Internalisation ‘trip capture’ Topic Paper

Contents

Internalisation ‘trip capture’ Topic Paper 1
Introduction 3
Definitions 5
Key evidence documents 7
North East Cambridge Area Action Plan Transport Evidence Base. 2019. Mott MacDonald 7
Future of Mobility, 2019. Department for Transport 10
The Last Mile, Delivering goods more sustainably. 2019. UK Government 10
A time of unprecedented change in the transport system. 2019. Government Office for Science 11
Building for Life 12: Third Edition. 2015. Building for Life Partnership 12
Linking Active Travel and Public Transport to Housing Growth and Planning. 2017. Sustrans 15
Healthy Streets. 2018. Transport for London 16
A Housing Design Audit for England. 2020. Place Alliance 17
A Fare Framework: How transit agencies can set fare policy based on strategic goals 19
Greater Cambridge Integrated Ticketing Study 20
Neuroscience for Cities, 2018. Future Cities Catapult 21
Fourth Industrial Revolution for the Earth: Harnessing the 4th Industrial Revolution for Sustainable Emerging Cities 22
Key issues 25
Land use monocultures 25
Demand responsive transport efficiency 25
Micromobility and street space 26
Phasing and habit forming 26

Interchange 26
Severance 27
Mental health, dementia, autism, and all levels of ability 28
Data infrastructure [being double checked] 28
Deliveries 29
Servicing 29
Dynamic kerbside 29
Public space 30
Air space 30
Recommendations for policy 31
A design led approach to placemaking 31
Policies that facilitate an experimental approach that can adapt over time 32
Coordination to ensure enabling infrastructure exists 33

Introduction

Internalisation or internal trip capture is the percentage of trips generated within North East Cambridge (NEC) that will both begin and end within the boundary of the Area Action Plan (AAP). As these internal trips will make up a portion of NEC's total trip generation, the higher the rate of internalisation, the lower the impact on the local and wider highway network. Evidence undertaken to support the preparation of the AAP shows that some of the existing roads within the local area, including Milton Road, are already at capacity and as such, the AAP will need to carefully manage vehicle movements to and from the area to ensure the plan can be delivered. Consequently, the NEC AAP needs to establish policies that create the right conditions to maximise internalisation and minimise the demand on the external road network. Internalisation will be key to meet the AAP's trip budget. This trip budget is an agreed planning approach, detailed in the transport evidence base and addendum, to limit the AAP trip generation within a site, which proposed developments will have to demonstrate their adherence to for approval.

Several factors are known to influence how much internal trip capture can be achieved within mixed-used developments. (https://pdfs.semanticscholar.org/d1c3/fdddde7200f1fbf4698e79cc280100b1cb6d.pdf) . These include the diversity of activities located within the site boundary and the proximity of the site to the urban core, as well as the quality of walking and cycling facilities and availability of high quality public transport inside – and immediately adjacent to – the site. On a number of these indicators, the NEC AAP's existing context is not predisposed to internal trip capture. The NEC AAP area is in Cambridge's urban periphery, with mono land use areas including business parks and industrial estates, a lack of activities or third places (accessible places between and beyond home and the workplace such that act as anchors of community life) (For definition of third place. P. Myers (2012). Going Home: Essays, Articles, and Stories in Honour of the Andersons. Online: https://books.google.co.uk/books?id=ja_1AwAAQBAJ&pg=PA37&redir_esc=y#v=onepage&q&f=false), poor quality public realm which is dominated by vehicles and associated car parking and traffic junctions, and poor public transport accessibility across the whole

site. Cambridge North Station provides local and national rail connectivity, but it is located almost 2.5km from Cambridge Regional College in the west of the AAP area, and the guided bus route passes on the southern edge of the site, rather than forming a transport spine centrally to the site.

The AAP policies have significant potential to establish a high share of internalisation at NEC. This can be achieved through policies looking at NEC's:

- 'hard measures', the physical experience of NEC, which could include the built form spatial decisions such as buildings' functionality, and interaction with the street, co-location of uses and the distribution of activities and community facilities , as well as decisions on the public realm and the permeation of non-car modes, these can support the idea of linked trips by providing different local destinations near each other to reduce trips; and
- 'soft measures', user-centred policies that add activity and attractiveness or influence the behaviours of residents, employees and visitors in their modal choices through incentive schemes, the digital experience of NEC, or even wayfinding design.

A combination of both soft and hard interventions will be key to optimise NEC's internalisation, and this needs to ensure that it considers all levels of ability and all age groups to support mixed, balanced and cohesive communities.

This paper aims to provide policy recommendations for the Area Action Plan in order to increase the rate of trip internalisation and minimise the impact of development on the local and strategic highway network. It firstly considers key evidence related to trip internalisation, details key issues for policymakers to be aware of, and then provides policy recommendations for the Area Action Plan. To do this, the paper draws upon the transport study evidence base (and addendum) and wider policy and research.

