cenex

Lowering your emissions through innovation in transport and energy infrastructure

PROJECT

REPORT

Local E-Motion North Yorkshire

Pilot Schemes to Deliver Affordable Personal Electric Transport

Summary Report

September 2022

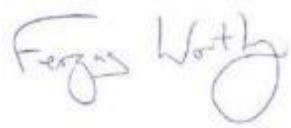
Prepared for:

Ollie Braithwaite
Climate Change Officer
Richmondshire District Council
climate.change@Richmondshire.gov.uk

Prepared by:

David Philipson
Technical Specialist

Approved by:



Fergus Worthy
Principal Consultant

Company Details

Cenex
Holywell Building
Holywell Park
Ashby Road
Loughborough
Leicestershire
LE11 3UZ

Registered in England No. 5371158

Tel: 01509 642 500
Email: info@cenex.co.uk
Website: www.cenex.co.uk

Terms and Conditions

Cenex has exercised all reasonable skill and care in the performance of our services and we shall be liable only to the extent we are in breach of such obligation. While the information is provided in good faith, the ideas presented in the report must be subject to further investigation, and take into account other factors not presented here, before being taken forward. Cenex shall not in any circumstances be liable in contract, or otherwise for (a) any loss of investment, loss of contract, loss of production, loss of profits, loss of time or loss of use; and/or (b) any consequential or indirect loss sustained by the client or any third parties.

Document Revisions

No.	Details	Date
1	Draft	09/08/22
2	Peer review	22/08/22
3	Second draft	05/09/22
4	Final draft for approval	26/09/22

Contents

Abbreviations

BCR	Benefit Cost Ratio
BEV	Battery Electric Vehicle
CBT	Compulsory Basic Training
CCC	Committee on Climate Change
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CREDS	Centre for Research into Energy Demand Solutions
DfT	Department for Transport
DRT	Demand Responsive Transport
EAPC	Electrically Assisted Pedal Cycle
EV	Electric Vehicle
GLCC	Green Lane Community Centre
HGV	Heavy Goods Vehicle
ICE	Internal Combustion Engine
IMD	Index of Multiple Deprivation
KPI	Key Performance Indicator
LA	Local Authority
LSOA	Lower Layer Super Output Area
MaaS	Mobility as a Service
MEP	Monitoring and Evaluation Plan
MOD	Ministry of Defence
NOx	Nitrous Oxides
NPV	Net Present Value
NTS	National Travel Survey
NYC	North Yorkshire Council
PM10	Particulate Matter (10 micrometres and smaller)
RDC	Richmondshire District Council
SBC	Scarborough Borough Council
SRO	Senior Responsible Officer
UK SPF	UK Shared Prosperity Fund
WMG	Warwick Manufacturing Group
Y&NY LEP	York & North Yorkshire Local Enterprise Partnership

1 Introduction

1.1 Introduction to Cenex

This report was produced by Cenex on behalf of the York & North Yorkshire Local Enterprise Partnership (Y&NY LEP), Richmondshire District Council (RDC) and Scarborough Borough Council (SBC). Cenex was established as the UK's Centre of Excellence for Low Carbon and Fuel Cell technologies in 2005. Today Cenex focuses on low emission transport and associated energy infrastructure and operates as an independent, not-for-profit research technology organisation and consultancy, specialising in project delivery, innovation support and market development.

1.2 Project Aim and Objectives

This document is the final summary report for *Local E-motion: Feasibility, Deliverability and Business Case Development Work for Pilot Schemes to Deliver Affordable Personal Electric Transport* (hereafter known as Local E-motion). Local E-Motion was part of a wider programme of work to deliver a carbon-negative energy system in North Yorkshire.

The aim of Local E-Motion was to work with local people and communities to explore opportunities for local e-mobility hub-based schemes and to co-design sustainable and well-evidenced proposals that will best meet the need of those in rural communities who want to make affordable low carbon transport choices.

The project had two specific objectives, which were:

- Undertake research, community engagement, feasibility, deliverability, and business case development work for pilot schemes to deliver affordable personal electric transport choices in two areas of North Yorkshire.
- Co-design virtual and/or physical hub-based holistic and bespoke personal e-mobility solutions with the communities of (and visitors to) four diverse settlements by using hyperlocal data and community insight.

The primary output from Local E-Motion was a suite of reports and bid-ready business cases for locally appropriate personal e-mobility scheme(s), which are either commercially viable or can be submitted as a bid to the Shared Prosperity Fund and/or any other suitable grant funding programme.

The project was split into five key parts detailed below. This is the final part 5 report concluding the overall project.

- Part 1: A "best available technology" report for different forms of personal e-mobility.
- Part 2: A report based on desk-based analysis and engagement with residents, businesses, and visitors to understand the demand for different technologies, and co-create solutions in four areas.
- Part 3: An appraisal of sites and options to identify two preferred options (one in RDC and one in SBC) to be taken forward for further analysis.
- Part 4: A detailed business case analysis of the two preferred options, with designs and costings for hubs, and an assessment of perceived barriers and identifying solutions.
- Part 5: A summary report providing key findings and outputs (this report).

The part one to four reports have been submitted confidentially to Y&NY LEP, RDC, and SBC and the findings are summarised in this document.

1.3 Project Scope

The geographical scope of Local E-Motion was the jurisdiction of two local authorities—RDC and SBC. Within those, the project longlisted hub-based schemes in four communities: Catterick and Leyburn & Hawes in Richmondshire, and Whitby and Eastfield in Scarborough. As discussed in this report we then identified the preferred option in each of the RDC and SBC communities (one in each local authority).

The technologies and services in scope are the personal e-mobility options that could provide a viable alternative to single occupancy journeys in privately owned combustion engine cars: privately owned electric cars, electric car clubs, shared and privately owned e-scooters, and shared and privately owned e-bikes. An explanation of each of these modes and services is in section 2 of this report.

1.4 Context of the Project

1.4.1 Privately Owned Electric Vehicles

Road transport produces 2.8 $MtCO_2e$ annually, according to figures published in the Y&NY Carbon Abatement Pathways report[1]. 95% of transport emissions are due to road transport, with more than three-quarters of road transport emissions due to cars and vans. The biggest contributors to this were cars and taxis (61% of road transport emissions), followed by heavy goods vehicles (HGVs) (18%), and vans (17%). It is therefore imperative that urgent action is taken to reduce emissions from road transport, and that privately owned cars should be a key focus of this activity.

There has been little change over time in transport emissions, either by mode or across the sector; in 2019 transport emissions were only 3% down on the total in 2009. While transport emissions have remained relatively static, other sectors have achieved significant reductions, notably energy emissions which have fallen substantially as the UK switched away from coal power.

In 2019 the UK set a binding target to reach net zero emissions by 2050. To help achieve this objective, the government has set a clear policy direction, supported by significant funding, to accelerate the transition from petrol or diesel powered internal combustion engine (ICE) vehicles to zero tailpipe emission alternatives. These measures have been highly effective, with pure electric vehicles (EV) making up 11.6% of new car sales in the UK from April to December 2021[2]. However, additional action is required to accelerate the transition to EVs and ensure that all members of society can enjoy the benefits of low emission technology.

1.4.2 Mode Shift

Accelerating the transition to EVs will deliver substantial cuts in road transport emissions. However, this leaves two challenges unaddressed:

- Private vehicle ownership is expensive and as such is not an option available to all members of society.
- Switching from ICE cars to an equivalent number of EVs will not tackle worsening congestion.

The UK must therefore shift to more sustainable and inclusive forms of transport. A transport hierarchy should have active travel (walking and cycling) at the top, as these modes have the lowest environmental impact and provide health benefits for individuals. The next best option is usually public transport, which has low emissions per passenger kilometre. Where active travel is not suitable and public transport is not available, e-scooters, e-bikes, and car clubs can provide an efficient, low cost, sustainable and inclusive alternative to private car use.

One of the few reports to have reviewed the benefits of personal e-mobility options was published by the Centre for Research into Energy Demand Solutions (CREDS)[3]. This study is a comprehensive assessment of the role of reducing energy demand to meet the UK's net-zero climate target. The report estimates that shared mobility innovations could reduce future traffic growth to 5% by 2050.

