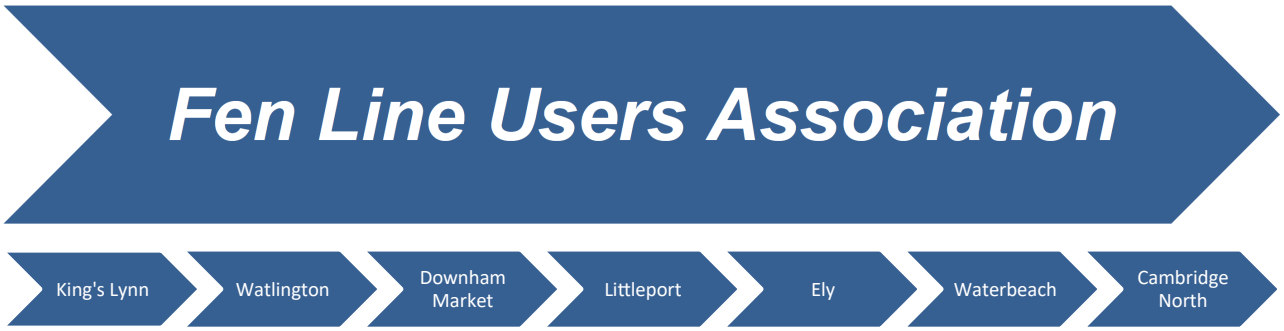

New technology for local transport

Introduction

One of FLUA's aims is "to seek the integration of other public transport services with Fen Line services". We have not had any success with bus services; for instance buses pass Downham Market station but don't call there, and at Waterbeach the bus from the new town arrives at the station just as the train is leaving.

The government has recently announced that driverless vehicles (without even an on-board supervisor) will be allowed to carry paying passengers on public roads from spring 2026 on a trial basis, with the full regime being implemented in 2027.

This paper sets out how autonomous vehicles could be used together with the railways to provide an integrated public transport service appropriate for East Anglia in the 21st century.

The opportunity

The use of vehicles without drivers for public transport not only eliminates a significant component of the cost of operation but also simplifies the logistics of the system, which no longer has to be organised around shift patterns. Coupled with automated route planning, this allows an efficient "turn up and go" service to be offered in areas that are comparatively sparsely populated and thus have low demand.

Running the vehicles on public roads allows the system to be rolled out more quickly than if dedicated tracks needed to be built. However, such tracks (possibly including tunnels under Cambridge city centre) should be built where they would allow vehicles to avoid congested roads and thus make journeys quicker and more reliable. These tracks can be lighter and therefore cheaper than a busway or tramline, as noted under "standards" below.

In order to run on roads, the autonomous vehicles need to use rubber tyres on flat tarmac or concrete; this provides them with more flexibility than would be possible with light rail or other physical guidance, for instance the ability to overtake vehicles that have stopped to pick up passengers. It also allows gradients to be steeper than would be possible with steel wheels on rails.

The "user experience"

Users of the system should be able to book journeys ahead or simply "turn up and go", via an app or website or by presenting a credit card to a machine at a stop.

The experience of someone arriving at a stop not having pre-booked would be similar to someone arriving at the lifts in a tall building, i.e. they choose their destination on a touch screen (or through the app) and are told which vehicle to get into. Depending on how busy the system is, they might be sharing the vehicle with other passengers who will be dropped off on the way. There could be a premium-class service for people who do not want to share the vehicle.

For longer journeys the user would be taken to a rail station. If the station at which they leave the train is not close to their destination there would be a vehicle waiting for them there.

Thus, using the system would be nearly as fast and convenient as car travel, and without the problems of finding a parking space at the destination.

Users would be able to select options for the route planning, such as accessibility requirements. The system might also be able to learn characteristics such as the speed at which they walk.

When booking ahead, for instance to travel to a meeting, users could specify the arrival time and the system would then plan a route and say when to be at the location from which they would depart. It could also message them in the case of disruption, perhaps to say an earlier departure is needed.

The system would automatically provide rail replacement transport for disruption or engineering possessions.