Definitions

Internalisation	Internalisation or internal trip capture is the percentage of trips generated that both begin and end within a site or area. In this case, it is the number of trips that begin and end within the North East Cambridge Area Action Plan area.
Trip budget	The limit to the peak hour vehicular trips that the AAP can generate to avoid creating a severe impact on the local and strategic highway network in terms of traffic flow and congestion.
Travel Demand Management (TDM)	Policies to reduce, retime, reroute and remode trips to decease demand for vehicular travel on the network.
Micromobility	Modes of transport through very light vehicles such as push scooters or electric scooters.
Dockless	A system that enables users to park without being connected to a fixed terminal, such as bike hire schemes.
Connected and Autonomous Vehicle (CAV)	Vehicles that have autonomous functionality, from self-parking or auto-collision avoidance to self-driving, and are able to perform vehicle-to-vehicle communication.
Meanwhile	Short-term use of space or buildings, often plug the gap until sites reach full maturity and permanent facilities are provided.
Woonerf	A street calibrated as a social space, rather than a thoroughfare, with a level surface, indirect carriageway and low vehicular speeds (design speed is ‘walking pace’).

Personal Rapid Transit (PRT)	Small automated vehicles such as podcars operating on a network of specially built guideways.
Drone	Remote-controlled or automated pilotless/driverless small vehicle often with flying capability and mounted with camera.
Car Free Day	A day or time in which vehicular use is not permitted and streets are animated by pedestrians.
Fourth Industrial Revolution (4IR)	Emergence of new technology systems including: internet of things, Artificial intelligence, Blockchain, Advanced materials, Advanced sensor platforms, 3D printers, Virtual reality, 5G, Robots, Drones
Mobility as a service	The integration of various forms of transport services into a single mobility service accessible on demand, often via a mobile phone application

Key evidence documents

This section identifies the key related evidence base documents which have been prepared to support the preparation of the North East Cambridge Area Action Plan as well as wider research and best practice papers.

North East Cambridge Area Action Plan Transport Evidence Base. 2019. Mott MacDonald

Summary of findings

Trip budget

A threshold has been set for mitigating the impact of vehicular traffic from development within the NEC AAP area on the existing highway network. This has been defined as a Trip Budget, a planning tool that allocates a number of peak time vehicular trips for the AAP site as a whole. The overall number of trips allocated in the budget cannot be exceed by new development in order to ensure there is not adverse impact on the highway network. This trip budget is detailed below.

From the Transport evidence base study:

> "Standard trip rates modified to fit local conditions have been derived to allow estimation of both person and vehicle trips for both existing and proposed future land uses in the study area. Based on this data, it is predicted that the future development scenarios being considered as part of this AAP evidence base could result in total person flows by all modes which are two to three times higher than existing flow levels, and so will require significant car driver mode shift in order that impacts on the highway network are minimised.
>
> A traffic modelling exercise was undertaken to establish a vehicular trip budget level for the study area within which development expansion could take place without creating a severe impact on local highway conditions, and to identify the level of car driver mode shift that would

be required for each development scenario to achieve this. Assuming that the investment in committed transport projects is delivered, and based on the average results for all development scenarios, this analysis suggests the following peak hour trip budget levels:

- AM peak hour: 3,900 two-way vehicle trips.
- PM peak hour: 3,000 two-way vehicle trips."

The transport addendum work allocates another trip budget from Kings Hedges Road. For access on to Kings Hedges Road, the trip budget is:

- AM Peak: 780 two-way trips
- PM Peak: 754 two-way trips

Trip internalisation

The transport evidence base identifies significant potential for trip internalisation. It categorises trips at NEC into the following six main categories listed below:

- Work related (grouping 'Work' and 'Employers business')
- Education
- Shopping
- Personal business
- Recreational/social
- Leisure (grouping 'Visiting friends/family' and 'Holidays')

In order to comply with the trip budget, the site as a whole will need to significantly reduce the car-driver mode share down from the 70% indicated in the Census but the final figure depends on the development mix". The study analyses all these trip types using the emerging spatial framework to estimate the overall residential trip internalisation rates achievable in the study area.

To achieve this level of internalisation, the transport evidence paper recommends addressing internal severance in NEC and increasing internal connectivity. The salient points from this are summarised below.

Severance features to address

Milton Road

At grade (at street level) or grade separated (e.g. bridge or under-pass) facilities for pedestrians and cyclists to cross the Milton Road are recommended to increase east west permeability.

Busway and existing development

Crossing points across the busway, including a toucan between Nuffield Road and Cambridge Business Park are suggested as well as access through existing development to improve permeability.

Additional connectivity

Internal shuttle system routes

Autonomous driverless vehicles such as pods, trains or separated cable cars that avoid interaction with highway network to enhance internal connectivity.