It is essential that feasibility projects like Local E-Motion are undertaken to help prove the benefits of these new mobility modes and services.

[1] https://www.ynylep.com/Portals/0/adam/Stories/VqQDBytZGUuDihbMTz2ZZQ/Body/North-West-Yorkshire-Emissions-Reduction-Pathways.pdf
[2] New UK EV and AFV Registrations - SMMT monthly data
[3] The role of energy demand reduction: Mobility (creds.ac.uk)

2 Personal Electric Transport Options

The first objective was to review the personal e-mobility solutions that can accelerate the modal shift out of private ICE cars. The options for review were privately owned EVs, electric car clubs, shared and privately owned e-scooters and e-bikes, rented electric mopeds, and demand responsive transport (DRT).

2.1 Personal E-Mobility Options

Privately Owned Electric Vehicles

- **Overview:** EVs store energy in a battery (usually lithium-ion) and deliver power to the wheels through an electric motor. Braking energy is captured by the electric motor and stored as electrical energy in the battery.
- **Benefits and challenges:** The main benefits are zero tailpipe emissions, and lower running costs than combustion engine vehicles. Challenges include high upfront cost and a lack of charging infrastructure in some areas.
- **Use cases and demographics:** The increasing range of vehicles and availability of infrastructure means EVs can be used for most journey purposes. Historically EVs have been bought by a narrow demographic but this is changing as adoption becomes more mainstream.
- **Trends and forecasts:** Uptake will rapidly accelerate ahead of the phase out of sales of new petrol and diesel cars from 2030.

Electric Car Clubs

- **Overview:** Car clubs are membership-based services that provide members with access to vehicles, with rentals typically by the hour or day.
- **Benefits and challenges:** The main benefits of electric car clubs are that they overcome the price barrier to using electric vehicles, reduce rates of car ownership, and help alleviate transport poverty. Challenges include finding suitable locations where infrastructure can be installed and ensuring that users plug vehicles in at the end of the rental.
- **Use cases and demographics:** Car club users are typically male, in urban areas, and are 24 to 40 years old. Car clubs are predominantly used for short journeys to carry large items or where public transport is unavailable.
- **Trends and forecasts:** Deployment of EVs is much higher in car clubs than in the UK's privately owned car fleet. Car clubs have seen sustained growth in recent years and are recovering well from the impact of Covid-19 restrictions.

E-scooters

- **Overview:** E-scooters are stand-up scooters powered by an electric motor and have a typical range of 25 to 50 miles. Currently they can only be legally used on private land, or through a rental scheme in Department for Transport (DfT) trials in selected towns and cities.
- **Benefits and challenges:** The main benefits are flexibility, improved journey time reliability in urban areas (compared to driving), and low cost. The challenges are uncertainty over regulation, and the need to ensure they don't compete with public transport and active travel.
- **Use cases and demographics:** Users are mostly younger men in urban areas. However, subject to their legalisation, e-scooters could provide low cost and sustainable solution for a much wider demographic group.
- **Trends and forecasts:** The DfT trials of rental e-scooters have been extended to November 2022 and until the results from that programme are published it is difficult to forecast the future market for e-scooters. Subject to their legalisation, there is likely to be significant demand for both shared and privately owned assets.

E-bikes

- **Overview:** E-bikes are bicycles with pedals and an electric motor to assist the user. Most common are the electrically assisted pedal cycles (EAPCs), for which UK law caps the power at 250W and forbids support from the motor when travelling over 15.5 mph. E-bikes can be privately owned or accessed through a hire scheme.
- **Benefits and challenges:** The main benefits are health benefits for users and facilitating modal shift from cars. Challenges include high upfront costs of e-bikes, and the need to ensure they don't compete with public transport and active travel.
- **Use cases and demographics:** E-bikes can open up cycling to individuals who may not be able to use a pedal cycle. The ratio of women and men using e-bikes is more balanced than for pedal cycles, which are more frequently ridden by men.
- **Trends and forecasts:** We expect the uptake of shared e-bikes to continue increasing in the 2020s, but this is from a very low baseline. If upfront costs fall significantly then uptake could be rapid for both shared and privately owned assets.

Electric Mopeds

- **Overview:** Electric mopeds can be ridden by users over the age of 16 who have taken a theory test and completed compulsory basic training. Electric mopeds are available via Wheels to Work[4], a not-for-profit loan scheme that helps people get to work, apprenticeships, or training, where no other form of transport is available
- **Benefits and challenges:** Electric mopeds can provide affordable access to transport for disadvantaged users. However, there are cost barriers to accessing rented mopeds, including the cost of training and a bond of £150. Also mopeds are loaned to a single user, rather than being shared, meaning they may have low utilisation levels.
- **Use cases and demographics:** The Wheels to Work scheme is available via Hambleton Community Action for residents of Hambleton, Harrogate and Richmondshire areas.
- **Trends and forecasts:** This is an emerging mode with limited market penetration and significant challenges to overcome and therefore was not considered in this project.

Demand Responsive Transport (DRT)

- **Overview:** DRT involves flexible routes operated by smaller vehicles (typically minibuses), with pick-up and drop-off locations varying according to passenger needs. DRT is not an e-mobility option as there are no competitively priced electric minibuses in the UK market.
- **Trends and forecasts:** Electric DRT is unlikely to be an option in the short-term due to the lack of suitable vehicles. Therefore, we recommended not taking this technology forward for further assessment in Local E-Motion.

More information on shared mobility options is available via the Cenex Insight into Sustainable and Shared Mobility, on the Cenex website[5].

2.2 Charging E-Mobility Assets

There are different charging needs and locations that must be considered for the modes and services in scope of this project.

Privately Owned Electric Vehicles

- **Off-street charging at home:** Private domestic chargers are usually standard rate chargers (7 kW) which can be used to charge the car overnight. This is ideal for EV owners as it has the lowest cost and is easy to use.

[4] https://www.wheelstowork.org/

[5] https://www.cenex.co.uk/app/uploads/2022/02/Intro-to-Sustainable-and-Shared-Mobility.pdf

- **On-street charging:** This is more expensive than off-street charging and is less easy, with a risk that there is not a convenient chargepoint available.
- **Workplace:** EVs can be charged in a workplace car park, typically using a standard 7 kW charger.
- **Public car park:** Charging can be provided in a public car park, typically using a 7 kW charger or fast charging (22 kW).
- **Opportunity charging:** This uses rapid charging (50 kW or above) for when EVs can't charge overnight or must travel further than a full battery allows.

Electric Car Clubs

- **Free-floating:** If shared EVs don't have fixed parking with dedicated charging infrastructure they can be charged at public charge points, though this is difficult for operators to manage.
- **Station-based:** Charging infrastructure at the station requires users to plug in the EV when they finish their rental period.

Private E-bikes and E-scooters

- **Battery swapping:** Private e-bikes usually have removable batteries which can be brought inside and charged by using a regular three-pin domestic socket.
- **Tethered charging:** E-scooters usually don't have a switchable battery, instead the whole vehicle is brought inside to be charged from a three-pin domestic socket. For e-bikes, some public charge points have been introduced in the UK.

Shared E-bikes and E-scooters

- **Free-floating:** The most common practice to charge free-floating e-bikes and e-scooters is to pick up depleted assets or batteries and charge them overnight in a depot.
- **Station-based:** When e-bikes and e-scooters are offered as a station-based service it is possible to charge them at the station.

2.3 E-Mobility in the Local Context

In this sub-section we outline the characteristics of the study areas and how personal e-mobility can help address specific local challenges.

The characteristics of the study areas are summarised in the table below.