Infrastructure

The system can use the existing road network, greatly reducing the amount of infrastructure that needs to be built. As noted above, dedicated guideways can be added to bypass areas that are congested or have low speed limits.

Although vehicles could pick up and set down anywhere for journeys booked on-line, there should also be stops, similar to (or, indeed, shared with) bus stops, with terminals similar to ticket machines.

Facilities for charging vehicle batteries should be distributed around the system, so that empty vehicles do not have to travel far to reach a charging point. It might also be necessary to provide some places for empty vehicles to wait off-street, for instance positioned ready for the morning (or evening) peak.

Maintenance facilities will of course be required, along with a control room which includes CCTV monitoring and responding to passenger requests for help. There also needs to be hosting for the software that allocates vehicles to journey requests and plans routes and timing. This software also needs an interface to rail journey planners and ticketing systems.

Vehicles

Currently, most road-going driverless vehicles are modified versions of vehicles that have a driver, either to accommodate a supervisor or to reduce the amount of design and development work needed. However, it is likely that they will quickly evolve into something more like current guided driverless vehicles such as shuttles between airport terminals.

Many journeys will be one person travelling on a route for which there is no other demand at that time, so there will need to be vehicles that can carry a single passenger economically. This does not preclude them having more seats – many car journeys are a single person in a vehicle with 5 or even 7 seats.

The system also needs to support vehicles able to carry a larger number of passengers, to serve peak time demand, and vehicles able to accommodate wheelchairs etc, which passengers can request when booking a journey.

Standards

Several aspects of the system will need to be specified by standards that will need to be adopted nationally and then internationally in order to create an efficient market for the vehicles and other components of the system.

There will need to be communications standards for vehicle-to-vehicle and vehicle-to-infrastructure, the latter including: audio and video between the control-room and passengers; scheduling; telemetry; traffic monitoring; and, in exceptional conditions, remote control of the vehicle.

The control system will need an open interface to the journey planning and booking facility, for example to allow venues to integrate travel with their booking systems.

Where a journey is partly by rail it should be possible for the system to use the rail industry’s standard third party ticket sales interface for the part of the journey that is by rail.

There needs to be a standard specification for vehicles that can run on the guideways. Parameters to be specified would include: guidance system; width and height (within which vehicles must fit, including allowance for vehicle suspension and accuracy of the guidance); axle weight; maximum gradient; and minimum radius of curves. To reduce the need for overtaking there should also be specifications for cruising speed, acceleration (from stops), and braking

Guideway specifications should be such as to minimise the land take and construction cost, including for tunnels. This includes supporting steep gradients, including at grade separated junctions and at access points to tunnels. Vehicles that can use the guideway will need to be narrower and lighter than buses.

Cambridge travel-to-work area

In many towns, employment is concentrated at the centre, along with retail and entertainment, surrounded by residential suburbs connected to the centre by radial bus or tram routes.

The Cambridge area is much more diverse, with significant employment on the edges of the City and in towns and villages beyond the green belt. Travel requirements are therefore also more diverse than in and around a typical urban area, and distances are greater. For many journeys, especially between locations that are outside the city, there is not enough demand to sustain a regular bus service: either the buses will be nearly empty or the frequency will be too low, with most potential passengers finding there is not a bus at around the time they need to travel.

However, an automated system with vehicles that are smaller than buses would be able to serve such journeys efficiently, and almost as conveniently as by car.

Rail is already providing an effective solution for local travel where demand is more concentrated, even for short journeys, as evidenced by the number of journeys between Cambridge and Cambridge North. This can be expected to increase when Cambridge South opens, and again when East West Rail is built. Other new services could be developed at a cost which can be expected to be less than building a separate mass transit system, for instance an all-stations shuttle between Ely and Whittlesford, eventually to be extended to Wisbech and Haverhill, and building new stations to the south of King’s Lynn and on the line from Cambridge to Newmarket.

Most of the Fen Line stations are some distance from the centre of the communities they serve; this is even true of the new stations proposed to serve developments at Waterbeach and at West Winch. Autonomous vehicles would be ideal for “last mile” travel to and from stations, reducing the need for station car parks and for passengers to take a bicycle on the train.