Spatial framework

The Area Action Plan spatial framework needs to create a permeable high level plan that provides viable alternatives to travel by private car:

- Public transport accessible to all areas; within 400m of bus stop and 800m of Cambridge Guided Busway.
- Clear wayfinding with an extensive network of high quality, legible pedestrian and cycle routes and cycle parking at key destinations
- Priority of active modes, including micro mobility, on road hierarchy
- Attractive placemaking
- Limited parking provided offsite from developments, not within the public realm
- Residential provision linked to workplaces
- Marketing campaigns to create sense of place and encourage sustainable travel choices

- Limit servicing trips to off peak times

Future of Mobility, 2019. Department for Transport

Summary of findings

To engender the growth of future mobility, the Department for Transport (DfT) identified the following principles that are applicable to the NEC AAP:

- Implement a flexible regulatory framework to trial new mobility including Mobility as a Service (Maas) and micromobility (p 53)
- Encourage data sharing (p 56)
- Prepare the urban environment through design and allocation of space (p 57)
- Promotion of zero emission vehicles, including e-cargo bike incentives and charging solutions for electric vehicles (EVs)

Reference

Department for Transport, Industrial Strategy. 2019. Future of Mobility: Urban Strategy, Moving Britain Ahead. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/846593/future-of-mobility-strategy.pdf

The Last Mile, Delivering goods more sustainably. 2019. UK Government

Summary of findings

To ensure the NEC AAP can accommodate the sustainable deliveries the following should be acknowledged:

- a cost gap between Ultra Low Emissions Vehicle vans and internal combustion engine vans exists as a key barrier to transition to sustainable transport (p 21)
- the Government is collaborating with industry in the coming years to help the logistics sector fulfil the commitment to reduce HGV carbon dioxide emissions by 15% by 2025 (p 22)
- availability of charge points is key to enable uptake of electric vehicles (p 24)

Reference

Government Response to Call for Evidence The Last Mile – Delivering goods more sustainably.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786879/last-mile-call-for-evidence-government-response.pdf

A time of unprecedented change in the transport system. 2019. Government Office for Science

Summary of findings

The NEC AAP should consider these key findings from the Government Office for Science's report:

- **"Integrate passenger transport with freight, alongside housing priorities, when making planning decisions**. Government can minimise future uncertainty by designing policies that meet multiple objectives and reconfiguring the way in which space is used, for example planning transport developments alongside housing development, while also integrating with existing town and city infrastructure. Government should also work in partnership with the privately-operated freight sector to ensure that developments cater for passenger and freight transport, where possible.
- **Use both hard and soft measures to achieve the scale of change needed**. As most travel behaviour is habitual, it is critical to understand what users want and how they make decisions when faced with incentives. Further research and regional data collection to understand travel behaviour at local scales should be used to inform local policies.
- **Consider the impact of future technologies on revenues and costs**. This is important, given the likely scale and pace of change. With current policies, the shift to electric vehicles decreases revenue from fuel duty, and automation may decrease parking charges. Policy choices such as road pricing may need to be considered among other

demand-side interventions. Technology can also significantly reduce operational and infrastructure costs.

Consider prioritising walking and cycling when allocating land use for transport to promote wider social benefits. Such an approach can change transport behaviour, improve people's health, reduce levels of physical inactivity and sedentary behaviour, and reduce air pollution and congestion. Effective ways to increase walking and cycling are well known internationally; for example, Copenhagen has markedly increased cycling over the last 20 years. Overall, this entails a mixture of investment in hard infrastructure (e.g. dedicated separate cycle networks) and softer measures." P.6

Reference

Government Office for Science. 2019. A time of unprecedented change in the transport system. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/780868/future_of_mobility_final.pdf

Building for Life 12: Third Edition. 2015. Building for Life Partnership.

Building for Life 12 is a government-endorsed industry standard for well-designed homes and neighbourhoods. Local communities, local authorities and developers are encouraged to use it to guide discussions about creating good places to live.
The report asks 12 easy to understand questions that are designed to be used as a way of structuring discussions about a proposed development. Many of these design challenges can induce internalisation of trips through good design. These are listed below for consideration in the NEC AAP.

Integrating into the neighbourhood

1. Connections

Does the scheme integrate into its surroundings by reinforcing existing connections and creating new ones, while also respecting existing buildings and land uses around the development site?

2. Facilities and services

Does the development provide (or is it close to) community facilities, such as shops, schools, workplaces, parks, play areas, pubs or cafes?

3. Public transport

Does the scheme have good access to public transport to help reduce car dependency?

4. Meeting local housing requirements

Does the development have a mix of housing types and tenures that suit local requirements?

Creating a place

5. Character

Does the scheme create a place with a locally inspired or otherwise distinctive character?

6. Working with the site and its context

Does the scheme take advantage of existing topography, landscape features (including water courses), wildlife habitats, existing buildings, site orientation and microclimates?

7. **Creating well defined streets and spaces**

Are buildings designed and positioned with landscaping to define and enhance streets and spaces and are buildings designed to turn street corners well?

8. **Easy to find your way around**

Is the scheme designed to make it easy to find your way around?

Street & home

9. **Streets for all**

Are streets designed in a way that encourage low vehicle speeds and allow them to function as social spaces?

10. **Car parking**

Is resident and visitor parking sufficient and well-integrated so that it does not dominate the street?