Table 1: Summary characteristics of the proposed study areas

	Demographic	Topography	Economic and Education	Access to transport
Leyburn and Hawes	Older, economically split population of higher and low income.	Rural, hilly. Some flat routes along river and disused railway.	Tourism and farming main industries.	Public transport connectivity is poor. High car ownership. EV range could be an issue.
Eastfield, Scarborough	Young families, some single parents. Low income/part-time or unemployed	Fairly flat, cut off from the centre of Scarborough by busy main roads.	McCain Factory large employer. Many in seasonal hospitality jobs.	Lateral connections across the area and to surrounding areas are poor. Car ownership is low.
Whitby	Older population, low income, mobility issues	Steep sea cliffs and narrow historic streets.	Tourism major industry, seasonal work.	Poor connection to the wider area. High visitors traffic impacts locally. Low car ownership
Catterick Garrison	Young men and families from military backgrounds.	Some slight hills, the centre is heavily designed around car use.	A large proportion is employed by the army on the base. Some industrial parks on the periphery.	Fairly well connected with Richmond and a growing urban centre.

The critical success factors for e-mobility deployments in the local context are:

- **Demographics:** Users of e-mobility have historically been male, able-bodied, affluent, living in urban areas, and for light electric vehicles they also tend to be younger. The study areas are either disadvantaged (based on their multiple deprivation indices scores) or have a low population density. Local E-Motion explored how the user base could be broadened to improve access to electric shared transport.
- **Infrastructure:** The study areas are hilly which makes cycling (including e-bikes) less attractive and reduces EV range. E-scooters are also less suitable for use on hilly rural roads. Providing charging infrastructure can also be more challenging in rural areas.
- **Community Engagement:** Community engagement is key to ensuring the success of electric mobility. This was a critical component Local E-Motion, providing invaluable insights into the proposed deployment areas, as described in section 3 below.
- **Mobility Hubs:** Shared transport should be provided at mobility hubs rather than in standalone single mode service points. Mobility hubs are sites which provide connections between personal electric transport services and public transport.

3 Longlist of Proposed Schemes

The next step was to quantify potential demand for personal e-mobility within the context of overall transport demand, with reference to community transport provision, and with consideration of inclusivity and equity. The main outputs of this part of the project were four evidence-based proposals for personal e-mobility schemes, which were taken forward for further analysis and down-selection to two preferred options.

3.1 Regional Transport Supply and Demand

E-Mobility Provision and Uptake

EV uptake is lower in Richmondshire and Scarborough than North Yorkshire and the UK overall. There could be up to a ten-fold increase in EV uptake in Richmondshire and Scarborough by 2027, although market penetration would remain low (less than 6%). There will be a requirement for additional chargepoint infrastructure, although a proportion of demand will be met by off-street domestic and rapid or destination charging provided by the private sector. With around 94% of cars likely to still be ICE models in 2027, there is a clear need for a transition to more sustainable modes to help reduce congestion and emissions.

There is limited provision of shared e-mobility in services in the study areas. Except for e-bikes for hire in Hawes, there are no shared e-mobility services that would support the communities in the four study areas and therefore public sector support to help introduce e-mobility may be needed.

Current and Forecast Travel Patterns

The UK Government's National Travel Survey (NTS) shows that under a 'do nothing' scenario, there is likely to be an increase in the number of all cars on the roads in the study areas, particularly Catterick, Whitby and Eastfield. This evidence contributes to the case for investing in shared e-mobility.

Covid-19 led to some changes in travel behaviour, including a decrease in car and public transport trips, and an increase in the number of active travel trips and distance covered. It is possible that travel behaviour will return to pre-Covid patterns. However, it also presents an opportunity to embed more sustainable transport options, particularly in deprived and marginalised communities.

The next sub-sections summarise the results of a survey and series of workshops undertaken to better understand the needs of the local communities.

3.2 Whitby: Survey and Community Engagement

The study area in Whitby is the properties off Green Lane in the Streonshalh Ward to the east of the town centre. This area is cut off from many services on the West Cliff by the harbour and divided by the A171, the main road through Whitby.

- **Public transport connectivity**: Whitby has limited rail transport connectivity, with only an occasional rail service north to Middlesbrough and onwards to Newcastle. Whitby has relatively good coverage of bus services, although the Green Lane area is poorly served.
- **Deprivation**: There are relatively high levels of deprivation in the proposed area.
- **Car ownership and use**: Car ownership is high at 90% of households. 26% of respondents stated that they plan to get an electric car in the next five years.
- **Previous use of e-mobility**: 17% of respondents have previously used an e-bike, and there is some familiarity with other e-mobility modes as well.
- **Local transport**: The biggest challenge for the residents of Whitby in relation to transport is the influx of visitors and the pressure this puts on transport services and parking.
- **Potential use of micromobility**: E-scooters are not likely to be viable due to the topography and road surfaces. E-bikes are more likely to be used, subject to bicycle use being considered in other transport schemes in Whitby.

- **Potential use of EVs and e-car-clubs**: EV chargepoints would be used by residents but there is a concern they will be blocked by tourists' vehicles in the summer. There was substantial interest in EV car clubs in Whitby to reduce the need for private car ownership.
- **Hub options**: We identified three possible e-mobility hubs: The Green Lane Community Centre (GLCC), St Hilda's Business Centre, and the Captain Cook Museum. From discussions with the community, the Green Lane Community Centre emerged as the preferred location.

3.3 Eastfield: Survey and Community Engagement

In Eastfield we focused on the high street (where the library and council buildings are located) and considered connections to the wider region via Seamer station and Scarborough.

- **Public transport connectivity**: Eastfield is served by Seamer rail station with connections to Scarborough, York, and Hull, and bus connections to Scarborough and Cayton.
- **Deprivation**: There are extremely high levels of deprivation in this area.
- **New developments**: There are plans for 1,350 new homes to be built at Middle Deepdale. This will put additional pressure on local services, including transport.
- **Car ownership and use**: Car ownership is relatively low at 78% of households. 25% of respondents stated that they plan to get an electric car in the next five years.
- **Previous use of e-mobility**: Fewer than 10% of respondents have previously used any form of e-mobility. Previous use of e-scooters was the most cited answer.
- **Local transport concerns**: Local bus and rail services are perceived as expensive, and much of the population does not regularly travel out of the area. East-west connections are poor, meaning it is not easy to access the station for residents on the east side of the settlement.
- **Potential use of micromobility**: Stakeholders felt that access to e-bikes and e-scooters would benefit the area by supporting access to employment and education.
- **Potential use of EVs and e-car-clubs**: Switching to a private EV is likely to be unaffordable. The community are interested in an e-car club as an affordable way to access a vehicle.
- **Hub options**: Stakeholders proposed four hubs: high street shops near the community centre and library, a site near the sports field, the local industrial estate, and Seamer rail station. The high street shops site emerged as the preferred hub option from our consultation activity.

3.4 Catterick: Survey and Community Engagement

Catterick can refer to the Catterick Garrison and adjoining community, or the smaller settlement of Catterick to the east. Local E-Motion focuses on the former area.

- **Public transport connectivity**: Catterick has no rail connection and limited bus connections, leading to high levels of car dependency
- **Deprivation**: There are relatively low levels of deprivation in this area except for Colburn which has high levels of deprivation.
- **New developments**: Catterick Garrison is forecast to expand from 6,000 service personnel to around 9,500 by 2031. This will result in expected growth of the number of family members and dependents living in the area from 2,600 to 3,800.
- **Car ownership and use**: Car ownership is very high at 96% of households. 40% of respondents stated that they plan to get an electric car in the next five years.
- **Previous use of e-mobility**: the e-mobility mode with which people have most experience with is electric cars (18%). Previous use of e-car-clubs is lower than in the other areas.
- **Local transport concerns**: the community are keen to improve sustainable transport options and maximise use of existing active travel infrastructure.
- **Potential use of micromobility**: the concept of e-bikes was positively received. E-scooters would not be permitted for use on Ministry of Defence (MOD) land.

- **Potential use of EVs and e-car-clubs**: most properties in Catterick do not have driveways, and therefore EV uptake would be constrained by a lack of publicly available chargepoints. There is significant potential for e-car clubs as a solution for single-car households and those with a low income but a driving license (for example, young service personnel).
- **Hub options**: a preferred hub was identified at the 'Broadway' shops and café on Catterick Road in Colburn. This could be linked to the planned regeneration work around Shute Road.

3.5 Leyburn and Hawes: Survey and Community Engagement

We were asked to treat the settlements of Leyburn and Hawes as a single location. Leyburn and Hawes are around 16 miles apart, connected by the A684.

