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Image: David Butler

Bridging the Gap

People and place: the key to bridging the transport decarbonisation gap

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FOREWORDS AND PERSPECTIVES

There is so much that needs to be done to change the practice of transport planning in order to really confront the challenge of keeping to 1.5C and to face the increasingly evident tragic consequences of the changes that this level of ambition implies; an ambition that seems increasingly difficult to achieve in the face of populist culture wars and wavering commitment to the tough decisions that the Climate Change Committee state should define our progress.

In some senses, it is straightforward to improve how we plan for climate change mitigation. We made almost no progress in the 30 years since 1990 and so there is lots of low hanging fruit. Better valuation of carbon in appraisal and increased consideration of carbon in strategic projects would take us forward, but this doesn't really provide the answers. If we really want to meet our climate goals then it is now clear that substantial travel demand reduction is required.

However, we can't expect people to simply accept things being taken away from them, or at least not nearly enough people would see the crisis as relevant enough to them to back such a shift. If we are to overcome this crisis of inaction, we have to create workable, believable visions of the futures that the science tells us we need. What might they look like? How could they work for people and businesses, and allow society to thrive at the same time?

Bridging the Gap is an ambitious piece of work which seeks to do just that. It has taken as a case study a proposed development and built, from the ground up, a set of methods to elaborate what kinds of alternative visions could be developed. The pioneering work of DecarboN8 on building a Societal Readiness Assessment Tool was deployed to help stakeholders understand how these changes might work, who would be affected and how and ultimately to shape whether the ideas are fit for the case study areas.

The messages are clear:

• First, long-term development planning cannot solve the carbon problem given the imperative for action before the end of the decade. However, it does have to be ready with projects and proposals which align with the actions which will have been taken to accelerate decarbonisation. There is no 'business as usual'.

• Second, the tools necessary to build radical alternative futures which fit with a decarbonised society are not sat on a shelf anywhere. They need to be built and tested. Bridging the Gap has pushed the envelope of thinking here but the toolkit is by no means finished.

• Third, and finally, taking a decarbonisation compliant approach changes the questions, the solutions and the conversations about how to get there.

I'm grateful to Stantec and the Engineering and Physical Sciences Research Council for their support in allowing Keith and the many others who have contributed to this report to take this challenge on and move the field forward. Our future ambition on planning is very much part of whether we will indeed, bridge the gap.

Professor Greg Marsden

Professor of Transport Governance, Institute for Transport Studies, University of Leeds

According to the IPCC, 40-70% of the emission reductions required to keep to 1.5C could come from changes in demand, and IPSOS surveys show that more than 60% of people worldwide believe that if they and their governments do not act on climate change, they will be failing future generations. And yet, even when leaders like UN Secretary General António Guterres declare a Code Red for humanity, there is little appetite to implement policies that would require the public to make significant changes in their lifestyles, especially when it comes to transport.

It is easy to blame the public for a lack of societal readiness. There are many possible solutions, including high-tech enabled shifts to net-zero with electric cars, smart cities, hydrogen and synthetic fuels, policy and design interventions such as low emission zones, streets dedicated to walking, cycling, leisure, play and social encounters, 15min neighbourhoods, as well as large-scale carbon capture and geo-engineering solutions.

Standardised Technology and Market Readiness Levels assessments suggest that many of these solutions are fit for purpose and potentially profitable. Billions are invested, and billions are lost in failed projects. People just seem unable to grasp the scale and urgency of the problem, many need concrete individual comfort more than abstract life-chances of future generations, they can tolerate the cognitive dissonance between their values and inaction. While experts call for better communication and education, a vocal minority actively exploit these problems to turn climate change into a culture war issue and delay action.

But this public deficit approach to societal readiness is destructive. It diverts attention from vital questions about the solutions themselves: How ready are they for people to adopt into their everyday lives? How easy are they for businesses and developers to sell? How can politicians promote them and still be elected? How good are they for society in the long-term?

Changing mobilities is risky for politicians, service providers, planners, housing and infrastructure developers, individuals and society as a whole, because existential human values of freedom, social connection, and opportunity have become utterly entangled with dysfunctional energy and mobility systems. Car dependence is not a choice, it is structural. Advertising, predict and provide-led planning, and land use decisions actively make the car a necessity. Individuals, families, communities struggle to make green transport choices, because employment, education, healthcare, shopping, culture and leisure opportunities are only available a long way from home or perceived to be better there. There are vast inequalities, with affluent commuters' lifestyles and sense of identity car-dependent in ways that are very different from how less privileged neighbours depend on their cars to make ends meet. Courageous creativity, careful analysis and innovation are needed to break these dynamics.

It has been an inspiration to be part of the Bridging the Gap project. The team has pioneered an invaluable vision-led planning approach and developed powerful tools for systemic analysis. It has embraced Societal Readiness Assessment (SoRA) - a method for formative evaluation of the societal readiness of solutions and visions that enables critical attention to carbon reduction, social justice, social impact and fit for a decarbonised future. They have used SoRA as a source of inspiration and creativity, and it is incredibly energising and hopeful to see how this approach has allowed the team to take the scale and urgency of climate action seriously, to develop place-based, multi-dimensional analysis with stakeholders in a way that invites dissent and leverages it constructively.

Professor Monika Buscher

Professor of Sociology and Director, Centre for Mobilities Research, Lancaster University

Bridging the Gap: At a Glance

Climate Change is an existential threat to humanity. Even knowing this, the UK is not doing enough to meet net zero in the surface transport sector. Current plans are focussed on delivering a transition of existing travel to alternative fuels. This is still important, but if we are to meet the UK's net zero mobility goals, we need to reduce car use by at least 20% (or equivalent) by 2030 and retain these levels thereafter.

This doesn't mean the car has to become a pariah, rather that we need to make alternative ways of travelling more convenient for some of our journeys. To do this, we need to create a future in which more radical interventions are focussed on substituting, shifting and switching higher volume, intermediate length journeys by car between 5 and 30km. This is where we are likely to find the greatest contributors to carbon emissions, and the most likely to be susceptible to change.

Our assessment suggests that a future based on urban living focussed around mass transit and active travel could be developed to put us on a pathway to net zero, but is such a future affordable and could it be made to meet the needs of a decarbonised society? Perhaps a digitally driven future might better meet the society's needs by making pay-as-you-go mobility services more convenient than using the car?

These (or other) alternative futures would inevitably be controversial. If such radical change is to be delivered, we need to constructively respond to the concerns of people about how alternative transport and land use futures meet their needs and reflect the context of the places they live. Unless we embrace 'societal readiness' concepts, we will not be able to meet the net zero mobility challenge.

These alternative futures would require a fundamental change in our approach to land use and transport planning and investment.

No longer would the requirement to fund new capital infrastructure projects to cater for more demand be considered desirable. Instead, providing revenue support for new land use and transport services would deliver alternative mobility solutions, enable us to manage demand, and develop and sustain thriving communities in the longer term.

There are barriers to these potential solutions in terms of professional practice, the planning system and the market. These will need to be debated and resolved if we are to make faster progress towards net zero mobility. This study seeks to develop an evidence base and examine these issues to enable an informed debate with community, professional, public and private sector stakeholders.

Study Contributors:
University of Leeds
Transport for the North
Lancaster University
Transport for Greater Manchester
Newcastle University
Bury Council

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Executive Summary

Climate Change is an existential threat to humanity. Unprecedented international collaboration has established global agreements aimed at tackling this threat. In the UK, a statutory framework has been put in place to reduce emissions. Transport is the biggest remaining contributor to UK greenhouse gases, and surface transport represents over 90% of these. The Climate Change Committee confirms that we are making insufficient progress to hit our carbon reduction targets, and highlights slow progress in the transport sector as being a key reason why we are falling behind our international commitments.

Government policy for transport decarbonisation relies mainly on the transition to electric vehicles and renewable energy to drive carbon reduction in this sector. It does not seek to deliver carbon reduction through systemic changes in the way we travel, despite the CCC confirming in its 2023 progress report that demand reduction, and more specifically the need to reduce travel by cars, vans and HGVs, is an important factor of the strategy needed to meet net zero mobility objectives.