11. **Public and private spaces**

Will public and private spaces be clearly defined and designed to be attractive, well managed and safe?

12. **External storage and amenity space**

Is there adequate external storage space for bins and recycling as well as vehicles and cycles?

Reference

Building for Life Partnership (Cabe at Design Council, Design for Homes and Home Builders Federation), Nottingham Trent University. 2015. Building For Life 12. Available online: https://www.designcouncil.org.uk/resources/guide/building-life-12-third-edition

Linking Active Travel and Public Transport to Housing Growth and Planning. 2017. Sustrans

Summary

The key messages from the report are summarised below:

‘1 Sustainable transport usage will be significantly increased if direct, attractive and safe walking, cycling, and public transport infrastructure are built both within and to connect new developments to existing networks.

2 The sooner sustainable transport is fully considered within the planning of a new development the more efficient their location, use and value will be.

3 In order to maximise sustainable travel, it is important to ensure:

a) The right transport infrastructure is built into new developments from the outset; and

b) New developments are connected to existing sustainable transport networks to enable people to reach their destination.

4 Walking routes should be coherent, direct, safe, comfortable and attractive.

5 The provision of safe, direct and attractive cycling routes alongside convenient and secure cycle parking should be provided.

6 A clear sensible layout with through routes ensuring the permeability of new developments for walking, cycling and public transport routes is essential.

7 In conjunction with sustainable transport provision, private motor vehicle use should also be managed - for example speed restrictions and parking management.

8 There are a number of freely accessible tools to help plan and develop the business case for cycling and walking schemes to connect new developments to employment and other services people require access to.

9 Active travel provision should also integrate with public transport use for longer journeys to enable convenient, attractive sustainable modes from door to door. This needs to include improving access and secure parking infrastructure for bikes.' P3

Reference

Sustrans. 2017. Linking Active Travel and Public Transport to Housing Growth and Planning. Available online at: https://www.sustrans.org.uk/media/4491/4491.pdf

Healthy Streets. 2018. Transport for London

The Healthy Streets Approach and the 10 Indicators of a Healthy Street were developed by Lucy Saunders, a specialist in public health and transport. These were first included in Transport for London (TfL) policy in the first Health Action Plan in 2014 and TfL has been working on how to deliver this Approach in London. The Mayor expects the Healthy Streets Approach to be delivered by all parts of the GLA family, as set out in A City for All Londoners and Healthy Streets for London.

The Healthy Streets Approach is a system of policies and strategies to deliver a healthier, more inclusive city where people choose to walk, cycle and use public transport. The 10 Healthy Streets Indicators are the essential ingredients for a healthy street environment. The 10 evidence-based indicators are deemed to be

what makes streets appealing, healthy, inclusive places. Working towards these should help to create a healthier city, in which all people are included and can live well, and where inequalities are reduced.

The ten indicators are:

- Pedestrians from all walks of life
- Easy to cross
- Shade and shelter
- Places to stop and rest
- Not too noisy
- People choose to walk, cycle and use public transport
- People feel safe
- Things to see and do
- People feel relaxed
- Clean air

Reference

Transport for London. 2018. Healthy Streets Explained: A guide to the Healthy Streets Approach & how to apply it. Online: https://tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/healthy-streets

A Housing Design Audit for England. 2020. Place Alliance.

Summary of findings

The Housing Design Audit for England provides a systemic approach to assess the design quality of the external residential environment to improve placemaking and enhance the potential for internalisation of trips. It scored new housing developments across England on a variety of metrics under the following broad categories:

- Environment and Community;
- Place Character;
- Streets, Parking and Pedestrian Experience; and
- Detailed Design and Management.

These were then subdivided into a greater number of metrics. The report found that generally the East of England region was building mediocre places. This reduces the spectre for internalisation as the higher the place quality the more internalisation of trips can be expected.

Key recommendations for local authorities:

Set very clear aspirations for sites (in advance)

All design governance tools help to deliver better design outcomes and it is far better to use them than not. However, the use of proactive tools that encompass design aspirations for specific sites are the most effective means to positively influence design quality. Such tools give greater certainty for housebuilders and communities, but their use and the sorts of design ambitions that they will espouse should be made clear in policy, well in advance of sites coming forward for development.

Design review for all major housing schemes

Local authorities should themselves establish or externally commission a design review panel as a chargeable service and all major housing projects should be subject to a programme of design review. Advice on how to do this can be found in Reviewing Design Review.

Deal once and for all with the highways / planning disconnect

Highways authorities should take responsibility for their part in creating positive streets and places, not simply roads and infrastructure. Highways design and adoption functions should work in a wholly integrated manner with planning, perhaps through the establishment of multi-disciplinary urban design teams (across authorities in two tier areas), and by involving highways authorities in the commissioning of design review.