- **Public transport connectivity**: Leyburn and Hawes are linked as part of a complex bus network around the Yorkshire Dales. There is no rail connection to either settlement.
- **Deprivation**: There are relatively low levels of deprivation in these communities.
- **New developments**: There are proposed plans for a 127-house development in Leyburn. This is a reasonably large development in the context of Leyburn's population.
- **Car ownership and use**: Car ownership is high at 94% of households. 30% of respondents stated that they plan to get an electric car in the next five years.
- **Previous use of e-mobility**: A relatively high share of respondents have previously used e-bikes (17%) and electric cars (14%).
- **Local transport concerns**: There was strong support for sustainable transport, particularly in Hawes where there are negative impacts from visitors and tourists in the summer. Access to public transport is a significant concern for those living in the area.
- **Potential use of micromobility**: No use cases for e-scooters were identified. E-bike hire is already available in Hawes.
- **Potential use of EVs and e-car-clubs**: There was some interest in the potential for peer-to-peer car clubs in these communities.
- **Hub options**: No location was identified for a hub in Leyburn. Hawes has a community-run garage with two chargepoints, which could be a potential site for future mobility deployments.

3.6 Proposed Schemes

The locations and shared mobility components of the proposed schemes are shown in the tables and maps below.

3.6.1 Whitby

Table 2: Proposed E-Mobility Scheme for Whitby

Category	Component	Scheme Proposal
Location	Primary location	Green Lane Community Centre (GLCC)
	Additional location(s)	St Hilda's Business Centre, Eastside Community Centre (Helredale Road), Sainsbury's/Aldi, Cinder Track access point, beach front, Church Lane/Captain Cook Museum, Park & Ride Guisborough Road, Whitby Station.
Mobility Components: Shared Transport	E-car club and chargepoint	1 e-car club vehicle and chargepoint based at GLCC
	E-bike and docking	19 e-bikes across multiple docking stations
	E-scooter	0 (not suitable due to topography)

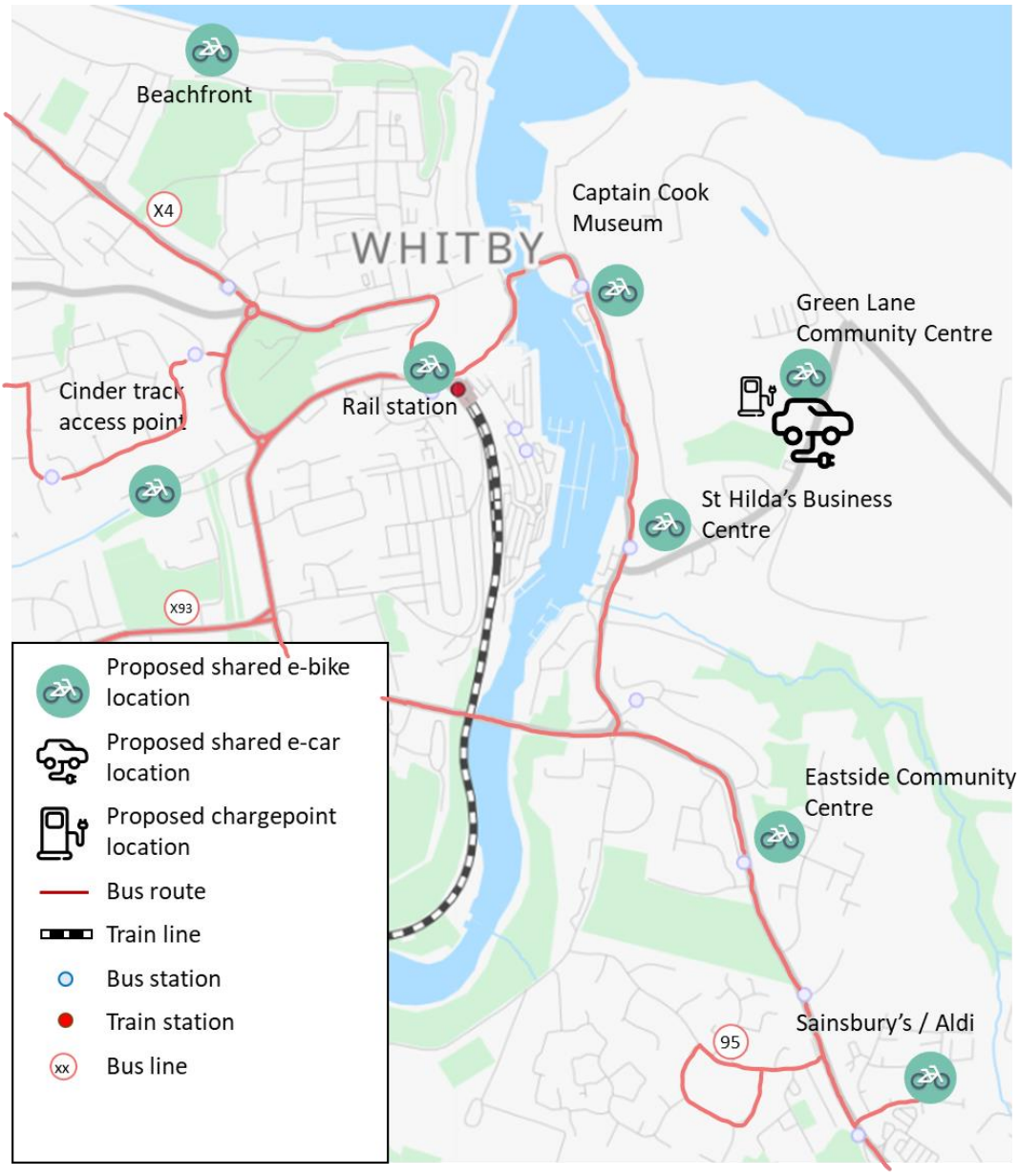


Figure 1: Proposed E-Mobility Scheme for Whitby

3.6.2 Eastfield

Table 3: Proposed E-Mobility Scheme for Eastfield

Category	Component	Scheme Proposal
Location	Primary location	Eastfield High Street
	Additional location(s)	Seamer station, Park and Ride (Osgodby), Morrisons, Cayton Bay Beach
Mobility Components: Shared Transport	E-car club and chargepoint	1 e-car club vehicle at the high street hub
	E-bike and docking	8 e-bikes across multiple docking stations
	E-scooter	16 e-scooters across multiple docking stations