The Government's policies have succeeded in generating momentum in the industrial and energy sectors, but it has avoided the more complex, controversial, but necessary transport related issues of demand management and behaviour change. Critically, it has resulted in there being few incentives to change the way land use and transport projects are delivered, with new development and infrastructure continuing to reinforce high carbon behaviour and outcomes. This is a major challenge that will need to be grasped if net zero mobility is to be delivered.

Bridging the Gap is a study that was established in 2021 with the aim of:

- Understanding the gap between what can be achieved by current government transport decarbonisation policy and the attainment of net zero mobility targets in a local planning context;
- Identifying a range of additional transport and land use measures that could be used to develop a shared vision for local planning and development that delivers demand reduction, and therefore help to bridge the gap;
- Developing some of the tools and techniques that will be needed to identify land use and transport planning priorities for action in support of demand reduction within a vision-led planning process;
- Investigating the societal barriers to net zero driven changes in land use and transport planning to create a more favourable environment for effective implementation; and
- Engaging with policy and market stakeholders about these issues to identify what might be done to change our approach to land use development and transport infrastructure to better support net zero, as well as better, healthier and fairer communities.

Stantec has worked with leading academics and practitioners to develop a case study through which these issues could be examined. Working with Transport for the North, Transport for Greater Manchester and Bury Council, Stantec has developed future travel demand profiles for proposed development at Elton Reservoir in the Bury area for 2040, for each of TfN's Future Travel Scenarios.

Together with the University of Leeds and TfN, it has made an assessment of which of these scenarios might be more successful in terms of carbon reduction - determining the extent to which there would be a remaining gap between the ability of each scenario to reduce carbon, and the net zero targets for the transport sector. The sobering conclusion of this work is that a reduction in travel by car of at least 20% is required by 2030 to meet surface transport net zero, assuming the most favourable outcomes from current policies.

This analysis has in turn provided the basis for developing alternative land use and transport futures based on the land use and transport context of development of Elton Reservoir, Bury and its surrounding conurbation*. The first of these used existing and emerging plans and policies to establish a 2040 baseline for the study. Two further 'futures' were then developed, embracing more radical changes in land use and transport infrastructure aimed at bridging the carbon gap. The three futures developed for this study are:

- Our baseline 'future' was based on the TfN Just About Managing scenario, assuming that the progressive policies of TfN, TfGM and Bury Council are implemented.
- Our second 'future' was a 'supercharged' version of TfN's Digitally Distributed scenario. The market has led the development of transport infrastructure and services, with digital and technology-led mobility services replacing car ownership and use.
- Our third 'future' was a 'supercharged' version of TfN's Urban Zero Carbon scenario. The public sector has led a strategy of high density living around mass transit systems, creating living environments more amenable to walking, cycling and micro-mobility.

These three futures provide the basis for an assessment of the potential to meet net zero mobility objectives and fit with society's needs, as a pre cursor to the development of a shared vision suitable for the operational and planning assessment process. In doing so, it is recognised that continued use of predict and provide assessment in planning will result in continued car dependent, high carbon travel outcomes, and that a move towards vision-led planning and design is needed. This study has therefore begun to look at some of the new tools and techniques that will be needed to support this process. These include the early development of demand led option assessment and land use and connectivity optimisation tools, (supported by Newcastle University).

Whilst many of our current tools can be developed to have a continuing use in this new approach to assessment, there are few parallels for the preparation of a shared, objective's led vision capable of providing the analytical framework for vision-led planning. Often, existing community engagement practice focusses on explaining a land-use and transport project in a way that persuades local people about the advantages of the proposed scheme, whilst seeking to avoid a debate that would require change to the underlying project principles.

An alternative approach has been developed by the Department of Sociology at Lancaster University which seeks to understand how the vision might need to be changed to better meet societal needs. Without a scheme being societally ready it is contended, the vision will not succeed in meeting its objectives. If part of the vision objectives is carbon reduction and involves changes in societal behaviour, there needs to be a concerted effort to optimise the future vision's societal readiness.

Working with Lancaster University, we have used our supercharged Digitally Distributed and Urban Zero Carbon futures as the basis for a preliminary assessment of the societal challenges associated with implementing more radical land use and transport solutions. Together, we have piloted a Societal Readiness Assessment workshop, and reviewed the extent to which this process could usefully form part of our vision-led planning system. Our aim is to engage with professionals, policy makers and market makers about the challenges of vision-led planning, and the need to stimulate the change urgently needed.

*This study is set in a real-world context with the aim of developing future scenarios that could more easily be imagined by a local community, than if a hypothetical situation had been used. These scenarios were not intended to represent any existing development or transport plans for this or other sites in the area. Any future local transport scenarios or developed for this study

Key Conclusions

1. TfN's Future Travel Scenarios enable us to better understand which alternative pathways provide the best route to net zero, and to test what else needs to done to meet surface transport net zero objectives. Bridging the Gap concludes that 'Urban Zero Carbon' is the pathway that achieves the best carbon reduction outcomes, with 'Digitally Distributed' representing the best of the rest, (based on TfN's 2019/ 2020 futures). A reduction in travel by car, or equivalent, of at least 20%, (30% for DD), is required by 2030 to meet surface transport net zero, assuming the most favourable outcomes from current policies.

2. In considering a new development at Elton Reservoir in Bury, both UZC and DD would need to be 'supercharged' with additional Net Zero Mobility Measures (NZMMs), if a net zero mobility future is to be created. Whilst it is important to promote greater movement by active modes, the key to carbon reduction is the reduction of intermediate trips (between 5 – 30km) which would represent over 60% of the travel distance related to the site.

3. A high-level vision and validate style assessment of alternative future scenarios has identified technically plausible land use and transport futures capable of meeting net zero mobility objectives. In all scenarios, car restraint policies would need to form part of a solution alongside the provision of convenient alternatives to the car.

4. In the DD+ future, this could be achieved using a combination of technology-led mobility services within a sub-urban environment, incorporating integrated community and mobility hubs and shared parking areas for EVs with Vehicle2Grid technology. In the UZC+ future, this could be achieved by focussed new urban living around mass transit hubs, streets focussed on active modes with constrained parking in remote parking buildings.

5. Neither of these alternative futures would provide a system of mobility that would be ready for adoption by society. Concerns about the DD+ world providing for the many and complex journey destinations and purposes required, and about the nature of UZC+ urban living in a generally sub-urban environment would leave society anxious about its ability to thrive. Much work would need to be done to develop these visions into something capable of being embraced by society.

6. An iterative approach which treats community engagement and Societal Readiness Assessment as an integral part of the commercial, technical and operational assessment processes would need to be adopted to ensure the development of a shared vision of the future that could guide a vision-led planning and design process, and lead to the carbon outcomes envisaged.

7. In assessing the practical implications of pursuing either the DD+ or UZC+ scenarios against a multi-criteria appraisal framework, it can be seen that some elements of each future are unlikely to be capable of implementation in the short timescale needed to meet the demands of a net zero pathway by virtue of the scale of cost, risk and complexity of projects required.

8. A hybrid vision begins to emerge which builds on existing plans to improve local transport systems, and focusses on promoting the quickest wins that have the greatest impact on intermediate trips, such as through the provision of new mobility services, and a development plan that uses UZC and DD features where most appropriate.

9. Critically, this requires a co-ordinated approach to planning and development across the local conurbation which prioritises investment in land use and transport interventions focussed on delivering net zero mobility priorities, and avoids unnecessary or counterproductive investment in providing greater capacity for car movement.

10. Place-based conversations between government, regional and local authorities, developers, investors and communities are urgently needed to lead this debate.

Policy Considerations

1. The carbon gap is bigger than we thought, and the underpinning policy is changing faster than plans can be made. There needs to be a debate about this to decide what to do. Is it really feasible to reduce demand by 20% or 30%, and if so will this lead to the attainment of net zero? Only if everything else in the decarbonisation process is also being delivered to the maximum possible, including electricity grid transition, car manufacture and transport system investment. These cross-sector conversations need to be taking place more actively, especially locally.