Refuse sub-standard schemes on design grounds

The NPPF is very clear in its advice that “good design is a key aspect of sustainable development”. Consequently ‘poor’ and even ‘mediocre’ design is not sustainable

and falls foul of the NPPF's 'Presumption in favour of sustainable development'. Local planning authorities need to have the courage of their convictions and set clear local aspirations by refusing schemes that do not meet their published design standards.

Consider the parts and the whole when delivering quality

Some well-designed large schemes are being undermined by a failure to give reserved matters applications adequate scrutiny or through poor phasing strategies resulting in the delivery of disconnected parcels of resident

Reference

Place Alliance. 2020. A Housing Design Audit for England. Available online: https://indd.adobe.com/view/23366ae1-8f97-455d-896a-1a9934689cd8

A Fare Framework: How transit agencies can set fare policy based on strategic goals

Summary of findings

Fare capping

Fare capping means public transport users who pay per ride are not charged additional fares once they have spent the equivalent cost of an unlimited transit pass. This ensures that users who can't afford the upfront cost of a weekly or monthly pass no longer pay more than riders who can.

Simplified fare structures and integration of ticketing.

Reduce fare structure complexity and make paying easier across different operators. Flat fares across services regardless of distance or time of day, were found to reduce barriers to public transport uptake.

Robust discount fare programs.

Providing a variety of discount and low-income fare programs helps increase public transport usage. Free passes and discounts provided to the elderly, young people, disabled residents, and/or people with very low incomes have been seen to make transport more affordable to people who need it most.

All-door boarding on buses

Can increase average bus speeds, reduce dwell times, and increase bus ridership. Early concerns about a decrease in fare revenue were proven to be unfounded, and the rate of fare evasion was not found to have increased.

Reference

TransitCenter. 2019. A Fare Framework. How transit agencies can set fare policy based on strategic goals. Available online: https://transitcenter.org/wp-content/uploads/2019/10/FareFramework-1.pdf

Greater Cambridge Integrated Ticketing Study

Key findings

The report outlines that Integrated Ticketing in Cambridge is desirable and feasible. It outlines the following timescale for integrated ticketing.

- Current Situation: cEMV Model 1 (bank cards) cash replacement, ITSO smart and mobile phone ticketing on Stagecoach bus and rail services. ENCTS passes are accepted on bus.
- Deliverable #1 March 2021: cEMV Model 1 cash replacement on all Greater Cambridge bus services.
- Deliverable #2 February 2022: Multi-token ABT on all Greater Cambridge bus services.
- Deliverable #3 June 2022: Multi-token ABT extended to Greater Cambridge rail services.

Reference

Connecting Cambridgeshire. 2019. Greater Cambridge Integrated Ticketing Study. Available Online: https://www.connectingcambridgeshire.co.uk/wp-content/uploads/2019/08/Greater-Cambridge-Integrated-Ticketing-Final-20190529.pdf

Neuroscience for Cities, 2018. Future Cities Catapult

Key findings

Ageing populations, artificial intelligence (AI), climate change and mobility are all going to impact on how spaces are designed. Understanding the cognitive impact of this is increasingly important to ensure that the city remains accessible. How it sounds, looks, smells and functions can be incredibly influential on how people move around the built environment, especially for people with mental health problems, dementia, autism or other disabilities.

Some of the key considerations include:

Acoustics

Control acoustics to minimise background noise, echo and reverberation to suit the individual and level of focus required.

Spatial sequencing

Design spaces in a logical order based on use to support routine and predictability.

Transitions

Using transition zones helps the individual recalibrate their senses as they move from one level of stimulus to the next.

Safety

Safety is especially key for people who may have an altered sense of their environment.

Reference

Future Cities Catapult. 2018. Neuroscience for Cities. Available online: https://futurecities.catapult.org.uk/wp-content/uploads/2018/06/Neuroscience_x_Cities_A5_1306.2-reduce-size.pdf

Fourth Industrial Revolution for the Earth: Harnessing the 4th Industrial Revolution for Sustainable Emerging Cities

Key findings

Integrated data

- Integrated public transport systems, on-demand mobility and intelligent traffic management will be crucial for improving air quality and connectivity in gridlocked emerging cities. Fourth Industrial Revolution (4IR) innovations can improve current traffic flow and management.

Internet of things (IoT)

- IoT and AI, coupled with big data and low-tech solutions including mobile phones and GPS navigation systems, can automate traffic monitoring and communicate congestion to vehicles on the road. This can help to optimise route planning, cut travel time and reduce Green House Gas (GHG) emissions.

Blockchain

- Blockchain technology, combined with real-time pattern recognition data, can help cities price and trigger incentives for transport network companies to

provide services during off-peak times and to complement public transport. Technological advances can also help reduce traffic volumes.

Autonomous Vehicles (AVs)

- Autonomous vehicles (cars, buses and trucks), especially when low or zero-emission and deployed for shared transport and logistics services, can reduce energy use, emissions and the number of vehicles on the road.

Drones

- Drones can be used for maintenance, to ensure that buildings and installations are operational more of the time, or for high-resolution real-time aerial data solutions and equipped with sensors linked to IoT platforms in a way that can offer real-time traffic and logistics information for optimised routing.
- Drones can also be used for delivery, airborne drones would reduce trips on the road. This would require accessible rooftops.

