May 2021

ADEPT Live Labs

# Last Mile Mobility

## In-depth Feasibility Study

ADEPT LIVELABS Transforming Local Places

Buckinghamshire Council

CATAPULT Connected Places

# Background

Buckinghamshire Council have been leading the £4.5m **‘SMART Connected Community: Live Labs’** project since 2019. It is part of a £23m programme, funded by the Department for Transport, and led by the Association of Directors of Environment, Economy, Planning and Transport (ADEPT). The project is built around four themes: **Smart Materials, Smart Communication, Smart Energy, and Smart Mobility.** The Connected Places Catapult (CPC) has delivered this Last Mile Mobility: In-depth Feasibility Study as part of the Smart Mobility theme.

The in-depth feasibility study was undertaken to investigate the current first and last mile mobility landscape, including the movement and people and goods, and determine the benefits of introducing new technological solutions for Buckinghamshire and other similar local authorities.

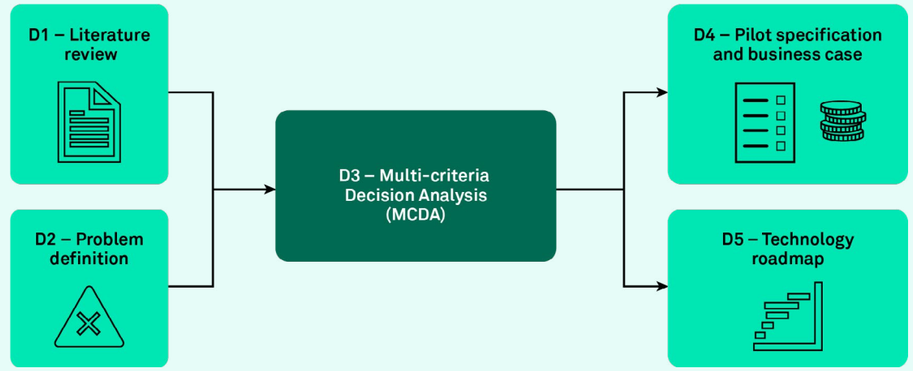


# Oveview

Innovative last mile mobility solutions present an opportunity to transform the mobility landscape and offer sustainable options in line with strategic aspirations for improving air quality and reducing the over-reliance on private vehicles and delivery vans for short journeys.

This document presents the outputs of the in-depth feasibility study which are made up of the following five deliverables:

- **D1 Literature Review:** explores the existing, emerging and future last mile mobility solutions for moving people and goods.
- **D2 Problem Definition:** uses interviews with key stakeholders to define a set of targeted problem statements.
- **D3 Multi-Criteria Decision Analysis:** evaluates the different last mile options against a defined set of criteria and identifies a short-list of solutions that satisfy defined needs.
- **D4 High Level Pilot Specifications:** outlines options for piloting the shortlisted last mile solutions in a sub-urban setting.
- **D5 Roadmap Report:** defines the evolutionary path for realising the full potential of last mile solutions and identifies the associated infrastructure and technology requirements.



# D1 - Literature review

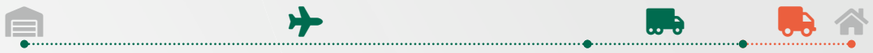
The literature review (Appendix D1) outlines the urgent need for change in how Buckinghamshire in particular and the UK in general, move goods and people over the last mile to meet Net Zero targets, reduce congestion, and improve air quality. The growth of diesel vans and internal combustion engine cars for short journeys were highlighted as key priorities for targeted modal shift.

For the purpose of this study we have defined last mile mobility as follows:

> First or last mile mobility is the movement of goods or people over short distances to facilitate either;
>
> a) end-to-end short journeys between a precise origin and destination, or;
>
> b) modal connections as part of a longer journey.

Example 1: Commute to work

Example 2: Goods from production to home delivery

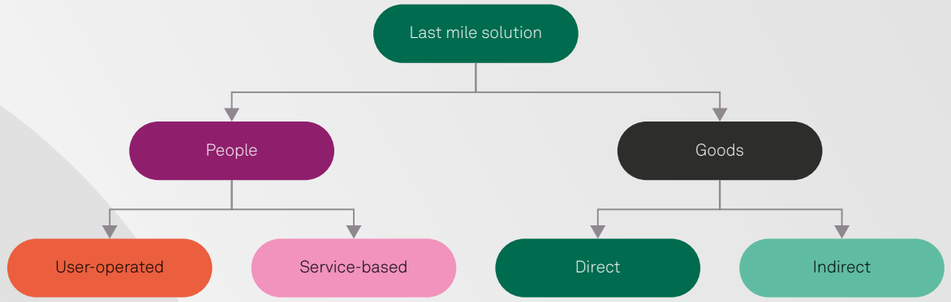


Example 3: Short Journey to a local shop




The literature review was conducted to explore the state-of-the-art of last mile mobility solutions and determine their relative merits. Information such as cost to user, occupancy/payload limits, maturity of technology, required infrastructure, cost to implement and the general benefits and limitations are provided within the report's appendices.