2. There is much to do to move away from car dependent models of land use and transport planning. Continuing to invest in additional highway capacity creates additional capacity for car use and congestion. Change will only come with a co-ordinated move away from this towards the funding of mobility services and reallocation of road space towards other modes.

3. Local development cannot make radical change unsupported. Local Authorities and developers respond to societal attitudes and political direction. In Wales, the Future Generations Act provides a national framework for the conversation about change, and both Wales and Scotland have set traffic reduction targets. Something else is needed in England to frame the conversation we need about road user charging, demand management and traffic reduction, and to provide the underpinning justification for a new approach to planning and transport decision making.

Market Considerations

1. There have long been developers and investors keen to deliver new models of development which respond more fully to net zero. How do developers and investors respond to the possibility of delivering quite radically different forms of development such as DD+ and UZC+? What do they see as the challenges and opportunities? How do societal attitudes affect commercial decision making?

2. Change has been very slow. The phenomenon of 'learned helplessness' has been identified as a causal factor* where even those who know they need to act feel they can't move ahead because there is no level playing field with those who don't. How do we break this vicious circle, both within the development planning world, and cross sector. Would SoRA provide a useful tool in helping to unveil some of the challenges and opportunities?

3. If development is to support the move towards provision of local amenities and mobility services as an integral part of its move towards net zero, there is a need to move from capital funding of infrastructure to revenue funding of services. This would need changes in planning policy and commercial delivery models.

Professional Practice

1. There is a clear need to change land use and transport planning to reflect the need for people and place to support the transition to net zero. DD+ and UZC+ offer potential solutions, but context is very important. Responding to local circumstances is essential to ensure that investment is focussed on tackling high demand movements, quickly, as a first priority.

2. We are a long way off knowing how best to pursue land use and transport planning in a vision-led planning system, in particular the establishment of an objectives-led, shared vision that this study has focussed on. Some early prototypes of some of the tools and techniques we will need have been developed. Many others are doing the same – some very sophisticated, others not. There is a need for a conversation about how to quickly achieve greater consistency of approach in a way that is appropriate at all scales of planning. This is probably best led by the professional associations.

*Stantec Climate Change Workshop, October 2021, UCL Climate Action Unit.

Despite best efforts, politicians, professionals and communities often fail to reach a common understanding of the challenges facing society, and creating a future that both achieves the intended transport and carbon objectives, whilst meeting the needs of society

3. Land Use and transport planners have long talked about the need to work across the disciplines - joined up thinking can help to change cultures and infrastructures - but how much effort has gone into working with sociologists or behavioural psychologists? Surely as most of the need for demand reduction implies a change of societal behaviour, this is needed more than ever? Is Societal Readiness Assessment a route to better vision-led planning….?

1.0 Study context

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National Climate Change Policy

1.1 Climate Change is an existential threat to humanity. The United Nations Secretary-General issued a 'Code Red' warning for humanity in 2021, stating that the risks of exceeding 1.5 degrees of warming was perilously close. Reducing the impacts of climate change is a globally shared ambition, with all the world's nations developing policies and plans aimed at reducing CO2 emissions at pace. In the UK, carbon reduction policies have been put in place across all sectors, and progress towards targets is monitored by the Climate Change Committee (CCC).

1.2 The UK's legal framework for its carbon targets is through the Climate Change Act 2008, (modified in 2019), and these are updated through international agreement. The UK's targets are governed by its Nationally Determined Contribution (NDC) which was set at COP 26. This requires at least a 68% fall in territorial emissions from 1990 levels by 2030. In turn, this requires the rate of emissions reduction outside the power sector to almost quadruple.

1.3 The UK's Net Zero Strategy was published in October 2021(1), two weeks before COP 2026 which was held in Glasgow. This provided the overarching strategy for carbon reduction, encompassing a range of previously published sector strategies, covering energy, hydrogen, heat & buildings, industry, and transport, and the establishment of a UK Emissions Trading Scheme (to replace the European equivalent).

1.4 Following High Court action by Friends of the Earth, Client Earth and the Good Law Project, Government was required to publish further explanation and quantification of how its strategies would achieve the Nationally Determined Contribution. Government published the Carbon Budget Delivery Plan (CBDP) in March 2023(2), updating the previously published Net Zero Strategy.

1.5 In June 2023, the CCC published its 2023 Report to Parliament on the progress being made in reducing emissions(3). The news was not good. The Committee was critical of a lack of leadership in promoting positive action to fight climate change and build a better, cleaner and fairer world; and says that its confidence in the achievement of the UK's 2030 target had 'markedly declined' since last year.

1.6 The CCC progress report identifies two policy areas as being the predominant reasons for its increased pessimism. These relate to:

- an increased risk to the decarbonisation of surface transport and electricity supply, and

- policy gaps, and delays in funding and guidance which are hampering progress with industrial electrification, reform of agricultural and land policy and practice, and the 'engineered removal' of carbon.

National Transport Emissions Policy

1.7 Transport is the largest remaining carbon generating sector. Total transport emissions represent 27% of 2019 emissions(4), with surface transport representing 25% and 24% relating to road transport. Potential pathways to the decarbonisation of this sector are set out in the Climate Change Committee's report, The Sixth Carbon Budget, The UK's Path to Net Zero(5) and its Surface Transport Appendix(6).

1.8 Measures critical to achieving net zero in the CCC's Balanced Pathway can be summarised as being:

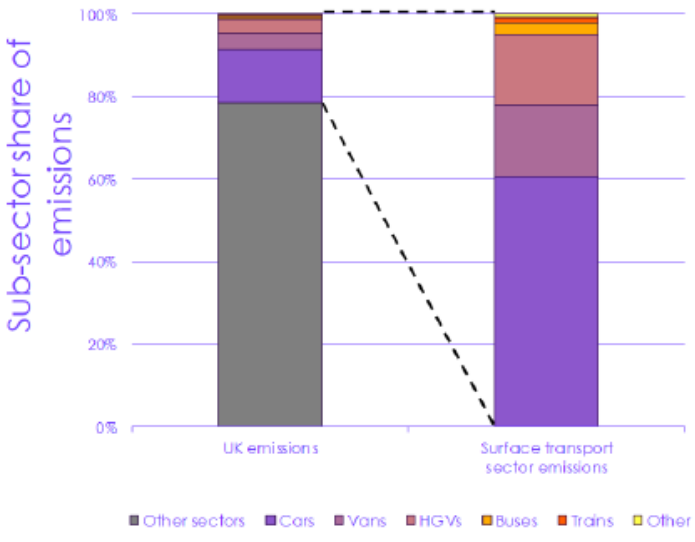
• Significant efficiency improvements of the existing vehicle fleet leading to reduction of CO2 intensity of 12% for cars and vans, and 21% for HGVs

• An ambitious transition to Battery Electric Vehicles (BEVs) stimulated by the end of sales of new conventional cars, vans and plug-in-hybrids by 2032 at the latest, and an equivalent scale-up of charging capacity for the BEVs, and

• A reduction in car travel equivalent to 9% by 2035 and 17% by 2050, and a reduction of 3% and 10% for vans and HGVs respectively.