Virtual reality

- Virtual, augmented and mixed reality meeting services in shared spaces could also reduce the need to travel for meetings, boosting broader connectivity and the competitiveness of smaller companies in emerging cities.

Ultra-high speed surface solutions:

- A number of companies are in the early stages of prototyping a super high speed vacuum-based transportation system called Hyperloop. It is projected to be fully self powered by solar panels along the tunnel surface. Advanced materials are planned for the tunnel, the vehicle and for next-generation rechargeable battery storage devices. The vehicle itself will be highly automated using AI. Potential travel speeds above 500 miles per hour (805 kilometres per hour) between cities means that Hyperloop could provide a

cheaper and cleaner alternative to air travel and long-haul road transport, particularly for those cities within one to two-hour flight times.

Underground transport solutions:

- Although traditionally challenged both by physics and financial feasibility, further potential could be drawn from underground space. For example, The Boring Company, led by Tesla entrepreneur Elon Musk, is in the early stages of designing high-speed transport tunnels for short- and long-distance travel. The tunnels would be equipped with high-speed automated electric “skates” for short haul vehicle transport, or used as a long-haul Hyperloop vacuum-tube supersonic transport system. If this could be done efficiently, and enhanced by 4IR technology, these enterprises could play a role in tackling congestion, reducing air and noise pollution, lowering GHG emissions, and cutting travel time for passenger transport and logistics across and between cities. Many significant engineering and regulatory hurdles must, however, be overcome for this concept to become commercially viable, and serious questions exist about upfront capital and maintenance costs, seismic risk, lifecycle energy needs and the quality, safety and affordability of the passenger experience.

Reference

PWC. 2017. Fourth Industrial Revolution for the Earth Harnessing the 4th Industrial Revolution for Sustainable Emerging Cities. Available online: https://www.pwc.com/gx/en/sustainability/assets/4ir-for-the-earth.pdf

Key issues

Land use monocultures

The clustering of different uses was identified as a key constituent in trip type by the transport strategy and in the Place Alliance report. The existing land uses within North East Cambridge reflect a zoned approach, where similar uses are clustered within business and science parks as well as industrial estates. To address this, alongside community uses and recreation facilities, the current land uses envisioned in the Area Action Plan are:

- A1-A5 ancillary retail
- B1/B2/B8 employment
- C1 hotels
- C3 housing
- D1 public services
- D2 education

The walkable neighbourhood principle indicates that these need to be distributed across the site to ensure that journeys can be made by foot, cycle or micro mobility. The provision of these uses also raises some opportunity for the co-location of different uses to further reduce the need to travel through linked trips.

Demand responsive transport efficiency

Demand responsive transport is a transport service that responds to user needs. It can be split into fixed-route and on-demand services. On fixed routes, passengers gather at a stops, and the shuttle runs in a straight line that many people will find direct – these are also called personal rapid transport (PRT). In flexible, on-demand services, the vehicle meanders to serve various points where people have requested it, one example is Transport for London's on demand service for Sutton (https://tfl.gov.uk/modes/buses/demand-responsive-bus-service). This leads to more driving time for fewer customers than a fixed route. Fixed routes are likely to be more cost efficient than on-demand flexible routes, which is a key consideration for the operational efficiency of these services. As the Department for Transport's Future of Mobility Report suggests, demand responsive transport could be explored and tested at NEC to hone its utility.

Micromobility and street space

Micromobility is an emerging travel mode that encompasses shared cycles, push scooters, and e-scooters. These are similar to demand responsive transport in that they can be docked or free floating. Docked schemes are physical on-street stations for dropping off and picking up cycles or scooters, whereas free floating can be left in the public realm and accessible via an app on a smartphone device. The limitations of docking stations is that stations are costly to build, require street space and are often far apart or full which can be problematic for users, although they provide security for cycle storage and it keeps the cycles off the pavement where they can form street clutter. Free floating schemes can minimise public realm clutter by creating digital fences that designate areas for parking in the app. All forms of micromobility should be able to use the cycle lanes provided at NEC to encourage their use and minimise conflict with other street users. They can offer a transport choice and improved accessibility for all people, be financially sustainable as a business model, and should not impact negatively on the pedestrian environment.

Phasing and habit forming

As indicated in the transport evidence and the National Housing Audit phasing, ‘bringing forward ancillary uses’ is key to ensuring that the AAP area can mature well and embed good travel practices from its inception. This includes habit forming of localising trips and activities within the site. If ancillary uses are brought forward, it will help engender a sense of place early on in the development’s lifecycle and promote the localisation of activities, this could be done through meanwhile uses.