The solutions were categorised as shown in the flow diagram below.




As shown in the flowchart, the **people-based solutions** are subcategorised into user-operated and service-based solutions with the following definitions:

- **User-operated solutions:** require active engagement from the user for the duration of the journey.
- **Service-based solutions:** operated by a paid operator and/or automated technology and do not require active engagement from the user.

The **goods-based solutions** are subcategorised into direct and indirect solutions with the following definitions:

- **Direct solutions:** allow for goods to be delivered to the precise end destination directly.
- **Indirect solutions:** improve efficiency of delivering goods but require a direct solution for journey completion.

The literature review can be used as a reference when evaluating the best last mile solutions to be trialled or deployed in a specified location. The full list of the solutions can be found in the table above. Solutions from this table were added to the 'longlist' where they were further analysed for their suitability for a pilot in Aylesbury using multi-criteria decision analysis.

| People | | Goods | |
|---|---|---|---|
| User-operated | Service-based | Direct | Indirect |
| Car | Bus | Van | Amazon lockers |
| Walking/ wheelchair | Taxi | Cargobike | Consolidation centres |
| e-scooter | Flying Taxis | CAV[1] | Magway |
| Car club | Water bus | Private car | Delivery to car |
| Bicycle | On-demand ride hailing | Drones | 3D printing |
| Docked share scheme | CAV[1] | Motorcycle | |
| Motorcycle | Cable car | Automated delivery robots | |
| e-bicycle | DRT[2] | | |
| Dockless share scheme | Segregated CAV[1] | | |

1 CAV: Connected and Autonomous Vehicle
2 DRT: Demand Responsive Transit

# D2 - Problem definition

The problem definition report (Appendix D2) outlines the last mile mobility challenges experienced by local authorities and the barriers they face when attempting to diversify and decarbonise their last mile mobility ecosystem. Through a series of interviews and workshops with members of Buckinghamshire Council, the following eight problem statements were developed:

### Problem statements

1. Investment in active travel is restricted by public and political perception.
2. Heavy Goods Vehicles are routed through towns and villages.
3. Reliance on diesel vans to fulfil low density last mile deliveries.
4. On-demand delivery vehicles cause traffic disruption.
5. Powerful lobbying from car users perpetuates driving dominance.
6. New housing developments are not setting best practice.
7. Public transport is inefficient over the last mile.
8. Long-term change is difficult to plan and implement.

These challenge statements were used to develop the multi-criteria decision analysis framework, whereby solutions which work to overcome these challenges scored more highly.



# D3 - Multi-criteria decision analysis

The longlist of solutions identified and explored in the literature review were scored and ranked using a multi-criteria decision analysis (MCDA) framework – see Appendix D3 for more details. The developed MCDA framework considered the solutions' current maturity and costs of implementation in addition to benefits such as environmental and political and challenges such as public perception and infrastructure requirements. Solutions which are unlikely to reduce carbon emissions compared with a car or diesel van were discarded and discounted from the rankings.

The top five solutions for the movement of people and goods are presented in the tables below.

**Movement of people**

| Rank | Solution (People) | Total score (-34 to 78) |
|---|---|---|
| **1** | Walking | 64 |
| **2** | e-bicycle | 48 |
| **3** | Bicycle | 46 |
| **4** | e-scooter | 44 |
| **5** | Docked shared bike scheme | 43 |

**Movement of goods**

| Rank | Solution (Goods) | Total score (-26 to 63) |
|---|---|---|
| **1** | (e-)cargobike | 38 |
| **2** | Automated robots | 36 |
| **3** | Collectplus | 33 |
| **4** | 3D printing | 30 |
| **5** | Drones | 29 |

# D4 - Pilot specification and business case

Three pilot proposals were developed which showcase different combinations of the shortlisted solutions from the MCDA analysis. Each pilot tackles a different challenge, has different objectives, and supports the decarbonisation of the last mile as well as the wider mobility ecosystem. They are therefore not directly comparable, but could all be deployed simultaneously if desired without competing or significantly impacting each other's baseline data. Details of pilot proposals are in Appendix D4.