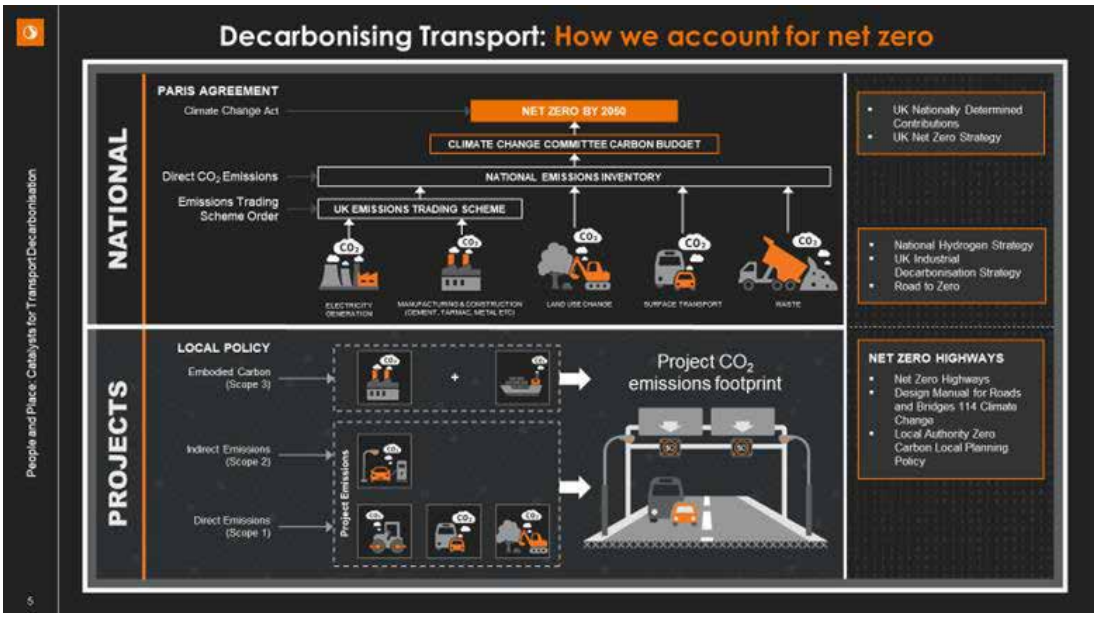
1.9 Decarbonising Transport, (colloquially, the Transport Decarbonisation Plan (TDP)), was published in July 2021. It sets out 78 commitments aimed at providing a 'credible, deliverable pathway to net zero GHG emissions by 2050, as well as delivering transport's contribution to demanding carbon budgets along the way'. However, the TDP was primarily focussed on technology as a solution to transport decarbonisation, with little focus on the need for behaviour change.

1.10 UK policy is applied on a sector by sector basis, with the result that our current strategy is pursued through technological transition of vehicles and the grid, but with no requirement to change our approach to travel. Figure 2 illustrates this disconnect between national policy objectives and project outcomes. This results in a lack of clarity about the carbon objectives that new infrastructure and development projects are required to meet, and makes effective decision making problematic.



Source: BEIS (2020) *Provisional UK greenhouse gas emissions national statistics 2019*; CCC analysis.

Figure 1: The Sixth Carbon Budget, The UK's Path to Net Zero: Surface Transport Appendix



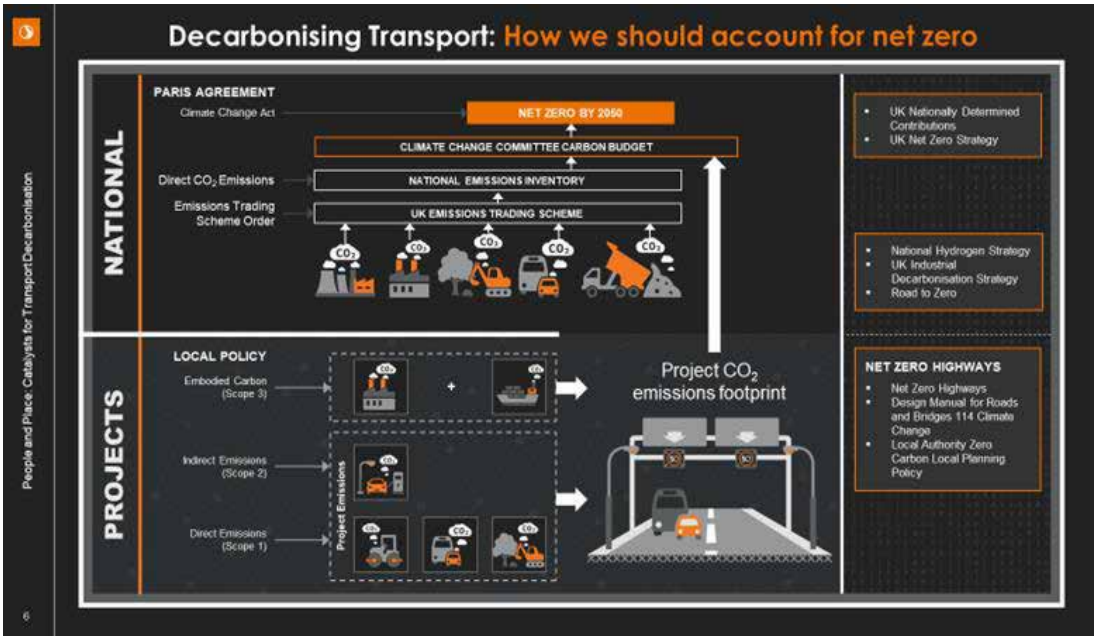


Figure 2: How we account/ should account for net zero

1.11 To further complicate matters, , the TDP was not transparent about the assumptions on which it based its claim that its commitments would meet the stated targets. As a result, an ultimately successful Freedom of Information request was submitted in March 2022 aimed at securing the underpinning evidence on which the carbon reduction claims of the TDP had been made. This data was then used to examine the realities and implications of national transport emission reduction policies, and published by CREDS and the DecarboN8 network in May 2023 as Reverse Gear(7).

Analysis for this report concluded that:

• The CBDP transport emissions reduction pathway is slower than previously set out in the TDP.

• Pathways which achieve the Government's aims on electrification could still be consistent with the CCC's Balanced Pathway(6) if a 20% reduction in road traffic levels were also to be achieved by 2030 relative to current plans

1.12 It is important to note that the trajectory to net zero is critical. The concept of a carbon budget equates to the total volume of additional atmospheric CO2 which can be generated before certain levels of temperature rise are predicted to occur. The slower we are to act to reduce emissions, the quicker we use up the available budget and exceed our carbon targets. As the CCC progress report states, progress has been slower than required, making the urgency for action even greater. Whilst technological change remains essential and urgent, so does the need for behaviour change.

1.13 The CCC progress report highlights nine areas for action. These include the need to

• develop demand-side policies and land-use policies, (especially relating to home energy, diet and travel)

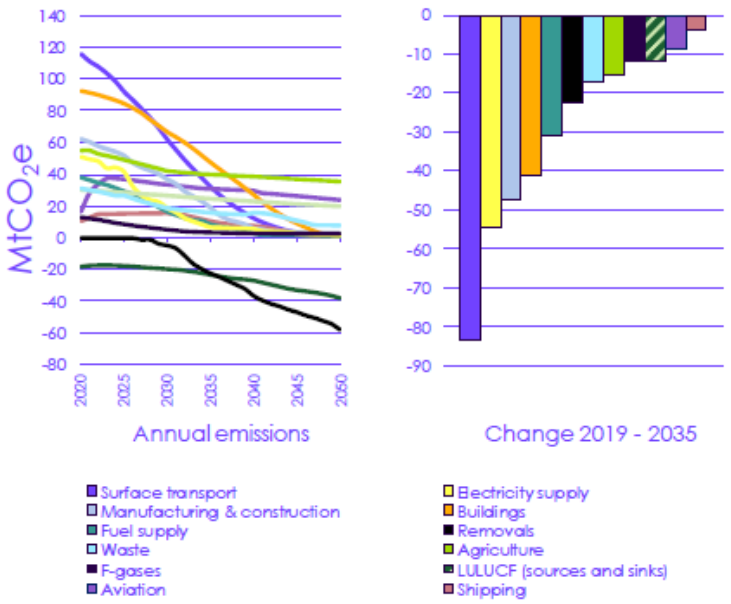
• empower and inform households and communities to make low-carbon choices, and

• radically reform planning policy to support Net Zero

thus confirming the importance of land use and behaviour change as essential components of any successful strategy to tackle climate change. As the IPCC's report on climate change mitigation(8) stated, having the right policies, infrastructure and technology in place to enable changes to our lifestyles and behaviour can result in a 40-70% reduction in greenhouse gas emissions by 2050. This offers significant untapped potential which can also improve our health and wellbeing.