Interchange

An interchange is a modal change from / to passenger transport. This is different to a logistics hub which are for consolidating deliveries across the site. The lack of existing public transport penetration in some parts of the NEC AAP area, means that any new site-specific transport will require a change of mode or service provider at a

rail station or bus stop for external trips. The transport evidence base indicates that shuttle services could be explored to create a new NEC AAP specific coverage. To maximise the use of proposed internal transport modes, these need to be as seamlessly connected as possible to the wider public transport network. Seamless connection could be supported by integrated ticketing that reduces user friction. This enhances the efficiency of the network overall, enhancing its appeal to engender a culture of using a shuttle system.

Key to this will be the interchanges within the site. These are the interfaces between modes and operators; a shuttle mode and a guided busway stop or Cambridge North station, or a bus stop. As noted by London Travel Watch, these need to be made as seamless, accessible and legible as possible as 'Time spent at an interchange is essentially 'involuntary time' because having to interchange will always be second best to using a direct service, so the more convenient the change the better' ([1] London Travel Watch. 2015. Interchange matters: passenger priorities for improvement. Available online at: https://www.londontravelwatch.org.uk/documents/get_lob?id=4040&field=file). All interchanges will therefore require high quality design consideration to optimise the user experience, and operationally, timetable coordination will need to be conducted to provide optimal functionality and incentivise public transport use.

Potential interchanges will be:

- Cambridge North railway station
- Milton Road Park and Ride
- Guided bus stops
- New logistic hubs for freight
- CAM Stops/Stations

Severance

Severance inhibits the permeability of North East Cambridge at key points which has a negative impact on the potential for internalisation. Milton Road, the guided busway, A14 and the railway are all points of severance hindering the axial and radial accessibility of the AAP area. These existing severance features will need to

be addressed. Development proposals can through comprehensive masterplanning, improve permeability for movements across the site in all directions. Proposed public realm and transport interventions, such as shuttles, will need to ensure they reduce severance for all movements. New infrastructure could become a new source of severance and therefore needs to this needs mitigated in discussion with providers.

Potential points of severance are:

- Milton Road for east-west movements
- Guided busway for north-south movements
- Railway for access to Chesterton Fen
- A14
- Existing land uses and development layout

Mental health, dementia, autism, and all levels of ability

Legibility across the AAP area will also need to be considered as sensorial experience that can help people of all abilities, including those with dementia, mental health conditions and autism to enable them to experience and move around the area comfortably, safely and easily. This should also include people of all ages, to empower children and young people to take short trips unaided as well as enabling older people to live independently for longer. Design that acknowledges neuroscience as a key factor of mobility, as outlined in the Future Cities Catapult, neuroscience for cities can help achieve a more inclusive built environment. An environment that is not inclusive to these needs could alienate people from internal trips and lead to more people using unsustainable modes.

Data infrastructure

Smart mobility generates data, and this should be captured where possible. This will the planning and transport authorities to shape and provide an oversight of transport services as well as create opportunities for better local services that can lead to an uptake in walking, cycling, other active travel and public transport. The Department for Transport's Future of Mobility report encourages data sharing of data from transport services, including ride-hailing. This could be done through procurement

where all operators need to provide machine readable data to the council and/or where sensors to monitor local environmental issues are provided to local people at NEC to understand local issues and decide what and how to address them. In enabling local people to have oversight on the data they produce this could provide opportunities for better services and social innovation.

Deliveries

The growth of internet shopping and on-demand services is increasing trip generation by adding delivery vehicles to the road. As the Government's 'The Last Mile' paper demonstrates, there is significant potential to increase the sustainability of delivery practices. This could be achieved by creating a freight consolidation centres/localised logistic centres and providing an enabling environment for zero emissions modes to deliver goods, either through paths accommodating cargo bikes or charging infrastructure for electric goods vehicles.

Servicing

Servicing has the potential to contribute to the internalisation of trips, as waste facilities off-site generate more trips and service trips can be planned to minimise trips. The places that scored worst on the National Housing Audit were those where the public realm prioritised bins and road space, highlighting how NEC has an opportunity to create a human centred place that is serviced sustainably and efficiently to minimise the impact on the road network and the design of the public realm. Developments could explore establishing an automated vacuum collection system for collecting waste to minimise public realm disruption and restricted access for servicing vehicles to ensure these occur at times of day that are not a nuisance to residents and workers.

Dynamic kerbside

With higher density development proposed at NEC, on-street parking will require control measures to be in place, which also has implications on mobility. Given the potential for private car free living, the growth of ride hailing apps and car sharing, there may be a growth in kerbside pick-ups and drop-offs, which could become an

issue for congestion, noise and air pollution and local environmental quality. Kerbside pick-ups and drop-offs could be an opportunity for charging to disincentivise external trips. This would require the utilisation of ANPR data.

Public space

The quality and user experience of NEC's public space will be a key factor in determining people's desire to conduct local trips by foot or cycle. This is a key component of the National Housing Audit's findings and Building for Life 12. Public space needs to feel safe and comfortable. This will mean providing a sense of enclosure where appropriate, establishing seating that enables pedestrians to dwell, creating areas of shade and planting to cool the public space in summer months and protection from the weather in the winter, creating multi-generational and multi-ability activities of interest along key routes and spaces, and facilitate passive surveillance with buildings that relate to the street at the ground floor and overlook public spaces, including side elevations. Differentiating streets for high capacity movements and lower ones is key even for active travel, where quiet routes (such as TFL Quietways) will provide alternatives to faster routes, often based around using residential streets and public spaces. Public space experience is also contingent on the management of this space. Even where spaces are not adopted by relevant public authorities they should feel and operate as if they are safely accessible to the public at all times of day.