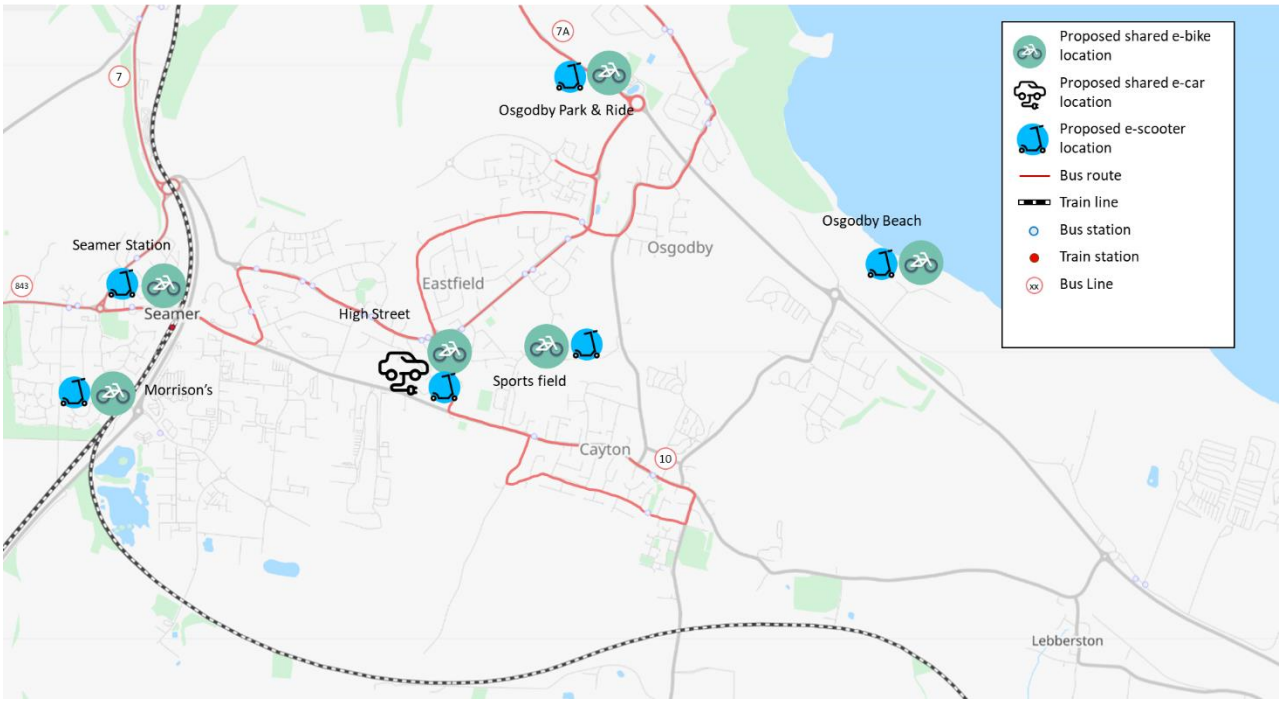


Figure 2: Proposed E-Mobility Scheme for Eastfield

3.6.3 Catterick

Table 4: Proposed E-Mobility Scheme for Catterick

Category	Component	Scheme Proposal
Location	Primary location	The 'Broadway' shops
	Additional location(s)	Shute Road, Scotton Park/Helles Barracks, Horne Road/Loos Road, White Shops (Byng Road/Catterick Road junction), Leyburn Road/Range Road
Mobility Components: Shared Transport	E-car club and chargepoint	1 e-car club vehicle at the Broadway hub
	E-bike and docking	19 e-bikes across multiple docking stations
	E-scooter	0: lack of interest from stakeholders and community

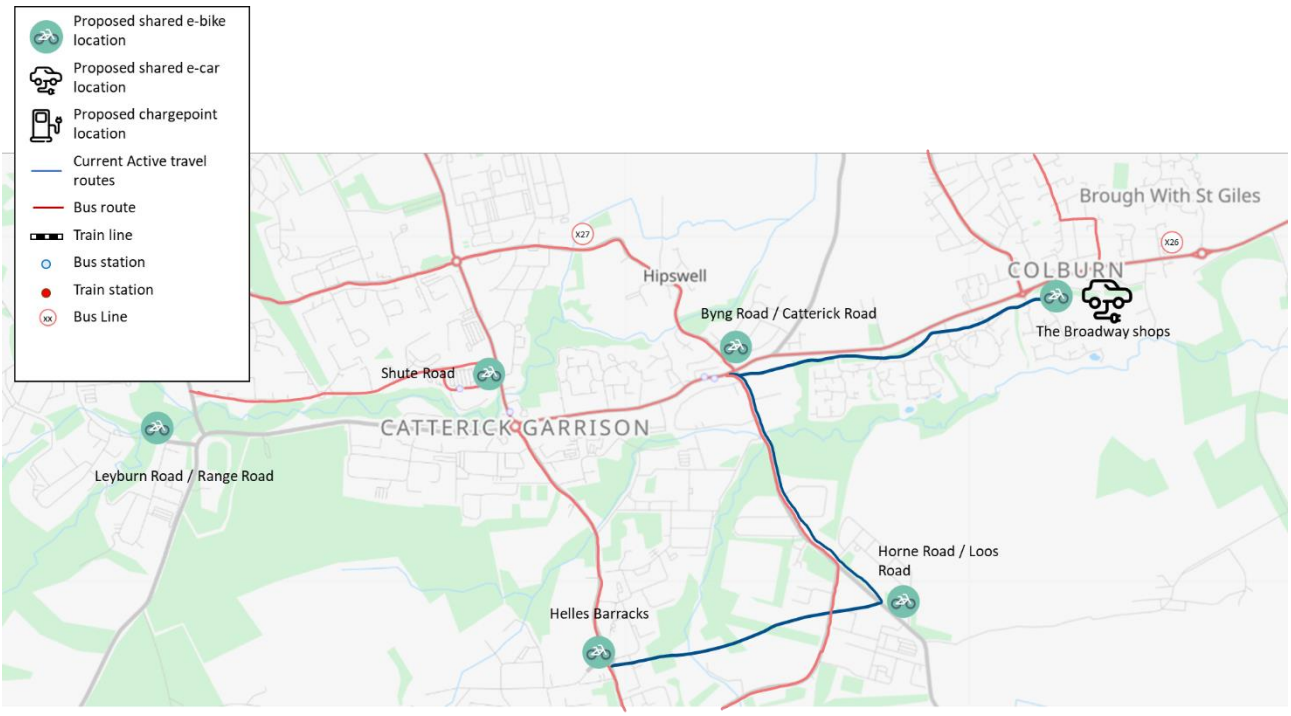


Figure 3: Proposed E-Mobility Scheme for Catterick

3.6.4 Hawes

Table 5: Proposed E-Mobility Scheme for Hawes

Category	Component	Scheme Proposal
Location	Primary location	Dalehead Garage
	Additional location(s)	N/A
Mobility Components: Shared Transport	E-car club and chargepoint	1 e-car club vehicle at Dalehead Garage
	E-bike and docking	0: lack of interest from stakeholders and community
	E-scooter	0: lack of interest from stakeholders and community

4 Options Feasibility and Scheme Selection

The objective of the next stage of the project was to assess the proposed schemes described above and select a preferred option in each region[6] to take forward for business case analysis. The outputs of this stage of the work were:

- A multi-criteria assessment tool to evaluate the four schemes and propose which schemes to carry forward.
- A review of the possible business models for each mobility option.
- An analysis of the potential barriers and risks of the proposed schemes including how these can be reduced and/or mitigated.

4.1 Results of Multi-Criteria Tool

Cenex created a bespoke assessment tool to assess each of the proposed schemes. Using the outputs from earlier parts of the research, and the CoMoUK guidance on mobility hubs[7], we created a set of criteria for a comparative assessment of the four schemes.

Cenex created seven main criterion types, as displayed in Table 6 below. As agreed with the steering group (Y&NY LEP, RDC, and SBC), environmental impact and equitability were the two key criteria that would take priority in assessing each scheme, with each weighted at 25% of the total score. Using our expertise in the sector, Cenex proposed weightings for the remaining criterion types to the steering group, agreed as per Table 6.

Table 6: Criterion type definition and weighting

Criteria Type	Description	Weighting (%)
Environmental Impact	CO_2 reduction and air quality	25%
Equitability	Current deprivation in the area	25%
Uptake Potential of Shared Schemes	Likelihood of successful implementation	15%
Wider Area Suitability (Macro)	Suitability for mobility options in the area	12.5%
Location Suitability (Micro)	Suitability for a mobility hub at the proposed premises	12.5%
Chargepoint Provision	Demand for and current provision	5%
Capital Investment	Capital cost of scheme	5%

The criteria scores are displayed in the chart below and then explained in the following narrative.

[6] Note the objective was to identify the preferred scheme within each local authority, not the two preferred schemes overall.

[7] https://www.como.org.uk/documents/comouk-mobility-hubs-toolkit. CoMoUK is the national organisation for shared transport, a charity for promoting its social, economic and environmental benefits.