Bridging the Gap: the role of people and place in transport decarbonisation

1.14 The original gestation of this study was in 2016 when researchers and policy makers began to see important changes in the way in which people were travelling around the UK. This included significant reductions in car travel by young people, (around 50% reduction for young men, and 18% for young women)(9). This, it was contended, made our traditional 'predict and provide' means of assessment no longer fit for purpose, and established a need to move towards vision-led planning for the assessment of future transport and land use proposals(10).



Source: CCC analysis.
Notes: LULUCF = Land-use, land-use change and forestry.

Figure 3: The Sixth Carbon Budget, The UK's Path to Net Zero

1.15 Stantec chronicled these issues in its Places First Reports in 2018 and 2019(11, 12), espousing the need to repurpose the development plan process to embrace a 'vision and validate' approach to assessment. This work concluded that little actual policy change would be required, but that there would need to be far greater focus on community engagement to develop an objectives-based vision capable of leading a more vision-led planning process.

1.16 Since then, the need to change our approach to planning and assessment has become more compelling, as the need to change our travel patterns has become recognised as a critical part of meeting the net zero challenge for transport and land use. Despite the wide appreciation of this issue, recent efforts to introduce measures aimed at reducing demand (such as Low Traffic Neighbourhoods (LTNs)) have often been frustrated by determined local resistance and obfuscation leading to widespread mis-understanding of the need and purpose of the proposals being promoted.

1.17 Over the intervening years, Stantec has continued to develop its approach to planning for community development and transport infrastructure. Most recently, it has published the outcomes of its Knowledge Transfer Partnership with the University of Reading: Better Places(13). This has developed analytical tools and techniques aimed at providing decision makers with better information about social value in support of vision-led planning as a counter-balance to more quantifiable transport and economic factors that have underpinned the predict and provide process.

Figure 4: Places First, Stantec, 2017/ 2018

Figure 5: Better Places for a Better Quality of Life, Stantec & Quality of Life Foundation, 2021

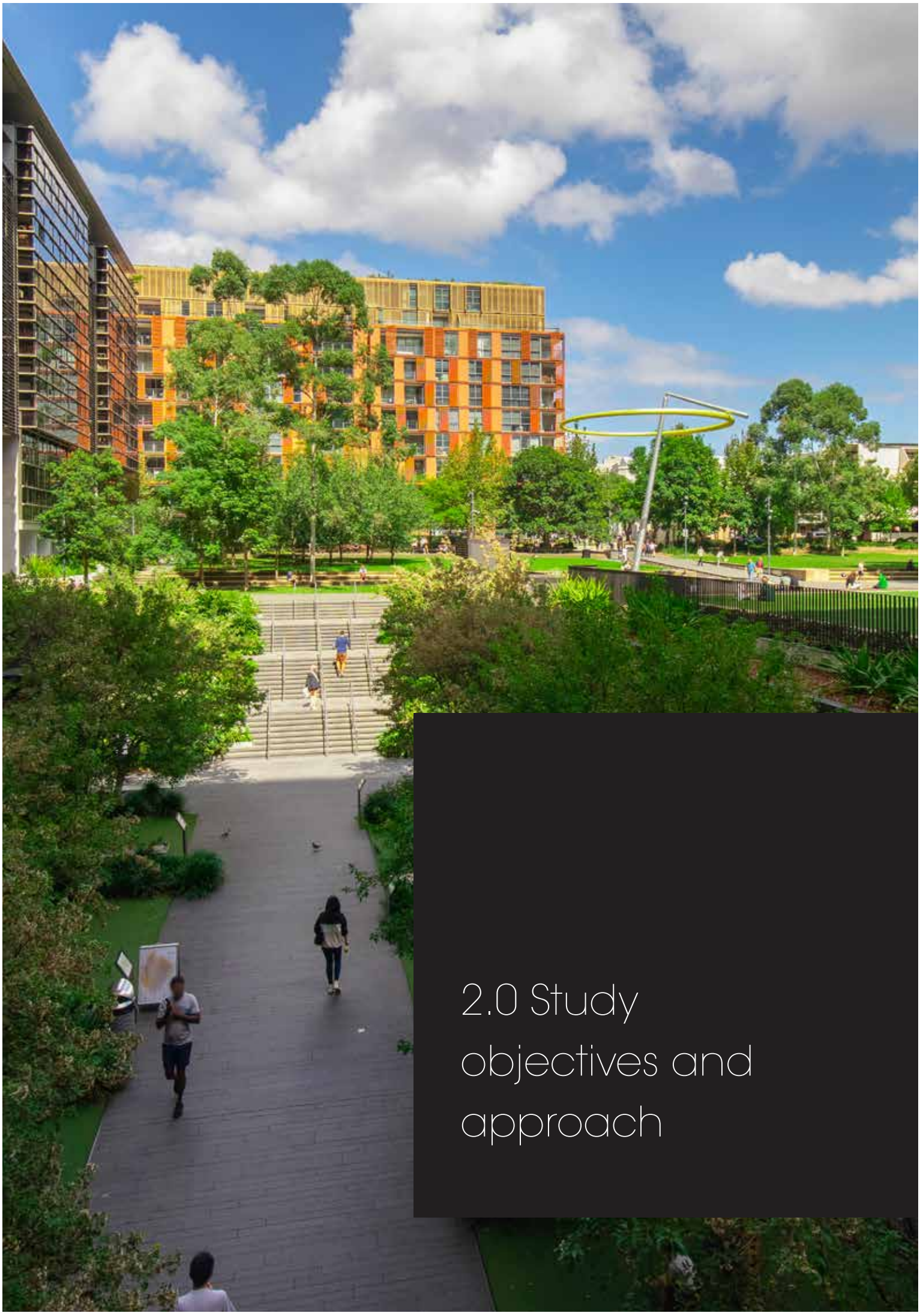
1.18 Bridging the Gap was conceived as a parallel piece of work, aimed at understanding the extent of the transport decarbonisation challenge, and better understanding how people and place could play a more significant role. This came further into focus as it became apparent that the Covid-19 pandemic had resulted in further changes in travel behaviour as a result of changes in working practices and other lifestyle factors. Could these be replicated in a post pandemic world? As suggested by the Independent Transport Commission in its report on The Covid-19 Pandemic: Transport and Land Use in Britain (14), the pandemic provided an opportunity to reshape transport and land use policy in ways that could support the net zero target.

1.19 However, as we began to emerge from the worst of the 'pandemic', there was a growing recognition that plans to 'Build Back Better' had not grasped the importance of changing our approach to the planning, design and implementation of housing and employment growth, and that we were missing the opportunity to support net zero mobility objectives as well as creating better, healthier and more equitable places for people to live and work. There appeared to be a reluctance to grasp the (admittedly) thorny issue of reducing demand for travel by car, and the societal, policy and market related issues that would raise.

1.20 It was also becoming apparent that Government policy for transport decarbonisation was focussed primarily on the transition of electric vehicles and the energy transition. This silo-based approach may have generated momentum in the industrial and energy sectors, but it avoided the more complex, controversial, but necessary transport related issues of demand management and behaviour change, and critically, this has resulted in there being no incentives to change the way land use and transport projects are delivered. This is a major challenge that will need to be grasped if net zero mobility is to be delivered.

1.21 This study has evolved to consider these issues: To what extent is there a carbon gap? What would be needed to support the level of travel behaviour change needed to meet net zero? How would this be regarded by policy makers? What would society think about living in radically different development? How could new development be adapted to better meet societal expectations? Could this influence how the market see this challenge?

1.22 There is no doubt that these are difficult challenges and that the prospects for change are, as things stand, slim. But as the challenges of climate change become more obvious, can we be ready to accelerate our approach to these issues?



2.0 Study objectives and approach

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2.1 Stantec is a global firm of consultants which provides services across a wide range of sectors. This includes the provision of planning and design services to deliver community development and transport projects. Stantec aims to deliver its services in a way that supports better outcomes for the communities affected by those projects, and yet as explained in Section 1.0, much of current practice continues to generate high carbon outcomes, with other environmental, health and societal harms.

