wider usage: assumed available to all adults
  - No automation for public transport, freight
- Using a systems dynamics model
  - Of Leeds
  - Including transport and land use
  - Running for 30 years



A causal loop diagram



The effects over time



Potential effects by 2050

- If all impacts included (by comparison with no automation):
- Person-km up 39%
- Person-km in cars up 56%
- Person-km in public transport down 19%
- Person-km walking and cycling down 13%
- Average speed actually lower than now
  - But perceived costs of travelling by car lower

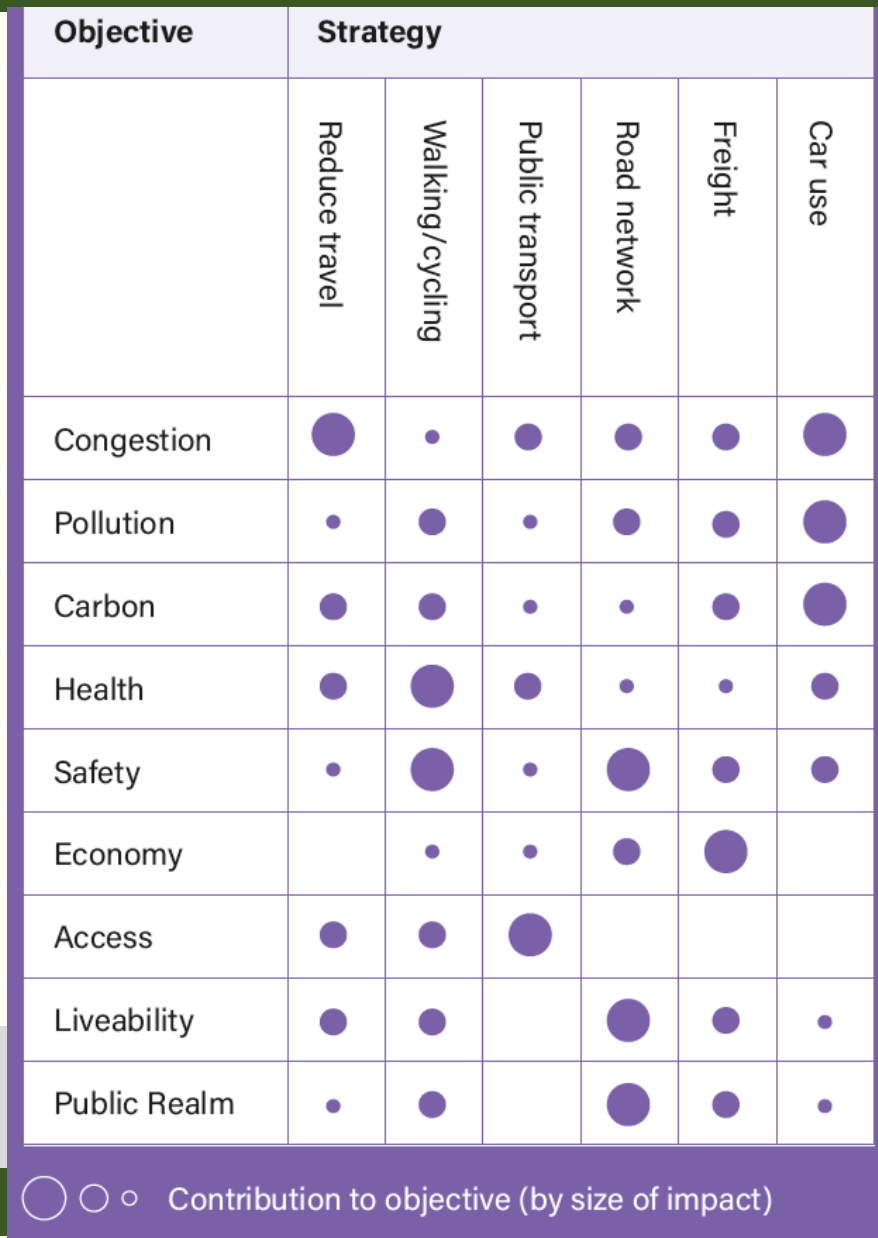
- So perhaps automation is not quite the panacea that government suggests!

But congestion relief is only one of our objectives

- **A vision for York: a city which respects its environment while enhancing quality of life, social justice and economic vitality**
- **Transport policy objectives:**
  - **Highest priority: reducing pollution, carbon emissions and congestion**
  - **Emerging priorities: improving public health and safety; supporting economic recovery**
  - **Continuing needs: enhancing equality of access, liveability, public space and heritage**

Wider policy implications

- Actions to reduce congestion
  - Can have co-benefits
  - Such as enhancing the environment
  - And improving public health
- But they may not support other objectives
  - Such as the economy or access
- And transport systems are complex
  - As demonstrated by the analysis of autonomous vehicles
- So we need to address all our policy objectives together
  - And consider the full range of measures
  - And the interactions between them
- This has been the focus of our Transport Strategy for York



Questions and further information

Questions?

For further information:

York Civic Trust's Transport Strategy for York:

www.yorkcivictrust.co.uk/planning/a-transport-strategy-for-York-2022/

Related policy documents:

www.yorkcivictrust.co.uk/home/transport/transport-policy-matters/

Or do please email me:

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