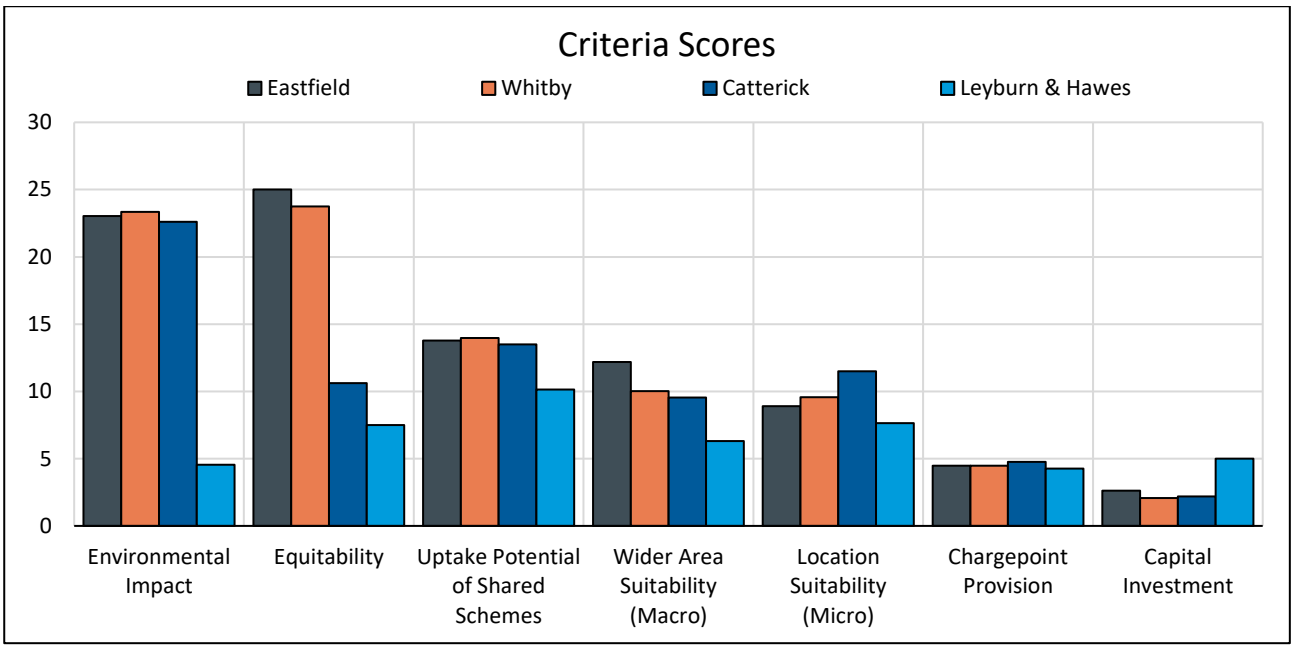


Figure 4: Comparison of all four schemes

Eastfield and Whitby

Whitby scored particularly highly in all categories, except Location Suitability, and Capital Investment. Whitby scored the maximum marks for CO_2 savings and placed second—amongst all four sites—for air quality improvements, scoring 3.3 out of 5. For Equitability, Whitby placed second—amongst all four sites—scoring 23.8 out of 25. For Location Suitability, the specific location of the proposed hub scored poorly on connection with other modes and visibility, with no public transport present in the area and the location on the outskirts of Whitby with most of the housing in the area located on one side, closer to the town centre. This is not something that can be easily rectified.

Eastfield scored particularly highly in all categories, except for Location Suitability, and Capital Investment. Eastfield scored the maximum marks for air quality improvements and placed third—amongst all four sites—for CO_2 savings, scoring 18 out of 20. For Equitability, Eastfield was scored maximum marks. For Location Suitability, the proposed hub scored poorly on safety and lighting due to the location currently offering little in terms of CCTV coverage and street lighting, though this can be easily rectified with appropriate installation of these components. The site also scored poorly on land ownership as the land is not owned by the local authority, which may pose a risk to installation of a hub.

Overall Eastfield scored a total of 90 points out of a total of 100 compared to Whitby which scored a total of 87 points. **We recommended that the Eastfield scheme be carried forward to the next stage.**

Catterick and Leyburn & Hawes

Catterick scored highly in all categories, except Equitability, Wider Area Suitability, and Capital Investment. Catterick scored maximum marks for CO_2 savings but was placed last—amongst all four sites—for air quality improvements, scoring 2.6 out of 5. For Equitability, Catterick was placed third—amongst all four sites—but scored significantly lower than Eastfield and Whitby. There are areas within the Catterick region that are more deprived than others, and importantly the location for the central mobility hub is proposed is within a more deprived area.

Leyburn & Hawes scored poorly in most categories, with the exception of Chargepoint Provision, and Capital Investment. Due to the size of the scheme proposed, Leyburn & Hawes scored poorly in potential CO_2 savings; conversely this leads to a high score in capital investment. There are low levels of deprivation present in the region resulting in a low score for Equitability, and due to the low

population density and higher average age of residents the region also scores poorly—compared to the other schemes—in the Uptake Potential of Shared Schemes.

Overall Catterick scored 75 points out of 100, while Leyburn & Hawes scored 45 points. **We recommended that the Catterick scheme be carried forward to the next stage.**

5 Business and Operating Models

In this section we compare the relative benefits and drawbacks of different business and operating models for potential mobility hub components.

EV Chargepoints

Cenex compared three common ownership models for public EV charging infrastructure: Own and Operate, Third Party Operator, and Concession. These three models have the following key characteristics:

- **Own and Operate**: The Own and Operate model represents the most involved level of intervention for the landowner. All costs are covered, and all revenue is retained by the landowner. The landowner prepares the site, including groundworks and electrical connection, procures the EV charging equipment, funds the installation of the equipment, and purchases a back-office system to manage the chargepoint. The landowner hence retains all revenue. This model was commonly used in the early days of the EV chargepoint market when charging networks were installed and managed by local authorities.
- **Third Party Operator**: The Third Party Operator model is identical to the Own and Operate model except that a third-party supplier is appointed to manage the chargepoint network. The supplier typically provides a back-office system at no direct cost, in return for a share of net revenue gathered by the chargepoint. The capital investment is still entirely provided by the landowner and, in all regards except for network compatibility, the landowner retains control of how the chargepoint is operated.
- **Concession**: In the Concession model, the landowner simply provides the land and establishes an electrical connection point for an external supplier to install and operate a chargepoint. As the landowner retains ownership of the connection point, there is no lasting obligation to the external supplier, beyond the terms of their concession.

In each ownership model, elements of the capital cost, operating cost, and revenue are shared differently between the landowner and chargepoint provider.

The ownership models were qualitatively compared regarding their suitability for specific EV charging infrastructure applications, and financial and operational considerations when planning an EV infrastructure network. Scores from one to five[8]—representing least to most ideal—and a red-amber-green scheme have been given against eight criteria for each ownership model. Table 7 summarises the strengths and weaknesses of each ownership model.

Table 7: Comparison of EV infrastructure ownership models, their relative strengths and weaknesses and their appropriateness for different types of infrastructure installations

Ownership Model	Charging Infrastructure Types				Network Finance and Operation			
	Residential	Destination	Transit	Hub	Revenue	Risk	Service	Local Authority (LA) Resource
Own & Operate	5	3	3	2	5	1	3	1
Third Party Operator	4	3	3	2	4	2	4	3
Concession	2	3	5	3	3	3	3	4

While the own and operate model appears suited for residential charging with the greatest potential revenue, the risk and required resource are high. As such, it is not recommended that an own and operate model is taken forwards.

[8] N.B. A score of 1 means 'least ideal'. For revenue, this is the lowest income but for risk, this is the highest risk. Correspondingly a score of 5 means 'most ideal'. For revenue, this is the highest income but for risk, this is the lowest risk

Of the two remaining models, third party operator and concession, both have their positives and negatives. Generally, the third party operator is better suited to residential charging and the concession model is better suited to a charging hub. While a concession model requires less resourcing from the local authority and has less risk associated with it compared to a third party operator, there is a reduced revenue and less control over the service provided.

In the long-term, it is likely that there will be a need to provide transit charging infrastructure as well as strategic charging hubs, where it may become more appropriate to deploy the concession model. Though the short and long term strategy for the area do not need to match, this could simplify things in the future, with the LA already understanding the business model well and the role that they play in the deployment of chargepoints.