Appendix D4 has been omitted from this document as it contains commercially sensitive information

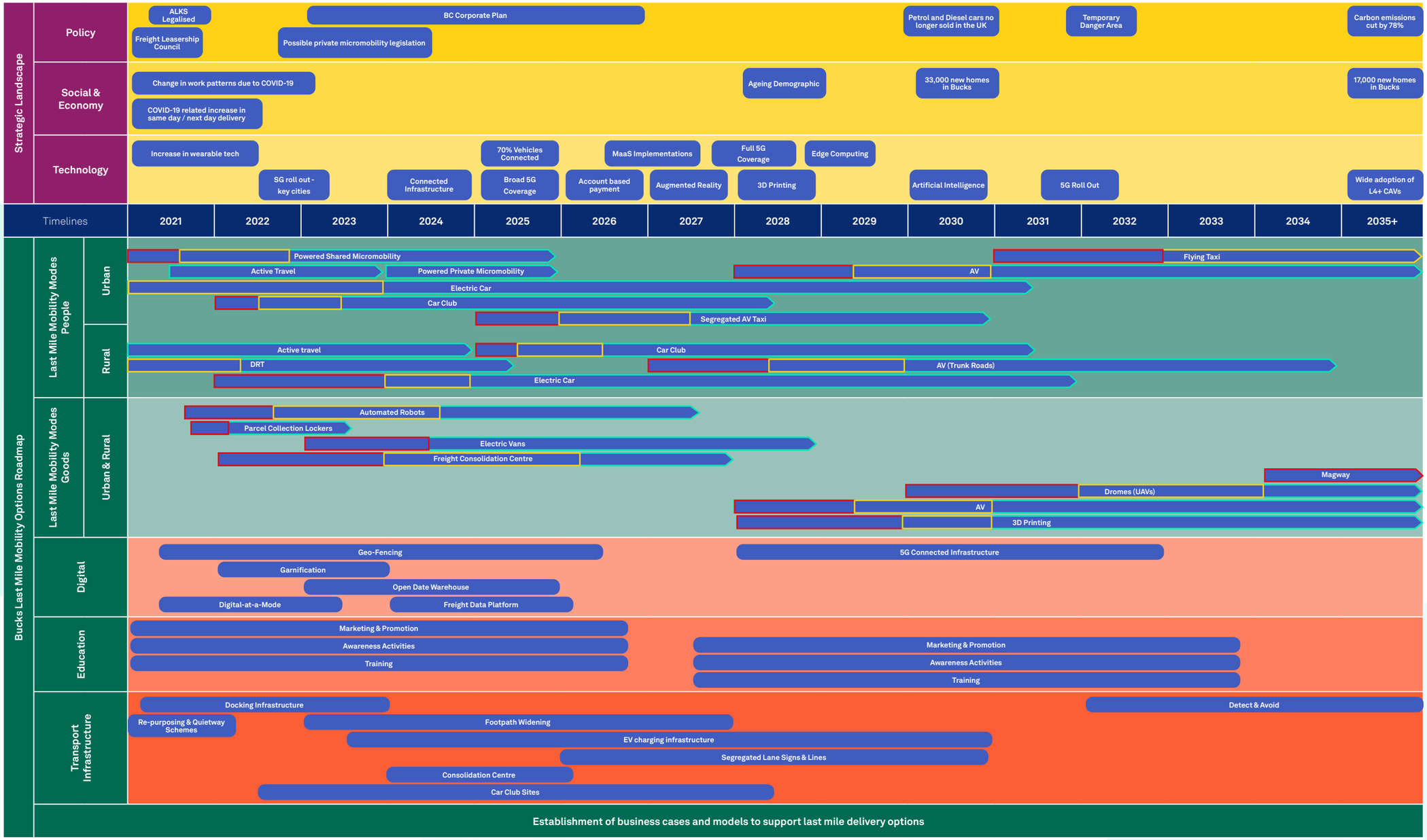
# D5 - Technology roadmap

The last mile mobility technology roadmap (Appendix D5) presents the changes that are on the horizon between 2020 and 2035, beyond which there is too much uncertainty to make reasonable assumptions. It outlines enabling activities that need to be undertaken to lay the foundations for last mile mobility modes to be delivered in line with Buckinghamshire Council's objectives. This roadmap builds upon the literature review, problem statement and multi-criteria decision analysis (MCDA), and last mile mobility pilot options activities.