2.2 Recent policy development recognises the need to move away from predict and provide planning, towards vision-led planning and design practice. However, there are limited case studies or guidance which help to support this significant change in practice. Key to the change needed is a way of establishing a shared vision which can lead the vision-led planning process at all scales of development and infrastructure. Without an objectives-led vision to lead our future plans and projects, we will continue to deliver schemes that reinforce high carbon behaviour and outcomes.

2.3 Bridging the Gap is a research activity supported by the Engineering and Physical Sciences Research Council, led by Stantec and the University of Leeds. It was established in January 2021 with the aim of:

• Understanding the gap between what can be achieved by current government transport decarbonisation policy and the attainment of net zero mobility targets in a local planning context;

• Identifying a range of additional transport and land use measures that could be used to develop a shared vision for local planning and development that delivers demand reduction, and therefore help to bridge the gap;

• Developing some of the tools and techniques that will be needed to identify land use and transport planning priorities for action in support of demand reduction within a vision-led planning process;

• Investigating the societal barriers to net zero driven changes in land use and transport planning to create a more favourable environment for effective implementation; and

• Engaging with policy and market stakeholders about these issues to identify what might be done to change our approach to land use development and transport infrastructure to better support net zero, as well as better, healthier and fairer communities.

2.4 Critical to achieving these objectives was to establish access to data that could enable the assessment of the carbon outcomes of alternative land use and transport futures. Stantec is therefore extremely grateful to Transport for the North (TfN)* and Transport for Greater Manchester (TfGM) for supporting this study and providing access to the modelling and resources that have underpinned the development of policy in Greater Manchester and the North of England. This data has provided this study with an essential analytical base that would have been extremely difficult to replicate in another way (15).

2.5 It was also decided that the study should be set in a real-world context. This would make any future scenarios developed for the study to be more easily imagined by a local community than if a hypothetical situation had been used. Bury, and in particular the proposed developments at Elton Reservoir (residential) and Northern Gateway (employment) have provided an excellent canvas on which this work has been based. Stantec is indebted to Bury Council for its generous support for this work.

*Footnote: https://transportforthenorth.com/future-travel-scenarios/

Figure 6: TfN Future Travel Scenarios, December 2020

Figure 7: Bury Local Transport Strategy 2040, approved by Bury Council on 5th October 2023.

2.6 The first step for this project was to make an assessment of the gap between the extent to which transport decarbonisation can be achieved in the context of current policy and the attainment of net zero objectives for the transport sector. The University of Leeds has been leading work in this area, and has undertaken this analysis, taking particular account of both the national and Northern policy context. This analysis has set the context for the rest of the study.

2.7 The second step was to develop an evidence base to support the development of alternative land use and transport futures capable of addressing the need to bridge carbon gap. Working with TfN and TfGM, Stantec has developed alternative place typologies relating to TfN's Future Travel Scenarios, focussed on Elton Reservoir and the Bury/ Rochdale conurbation, for 2040. These have formed the basis for an assessment of future demand, land use and connectivity.

2.8 National policy now recognises that a vision-led planning and design is needed, but the move towards making this a reality across all scales of planning and assessment is not yet complete. Whilst there is some good practice at regional scale where scale and complexity of analysis can be justified, much needs to be done to develop the tools and techniques needed at all scales of planning and development where a lighter touch is going to be required. A key issue to be resolved is how to frame a shared, objectives led vision in a way that is capable of guiding the analytical framework for vision-led planning, and of future monitoring and management towards the agreed outcomes. This study has therefore begun to consider some of the new assessment tools that will be needed to support this process. These include:

- Demand led scenario development and assessment tools
- Land use and connectivity optimisation tools, (working with Newcastle University).

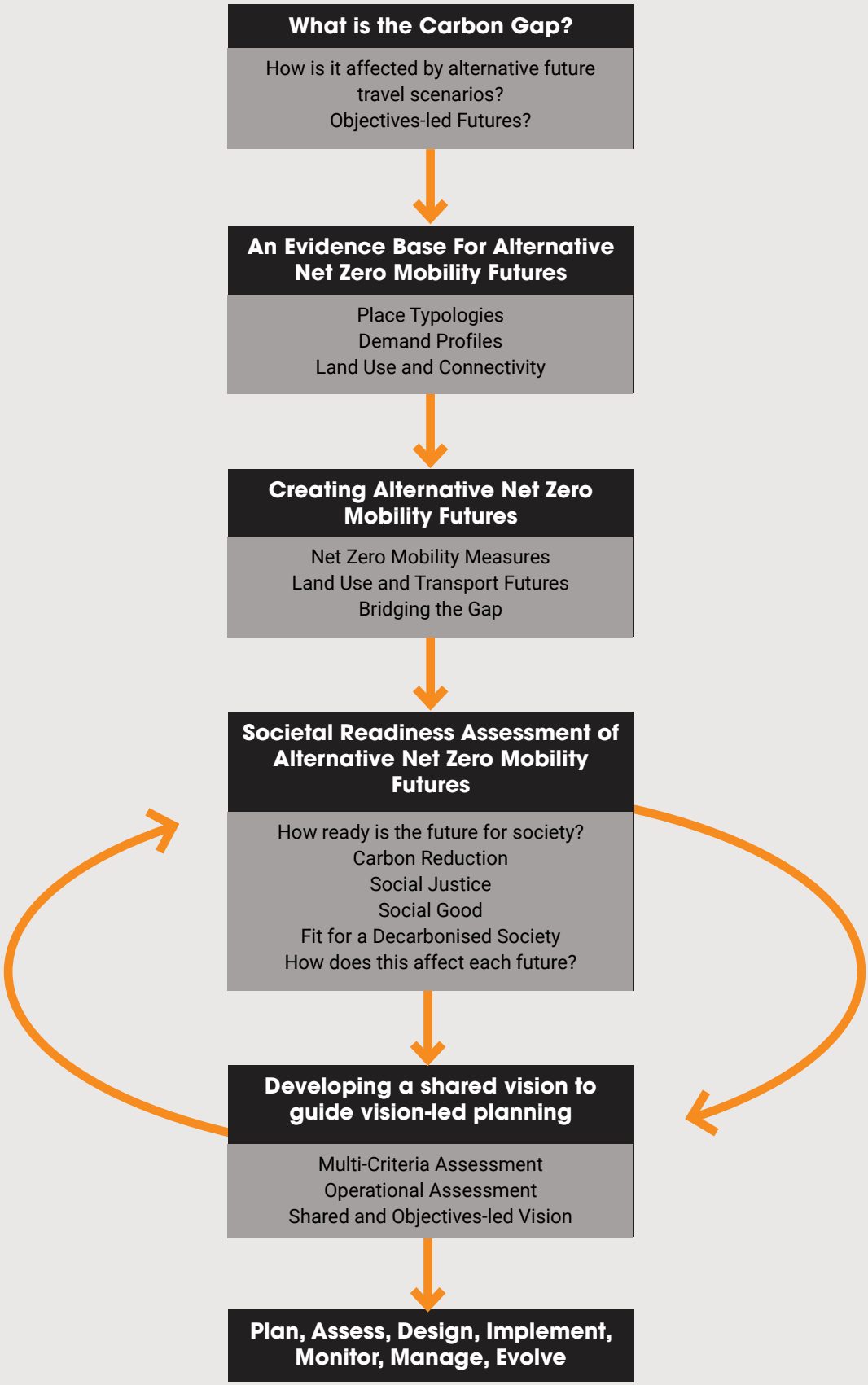


Figure 8: Developing objectives-led futures to guide vision-led planning

2.9 The third step was to use the technical assessments as basis for the preparation of alternative, objectives led land use and transport futures capable of delivering net zero mobility. These 'supercharged' futures are not intended to represent any existing development or transport plans for this or other sites in the area. Any place typologies, land use or transport futures developed as part of this research are entirely imaginary.

Further work will be required to develop these as part of a new approach to land use and transport assessment.

2.10 Three local land use and transport futures have been developed, illustrated as a local transport strategy and a place typology for the Elton Reservoir site. The first of these was based on existing and emerging plans and policies for Bury (16) and Greater Manchester to establish a 2040 baseline. This was equivalent to the TfN Just About Managing scenario, and reflects an ambitious business as usual approach.