Car Clubs

Cenex compared three common business models for operating a car club: franchise, private sector led, and concession. These models have the following key characteristics:

- **Franchise**: This model is often used in a scheme where cars are purchased and owned by the local community (usually a community group or climate action group). An operator is commissioned to provide a booking platform and manage payment, insurance, and other running requirements. This operator is provided with an annual payment to cover costs. Responsibility for maintenance of the vehicle, communications and marketing remains with the community organisation. It is rare for a local authority to run a franchise model directly, but they may support a local community organisation with funding.
- **Private sector led**: This option involves no public sector involvement; a car club operator will place vehicles in a location if they believe the business case is economically viable. The car club provider will expect no restrictions from the location authority and there is typically little to no opportunity for the authority to have any say on the operations. The operator bears the cost of setting up and operating the scheme.
- **Concession**: Local authorities can influence where a car club operator deploys vehicles through part-funding for the service or support in kind, such as covering the fee for traffic regulation orders, waiving rent for parking locations, community engagement and marketing support, or funding EV infrastructure. Local authorities can leverage this to encourage operators to deploy vehicles in less attractive locations, such as more deprived communities, that would otherwise not be considered by the operators.

Cenex recommend the concession model for RDC and SBC for the mobility hubs proposed, where they should seek to invite a car club operator to the area under a tendered contract. This ensures that a level of control is maintained over the operations and placement of the vehicles whtheyile funding can be provided to encourage operators to deploy vehicles at the sites specified matching the aims of the scheme—to provide zero emission travel to underserved residents.

There are no private sector led car clubs in the locations specified and it is unlikely that—without support—they will deploy vehicles in the near future.

Micromobility

Cenex compared four common business models for operating micromobility: direct control, service contract, procured operator, and permission to operate. These models have the following key characteristics:

- **Direct control**: Assets (such as e-bikes or e-scooters) are purchased and operated by the local authority. There is no procurement to a third-party operator.
- **Service contract**: The local authority purchases assets and commissions a third party to manage and run the scheme.
- **Procured operator**: The local authority tenders for an operator to supply the assets as well as manage and run the scheme.

- **Permission to operate**: Operators set up services with permission to operate provided by the local authority, but without any further public sector investment or involvement.

We recommend that a service contract or procured operator business model is used for the mobility hub schemes. These business models provide a level of control over how the services should or will operate as well as providing the opportunity for RDC and SBC to provide incentives to operators and service providers to operate in the area: such as purchase of the vehicles and/or infrastructure.

With a permission to operate model there is little control over the services to be provided and this model often works best where operators already see a profitable business case with no external funding or capital required. A direct control model for a small number of vehicles and hubs, as proposed, is unlikely to be economically viable as it is rarely more cost-effective and efficient to run micromobility services in house.

If a service contract or procured operator business model is selected the exact operating model will be will partially down to the operator/service provider with many having a preferred method of operation, and the ability to adapt this depending on local circumstances and priorities will vary. The priority of this project is to reduce emissions and to tackle deprivation through equitability of zero-emission transport options. With this in mind an operating model that is in-line with these Key Performance Indicators (KPIs) should be prioritised. For instance: parking locations and operational boundaries focused on the most deprived areas, and recharging of vehicles that limits the operational carbon footprint.

5.1 Incentives

Through Cenex's engagement with the communities involved in the proposed schemes, we recommend that the following incentives be investigated as a priority. These incentives had the most positive responses from the community engagement, and/or Cenex have concluded that these mitigate some of the most challenging aspects regarding future uptake of the services:

- Introductory offers: For both Catterick and Eastfield this will help with initial interaction and use of the services.
- Mobility credits: For Eastfield this should be a targeted subsidy to those most economically vulnerable.
- Bundle tickets: For both Catterick and Eastfield, most operators offer these already for their own services but should be explored in the tender for operators to work collaboratively—cross platform—to offer incentives to use other services. In Eastfield specifically bundle tickets could be inclusive of any future mobility schemes in the wider Scarborough area
- Group ride & introductory sessions: These two incentives can be combined and should be looked at in Eastfield specifically around e-scooters—a relatively new form of mobility still where there would be clear benefits to the residents.
- Engagement with MOD: In Catterick this will be key with MOD staff representing a large proportion of the population.
- Job and community support: In Eastfield offers of free or subsidised rides to job support group members, youth groups etc. should be considered for those who need it most and are more financially vulnerable.

5.2 Key Barriers and Mitigation

Thirteen potential barriers were investigated relating to the proposed mobility hubs. An overview of each barrier was provided along with examples (where applicable) and potential mitigation of these risks. Each barrier was evaluated for the likelihood of this barrier occurring and the severity to create a potential risk score, given a score out of 5, and these were multiplied together to determine the risk score. Table 8 shows the top five barriers to the proposed schemes.

Table 8: Top five barriers

	Location	Likelihood	Severity	Risk	Mitigation
Land ownership	Eastfield	4	3	12	Bring the land owner into the project at an early stage
Tender not taken up	Both	3	4	12	Early engagement with potential operators and financial incentives
Vandalism	Eastfield	3	3	9	Multi-criteria tool, community, and police engagement
Unsuccessful bid/funding	Both	2	4	8	Seek all possible guidance available from funding body
Public acceptance	Both	2	4	8	Community engagement and lessons learned from other schemes

6 Business Case Development

The objective of the final stage of the project was to create an outline business case using the UK Government (HM Treasury)) Five Case Model for the two schemes[9] selected. The outline business case covers the following five cases: Strategic, Economic, Commercial, Financial, Management.

6.1 Strategic Case

The strategic case compiled the findings from earlier parts of the project. It presented the proposed schemes in Eastfield and Catterick, and the strategic reasoning for the funding application via the UK Shared Prosperity Fund (UK SPF) through the "Communities and Place" investment priority. The contents of the Strategic Case have been summarised in earlier sections of this report.

6.2 Economic Case

Cenex estimated the benefit cost ratio (BCR)[10] and net present value (NPV)[11] of the two preferred schemes by assessing the following benefits.

- **Monetised benefits – Emissions**: Carbon dioxide (CO_2), Particulate matter (PM10), and Nitrous Oxides (NOx)[12].
- **Monetised benefits – Social impact**: Reduced congestion, reduced severity of accidents, reduced noise, health benefits of cycling and reduced risk of premature death, reduced absenteeism due to health benefits, and reduction in indirect taxation.
- **Additional benefits that cannot be monetised**: Deprivation, mobility opportunities, and mental health benefits from outside journeys.

The schemes were analysed over a 10 year period, calculating the costs of setting up the scheme (and grant requested), and comparing this to the monetised emission and social impact benefits. Sensitivity analysis was undertaken to estimate the impact of low and high consumer utilisation, and different emissions abatement damage costs.

The BCR analysis showed a strong case for the Catterick scheme, achieving a BCR above 1 for all but the low usage scenario with low emission abatement costs. A BCR above 1 suggests that the calculated benefits exceed the investment costs requested through the grant.

The BCR analysis shows a strong case for the Eastfield scheme provided there is a high uptake of micromobility in the area. Grant funding should be secured for community engagement and training on these modes to maximise uptake of these vehicles.

Table 9: Benefit Cost Ratio of the scheme

	Catterick	Catterick	Eastfield	Eastfield
Usage Scenario	**Low**	**High**	**Low**	**High**
Low prices	0.90	1.81	0.54	1.03
Central prices	1.05	2.12	0.68	1.28
High prices	1.21	2.43	0.83	1.53

[9] An additional business case for the Whitby scheme will be carried out from September 2022 and will include DRT in addition to the mobility components stated in Table 2.

[10] The benefit-cost ratio (BCR) shows the relationship between the costs and benefits of a proposed project. If a project has a BCR greater than 1.0, it is expected to deliver positive value to funders or investors.

[11] Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over time. It is used to analyse the potential profitability of a proposed project.

[12] Carbon dioxide (CO_2) is a greenhouse gas which contributes to climate change. Particulate matter (PM10) and Nitrous Oxides (NOx) are pollutants which contribute to poor air quality.

6.3 Commercial Case

A competitive, regulated grant application process is required for the delivery of each service and aspect of the mobility hub. This should be achieved through competitive tenders for running the services outlined in the strategic case as well as the execution of delivering the hub and its design.

The payments should be made under a grant funding agreement, which will give the local authority rights to step into the operator's supply contracts if conditions have been breached. The total value of money available for the scheme will be set by the SPF and apportioned appropriately versus the costs envisaged in the Economic business case.

During the time that the scheme is live, Cenex recommends that a member of staff at each local authority monitors and manages the scheme and contracts with operators.