Air space

As the Fourth Industrial Revolution takes hold, outlined by PWC, NEC could consider the role of unmanned airborne drones. These could be tested for deliveries, servicing, and the inspection of tall building facades. The AAP provides an opportunity to consider how air can consider opportunities and balanced them with other considerations including privacy, noise and safety concerns.

Recommendations for policy

A design led approach to placemaking

- NEC's rate of internalisation will hinge primarily on good urban design and its delivery of placemaking.
- The site needs to be delivered as a coherent whole, where:
    - amenities are within 5-10 minutes walking distance from residential areas and businesses;
    - streets prioritise human presence and active travel over car modes, the urban grain is permeable; and
    - routes are legible with landmarks and edges enabling intuitive wayfinding.
- This requires a well-considered phasing strategy.
- The evidence documents clearly share the view that placemaking, a key element of internalisation, will be facilitated by design decisions.

Adaptable street design that supports active travel and well-being

- NEC needs public spaces that are designed to make active travel the first-choice mode for all ages and abilities.
- Public space needs to inclusive and consider the needs of:
    - Those with dementia and mental health conditions;
    - all ability levels; and
    - all age groups.
- Public spaces should facilitate opportunities to dwell with public seating which is accessible and available to use all year round as well as publicly accessible toilets. To achieve this the public realm should:
    - provide opportunities to sit;
    - establish public toilets; and
    - deliver planting to enhance interest, biodiversity and sustainability

- Any on-street parking and delivery bays should be inset in footways where possible so that the space given to the public realm is maximised when cars are not parked.

Innovative use of density

- All residents, workers, and visitors should be able to find everything they need within a short walk (5 to 10 minutes). This will support the concept of linked trips as co-locating uses will help make local options the first choice and help establish a strong character to the area.
- Higher density development provides an opportunity to support a public transport network, and a mix of uses and local services and facilities.
- This should be combined with meanwhile uses and markets that can provide additional services to residents and enliven unused spaces in different periods of the construction phasing and at different times of day.

Policies that facilitate an experimental approach that can adapt over time

NEC needs to be an adaptable space that can accommodate the changes brought about by technological changes and enhancements. This means establishing a space for testing innovation while enabling local community members to exercise some control over their own space and policies.

Experiments

- NEC should facilitate the testing of new transport systems to enhance the potential of supplementary non-car-based modes. This could include:
    - Personal Rapid Transport
    - Dockless cycles and scooters that provide first and last mile travel options for residents, workers, and visitors
    - docked shared cycle schemes; and
    - shared cargo bikes.
- These experiments should be monitored to ensure that they are providing cost effective benefit to local people.
- Low-fi experiments could include:

    - regular car free days; and
    - the designation of local residential roads as ‘play streets’ to enable community members to convert their street into a public place without incurring the usual fees for traffic closures.

Travel demand management and community involvement

- Travel planning that involves community members in interesting ways should be promoted as a means to manage travel demand within NEC.
- Major employers, schools and other large community and leisure facilities should proactively adopt travel demand management measures, and these should be monitored to ensure that travel patterns to these key sites facilitate NEC’s overall transport strategy objectives.
- Measures could include:
    - school streets, i.e. the closure of the road space in front of the school during peak hours
    - ‘walk buses’, where students walk to school in large group along a set route;
    - competitions for step counts; and
    - incentives on transport fares.
- A site wide transport assessment and travel plan should explore these options.

Coordination to ensure enabling infrastructure exists

To optimise the role of public transport and future mobility modes in maximising internal trip capture, the planning authority needs to continuously engage with relevant public bodies and private companies to ensure that relevant enabling infrastructure is extant.

Being tied into wider a network of improvement

- The transport network needs to be considered as a system, rather than loosely connected modes. This includes ensuring that:

    - scheduling at Cambridge North Station is synchronised between key train routes and the guided busway;
    - cycleways form part of larger networks of Greater Cambridge-wide cycle routes; and
    - all modes provide data that can be captured to provide up-to-date route information.
- NEC should be well placed to adopt innovations such as kerbside charging or space vacancy sensors, and this will require engagement between transport bodies to test these innovations on-site, and working with developers to provide enabling infrastructure in-kind
- In this way the NEC AAP can help support wider objectives of Greater Cambridge's transport system.

Open data and social innovation

- NEC should retain ownership of its:
    - own network;
    - platform and data, and
    - protect the data of its residents.
- Development should ensure people and companies can access information that belongs in the public realm. This means that data is captured and provided publicly which can help small and medium sized businesses to develop new products which fosters innovation for transport and placemaking services.