2.11 Two further land use and transport futures were then developed, embracing more radical changes in land use and transport infrastructure aimed at bridging the carbon gap for the two more successful of TfN's Future Travel Scenarios in terms of carbon reduction.

- One future was based on TfN's **Digitally Distributed** scenario in which a market led approach is envisaged to the development of transport infrastructure and services, with digital and transport services replacing car ownership and use.

- The other was based on TfN's **Urban Zero Carbon** scenario, in which a public sector led strategy of high density living around mass transit systems provides living environments more amenable to walking, cycling and micro-mobility around each local area.

The resulting land use and transport futures are significantly different to what might be imagined might result at and around Elton Reservoir if a business-as-usual approach were to be adopted to land use and transport planning and design in this area.

2.12 The next steps in this process relate to the assessment and refinement of the alternative futures. Typically, in the predict and provide world, land use and transport solutions have been developed as incremental progressions on what went before. There has been little attention to how society might react to change because development and infrastructure proposals have reflected the status quo.

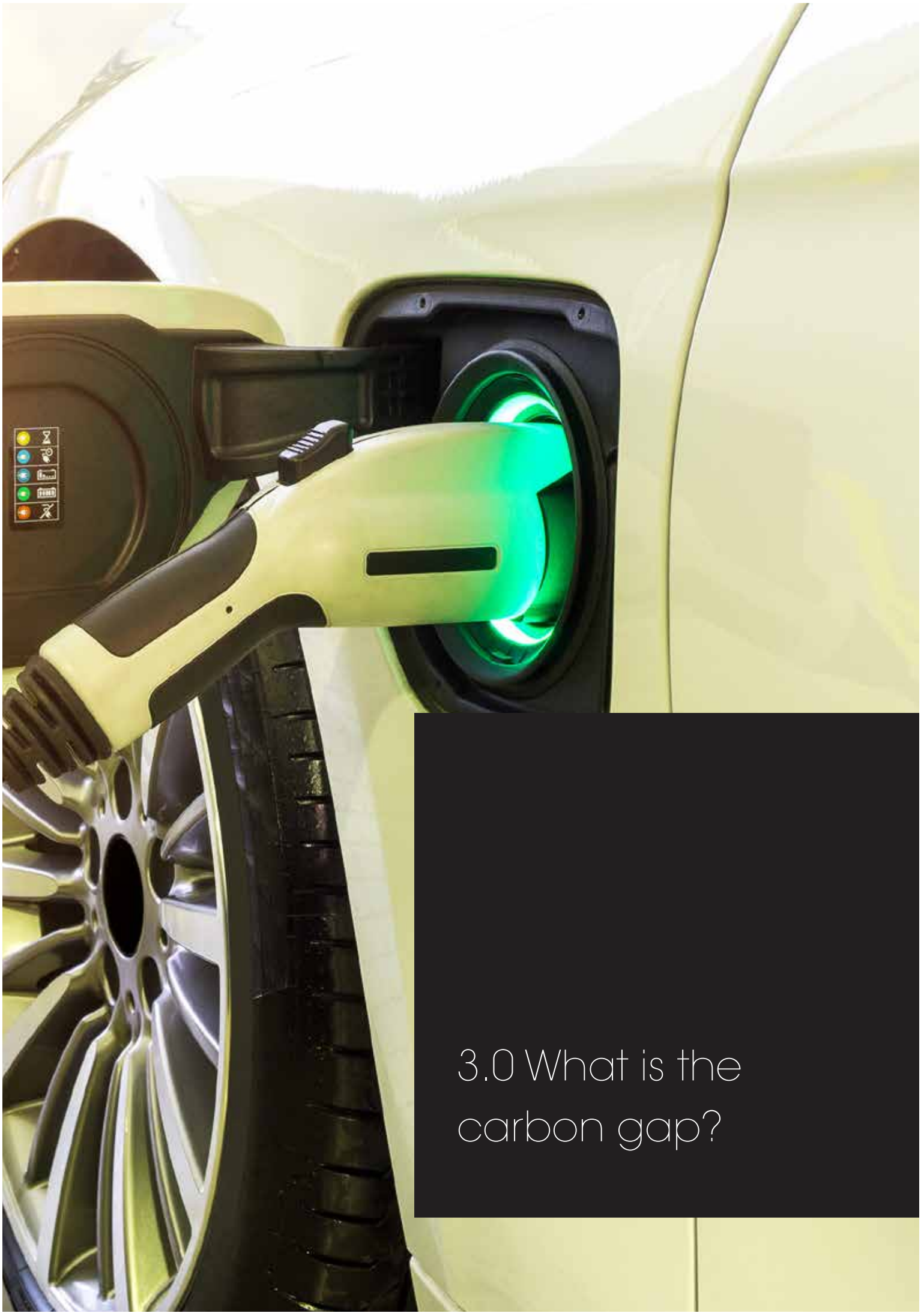
2.13 Given that this study is contemplating how to introduce more radical land use and transport solutions, the success of any future policy or strategy will be determined by society's reaction to what is delivered as a result. This should not be an exercise in presenting alternative futures to a local community so that a judgement can be made about how society might react to what is presented, but should be an exercise in making an assessment about how our innovations might need to adapt in order to align with societal needs and readiness for change??

2.14 The fourth step therefore adopts and adapts an alternative approach which has been developed by the Department of Sociology at Lancaster University. This Societal Readiness Assessment (SoRA) methodology has been developed to make an assessment of the societal readiness of new innovations and systems. This study has therefore piloted the use of Societal Readiness Assessment as a way of enabling the development of complex alternative futures consisting of a range of new innovations and systems. The aim is to test new ways of engaging stakeholders in the development of a vision by seeking to understand how the futures presented might need to be changed to meet societal needs.

2.15 We have therefore used our supercharged Digitally Distributed+ and Urban Zero Carbon+ futures as the basis for a preliminary assessment of the societal challenges associated with implementing more radical land use and transport solutions. Working with the Lancaster University, we have piloted a Societal Readiness Assessment workshop, and reviewed the extent to which the land use and transport futures developed as part of this research are truly ready for adoption by wider society, or if these futures remain an unobtainable ambition – incapable of public acceptance or delivery by policy makers or the market.

2.16 The fifth step then relates to the development of an objectives-led, shared vision which can form the basis for vision-led planning. Seen as an iterative process, the aim is to make high level assessments of operational, economic, environmental and social effects of each of the alternative futures. As more is understood about the implications of each future, so there will be a need for these to be developed into one proposition that better reflects the objectives of local policy, and the needs of society, investors and developers.

2.17 The overarching aim of this study is to develop an evidence base which helps to engage professionals, policy makers and market makers in this debate, and to stimulate more focussed efforts to address the challenges of vision-led planning, and the need to stimulate the change urgently needed to Bridge the Gap.



3.0 What is the carbon gap?

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3.1 Government has set out an ambitious plan to decarbonise the surface transport sector focussed on improving the efficiency of the existing vehicle fleet and transitioning to Electric Vehicles. However, there are significant risks impacting the likelihood of success. These include the rate of efficiency improvement within the existing fleet, the pace of expansion and transformation of the electricity generation and distribution networks needed to support the scale of EV charging required, the ability to manufacture the batteries needed, and the delivery of both the charging and vehicles at a price point which is attractive to all income levels. In addition, electrification of the fleet will also radically reduce tax income from fuel duty(17).

3.2 Even assuming these risks can be overcome, there is an increasing recognition that demand reduction will need to form a significant part of the plan. The Climate Change Committee's balanced pathway assumes a 17% reduction in car use, but the TDP was ambiguous about whether the Department for Transport's Decarbonisation Plan required demand reduction or not. Following the release of the assumptions behind the plan it is clear that only pathways with traffic reduction were consistent with the CCC's pathway.

3.3 However, the TDP also included pathways which had higher levels of demand and do not meet the overall climate goals. Over the plan period the difference between the upper and lower envelope was a staggering 2.0 trillion miles, with the low ambition pathway exceeding the high ambition by 47%.