The roadmap considers the key changes that are going to take place from a strategic, regional, local, technological and political lens. It sets a direction of travel and will need to be reviewed and refreshed on a continual basis throughout its term as new technologies will emerge that haven't been foreseen and changes may come more quickly or be delayed against current expectations. This roadmap should then support the more detailed planning, design, business case development, procurement and implementation of last mile mobility modes.

The Last Mile Mobility Roadmap (shown below) offers Buckinghamshire and similar local authorities with a view of a range of innovative and cutting-edge transport modes to address the four problem areas; **congestion, sedentary lifestyle, poor air quality and carbon emissions.** Whilst it provides a holistic view of multiple available modes it should not be seen as essential to deliver all of the last mile mobility solutions. Each solution will deliver incremental benefits and contribute towards delivery of the overall objectives and as such, there is a need to closely monitor and evaluate the success of any implementation.






**Notes**

- The development phases are shown as linear for clarity, however for some options there maybe overlap between the phases. For example, the powered shared micromobility option pilots may form part of the ongoing feasibility.
- The key to the right groups the development cycle into three board phases for the purposes of clarity with the roadmap. Should Bucks take forward any option there are likely to be a number of additional phases such as design.
- Powered micromobility includes a subset of options which follow a broadly similar implementation paths such as e-scooters and e-bikes.
- Active travel includes a subset of options which follow broadly similar implementation paths such as walking and cycling.

**Key**

**Feasibility** = feasibility of the option for Bucks or similar area (not when the option becomes a feasible solution in general i.e. the option may be feasible at an earlier state for testbeds and urban conurbations such as London)

**Pilot** = trial of the option and assessment of benefits before potential scaled rollout

**Rollout** = scaled roll out of the option before embedment into BAU

# Conclusion

The Connected Places Catapult's Last Mile Mobility In-depth Feasibility Study has highlighted the urgent need for change in Buckinghamshire to make last mile mobility more efficient and meet the current and future needs of residents. We found that there are many challenges experienced by local authorities as they strive to improve last mile mobility in line with their social, economic and environmental objectives. These challenges include geographical limitations such as available road network infrastructure, human behaviour and perception and the resistance to change, operational inefficiencies and not making the most of available technologies or lessons learned.

There are many potential benefits to be gained from implementing new last mile mobility options for the movement of people and goods. All of the solutions we took forward to consider for a pilot had the potential to reduce carbon emissions relative to the combustion engine car and van but the ones with the most significant reductions include active travel modes (walking, cycling, cargobikes) and electrification of vehicles (e-scooters, electric delivery robots, e-cargobikes). Active travel modes have the added benefit of health benefits to the user, zero particulate production leading to better air quality and wider societal benefits from the improved public health resulting from both. Solutions which remove the need for travel completely such as 3D printing may also contribute significantly to reduced carbon emissions once the technology rises in maturity to be able to manufacture a wider range of goods. Beyond our shortlisted options, quicker wins such as transitioning from diesel vans to electric vans should be considered but understanding that this will not tackle the wider system problems of congestion.

The success or failure of implementing new mobility solutions is very sensitive to contextual factors. As such, it is critical that a thorough trial with a measurable baseline and sufficient monitoring and evaluation is conducted before rolling out the technologies further. In Aylesbury, we suggest launching one, two or three of the pilot specifications set out in D4; electrifying pedal power, estate of the art or gamification of active travel as the findings will be replicable in many similar semi-urban areas. Elsewhere our multi-criteria decision analysis framework (MCDA) can be modified to meet the context and objectives of other authorities looking to implement last mile solutions.

Our last mile mobility roadmap demonstrates the importance of considering external factors when determining the feasibility of disruptive technologies or behavioural change in the last mile mobility system. Enabling technologies such as 5G networks and automation should be continually reviewed to check whether their maturity is sufficient to unlock new mobility solutions. In addition, legislative changes and policy interventions such as clean air zones should be treated as important potential levers for fostering innovation in last mile travel and to accelerating the transition to a greener transport network.



Georgina Box
georgina.box@cp.catapult.org.uk

Shyful Choudhury
shyful.choudhury@cp.catapult.org.uk

Khalid Nur
khalid.nur@cp.catapult.org.uk

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info@cp.catapult.org.uk


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