6.4 Financial Case

Cenex estimated the total costs of the scheme to the local authority over a 10 year period and this information has been supplied confidentially to the project steering group.

We recommend that the funding requested through the SPF (or other source) is:

- **Catterick**: £191,000 – £221,000.
- **Eastfield**: £211,000 – £251,000.

The cost range depends on whether staff costs for the local authority are included for the first two years of the scheme.

To make the tenders for operators attractive there is unlikely to be an income share between the operators and the local authority. As such, no direct income has been calculated for the local authority. However, there is the possibility to include within the tender, an option for operators to suggest an income share/profit share arrangement. This would help to support staff costs for management of the scheme and would be looked upon favourably, providing an extra source of income to the local authority.

The indicative total income for the operators in Catterick is estimated to be £620,000 - £1,300,000 over a 10 year period. The indicative total income for the operators in Eastfield is estimated to be £840,000 - £1,570,000 over a 10 year period.

6.5 Management Case

Committed resource is required from RDC/SBC, and future North Yorkshire Council (NYC), to ensure successful delivery. The project team will be responsible for the day to day management and overall delivery of the project, working with various stakeholders to ensure that the project delivers a scheme that works for the operators, general public, and NYC alike. Within the project team a Senior Responsible Owner (SRO) should be identified who is accountable for the programme, and for ensuring that it meets its objectives and delivers the expected benefits.

All major decisions should be brought to a steering group representing key organisations within the project. This will ensure that the project direction, scope, budget, and timings are held to. When approved by the steering group, a senior member of the NYC should sign off on any key decisions.

A possible governance structure, based off previous work, is suggested in the image below.

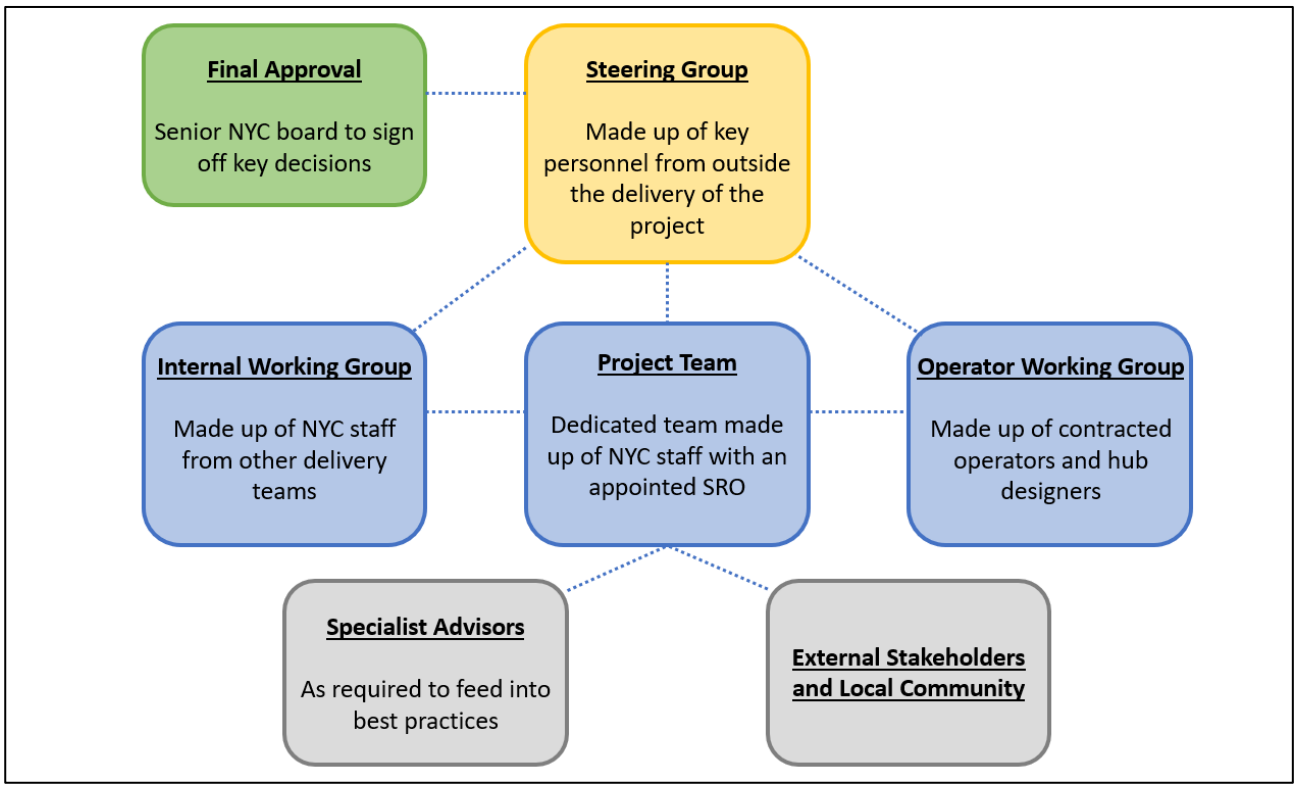


Figure 5: Possible governance structure for the scheme

A live benefit register has been created to monitor the expected benefits. Cenex recommends that the benefit register be reviewed and updated on a monthly basis by the project team and reviewed during the steering group meetings once a quarter.

A live risk register has also been created to monitor risks to the project. Cenex recommends that the risk register be reviewed and updated on a weekly basis by the project team and reviewed during the steering group meetings once a quarter, or sooner if necessary.

A Monitoring and Evaluation Plan should be prepared to ensure that the project is delivered on time and meets the objectives set out in the strategic case. This should be managed by the project team and reviewed every quarter by the steering group to ensure successful delivery and outcomes of the project.

Three key output reports should be produced for the evaluation of the scheme, during and after implementation, and these should be fed back to DfT as well as internally for future lessons learned.

- **Impact evaluation:** to provide reliable evidence of the extent to which the project has caused the changes in the outcomes and impacts. This will be considered through an outcomes report after year of the scheme going live, which assess the outcomes in relation to the defined objectives identified and comparing the post intervention situation with the pre intervention situation.
- **Process evaluation:** to identify what lessons have been learnt during implementation. This is likely to be presented through a series of quarterly progress reports produced during the implementation stage, followed by an end of delivery report to fully assess how the project has been delivered, and what lessons can be learned for future mobility hubs in the region, as well as the rest of the UK.
- **Economic evaluation:** aimed to establish the benefits of the scheme and relating these to the cost of the interventions.

7 Conclusion and Next Steps

Cenex has completed its work on the proposed schemes and submitted all recommendations and other material to the project steering group. The next steps are for the local authorities to develop funding bids to proceed with design and implementation of the suggested schemes.

Table 10 shows the proposed project timeline for the scheme. The timeline is sequential and as such the duration of each activity has been provided to allow ease of future amendments should the target start date be changed.

Table 10: Proposed project timeline

Activity	Start Date	Duration[13]	Actions
Funding decision from SPF	April 2023	NA	NA
Governance structure agreed	April 2023	1 month	This needs to be in place to allow the smooth running of the project and a clearly defined path to signing off decisions.
Design phase	May 2023	3 months	Specification converted to technical design documents, signed-off by steering group.
Public and external stakeholder engagement	August 2023	1 month	Public promotion campaign
Tender for service providers	September 2023	2 months	This phase can only begin once specifics are known, e.g., EV charging, operators.
Tender for construction	November 2023	1 month	Should only begin when services are guaranteed through tender.
Building and public information	December 2023	2–4 months	Time depends on availability of construction team, local services and local conditions.
Mobility hub and shared schemes live	February – April 2024	NA	NA

Future updates on progress will be provided by the relevant local authority.

[13] Durations in-line with CoMoUK guidance: Mobility Hub Guide

Lowering your emissions through innovation in transport and energy infrastructure

Transport

Energy Infrastructure

Knowledge & Enterprise

Cenex
Holywell Building,
Holywell Park,
Ashby Road,
Loughborough,
Leicestershire,
LE11 3UZ

Tel: **+44 (0)1509 642 500**
Email: **info@cenex.co.uk**
Website: **www.cenex.co.uk**
Twitter: **@CenexLCFC**
LinkedIn: **Cenex**