3.4 In March 2023, Government published its Carbon Budget Delivery Plan. Reverse Gear explains the implications as follows:

"The Government is planning for ambitious, but slower than originally deemed possible, electrification of cars and vans, with HGV legislation to follow. Quite considerable expectation appears to be loaded onto the improvements to the efficiency of the remaining fossil fuel fleet and this remains a significant risk. There is almost no expectation of measures on mode shift or travel demand management and there is a plan for traffic growth. Together, these outcomes demonstrate why there has been a lowering ambition for the contribution of surface transport to emission reduction goals."

3.5 As things currently stand the transport sector will overshoot the 6th Carbon Budget, and other sectors will need to take the strain, assuming that such a thing is possible. Much of this burden appears to be shifting onto Carbon Capture and Storage which remains, as yet, unproven at scale and economically. Reducing travel demand does not just have carbon benefits but many other potential wider benefits and the CCC is clear that now is not the time to back off from demand reduction measures in the transport sector.

3.6 Reverse Gear uses a simple spreadsheet model to calculate that the level of demand reduction required to stay in line with the 6th Carbon Budget would be a 20% reduction of traffic levels relative to current plans, and that pathways based around NRTP Core traffic growth will significantly exceed the emissions budget anticipated by the CCC. This is a figure based on an assessment of the national picture, so how would this differ in the local context?

3.7 Transport for the North has become a leading proponent of developing strategies that address the issue of planning in the context of an uncertain future. In December 2020, TfN published Future Travel Scenarios; Adaptive planning to deliver our strategic vision in an uncertain future (14). This report set out four alternative Future Travel Scenarios designed to be used as part of a vision-led planning process, as follows:

i. Determine a preferred future – a vision with associated outcomes that is desirable and achievable.

ii. Develop a series of plausible future scenarios that help expose the uncertain context ahead within which efforts to achieve the preferred future will play out.

iii. Establish and prioritise options for helping move towards the preferred future.

iv. Test how those options perform in each of the plausible scenarios – are they effective in all scenarios (resilience) or are they ineffective (or less effective) in some scenarios (risk)?

v. Compose a strategy for vision realisation that accounts for, with the selected options included, the uncertainty that has been explored.

The Future Travel Scenarios were used as the 'policy off' baseline against which the TfN's regionally decarbonisation strategy was developed and agreed. It was decided that this process, the TfN Future Travel Scenarios and their underpinning data would provide a relevant and helpful context for Bridging the Gap.

3.8 During 2020/21, TfN developed its Analytical Framework, a set of modelling tools, which are used to generate the evidence and insight that underpins TfN's Strategic Transport Plan, Investment Programme and business cases. This includes its Northern Carbon Model (the NoCarb tool), a vehicle fleet model that produces a baseline estimate for surface transport emissions in the North and projects emissions into the future based on scenario inputs. This tool was prepared to provide essential evidence for TfN's Decarbonisation Pathways, which are intended to show what policies and measures are likely to be required to meet decarbonisation targets.

3.9 TfN has provided the BTG study team access to the NoCarb tool to assist with an assessment of the carbon gap as it would relate to the four Future Travel Scenarios. To do this, it was proposed to make use of the reverse engineered model (Carbon Scenario Estimator – CaSE) that had been developed to support Reverse Gear. This would enable an approximation of the carbon emissions based on the TfN Future Travel Scenario assumptions.

3.10 The CaSE model is a simple spreadsheet tool which produces estimates of the total national CO2 emissions from the three main components which define carbon from surface transport:

- traffic levels by cars, vans and HGVs
- the proportion of those miles driven in zero emission mode
- the efficiency of the fossil fuel vehicles which drive the remaining miles

3.11 The NoCarb tool by contrast, applies to all surface transport emissions, including bus, rail and 'other'. There has therefore been a need to estimate the model differences and calibrate the CaSE model to take account of differences in model assumptions and methodology. Annexe One contains an explanation of this process, together with a summary of the results of the assessment undertaken.

3.12 It should be noted that CaSE takes no account of emissions from electricity generation, nor upstream emissions in the construction of vehicles in line with the DfT's accounting procedures. All scenarios with lower demand futures have lower infrastructure needs, smaller vehicles or vehicle fleets and therefore will perform better on the associated industrial emissions. CaSE ignores these factors, not because these should be ignored, but that the additional complexity of doing did not

provide returns in terms of significantly greater accuracy or insight.

3.13 The Bridging the Gap Carbon Gap Assessment uses the CaSE model to assess the performance of each of the four TfN Future Travel Scenarios. These are:

- Just About Managing: This scenario sees a future where people are unwilling to change their behaviours or give up certain luxuries. There is a reasonably widespread uptake of electric vehicles (EVs) and a modest uptake of autonomous vehicles and shared mobility services by 2050, but low levels of regulation and Government policy means its main impact is to increase travel demand for those who can afford vehicles and mobility solutions with lower operating costs.

- Prioritised Places: This scenario sees the UK significantly shifting the political and economic direction to ensure that no place is left behind. Although an emphasis on localising activity and use of public transport helps to reduce emissions at a more rapid rate, a failure to sufficiently embrace technology sees continued private mobility ownership and a struggle to realise a fully zero-emission transport network before 2050.

- Digitally Distributed: This scenario is led by technology, with the biggest drivers being technical advances and a willingness to embrace mobility-as-a-service and shared mobility. By 2050, autonomous vehicles are relatively widespread, levels of private car ownership are very low, and all cars are electric. Optimised road pricing and higher levels of online interaction mean that some trips are discouraged, although congestion persists in places, particularly in the short to medium-term. The number of trips per person falls, but distributed lifestyles mean trip lengths increase.

- Urban Zero Carbon: This scenario sees a significant shift in public attitudes towards action on climate change, and a strong Government response to meet it. Urban living and working makes face-to-face interaction with friends and co-workers easy. Transport users embrace an increase in the use of publicly available transit and active travel options. Non-traditional shared mobility systems become increasingly integrated with traditional public transport in a well-regulated urban mobility system, with a blurred line between 'public' and 'private'. Road pricing is used to manage demand, and this has the biggest impact outside cities and towns, where there are fewer active travel and public transport options.

3.14 The CaSE model provides the following information about the carbon gap to be bridged for each of the TfN scenarios:

Scenario	Total carbon budget	PT and other	Budget left for Car/LGV/ HGV	CaSE Car/LGV/HGV	Gap to be bridged
JAM	242	22.0	220.0	301.2	81.2
PP	242	22.2	219.8	280.2	60.4
DD	242	20.6	221.4	262.8	41.4
UZC	242	21.6	220.4	243.8	23.4

Table 1: Assessment of carbon gap, Million Tonnes of Carbon (MTC)

As can be seen in Table 1, the scenarios with the lowest carbon gap are Urban Zero Carbon, followed by Digitally Distributed.

3.15 The CaSE model has then been used to test six alternative carbon reduction scenarios based on the four Future Travel Scenarios. There is only one of these amended scenarios which reaches the carbon budget:

- Urban Zero Carbon assuming an additional 20% reduction in car traffic between 2019 and 2030, with traffic levels remaining constant between 2030 and 2050. In addition, there is a 10% reduction in levels of LGV and HGV traffic.

- Digitally Distributed is the next best performer, but still falls short despite a 30% reduction in car traffic between 2019 and 2030, and a 10% reduction in LGV and HGV traffic.

3.16 These findings suggest that there are no viable pathways unless these ambitious traffic reduction objectives are met.* It should be noted that the greater the traffic reduction required for any of the scenarios, the further away is gets from the original storyline which the scenario was supposed to represent. There is therefore a theoretical inconsistency in redefining the scenarios as suggested. However, as the ultimate purpose of considering the carbon gap is to assess the societal challenges that this would present, this would seem to be an inconsistency that is acceptable in the context of this study.

3.17 The study team also concluded that there were no remotely plausible options worth considering for Prioritised Places or Just About Managing. Instead, Just About Managing was considered to represent a reasonable baseline for the study. This is not the same as assuming the baseline is business as usual, but instead assumes strong ambitions for transition to EVs, and modest levels of regulation and policy.

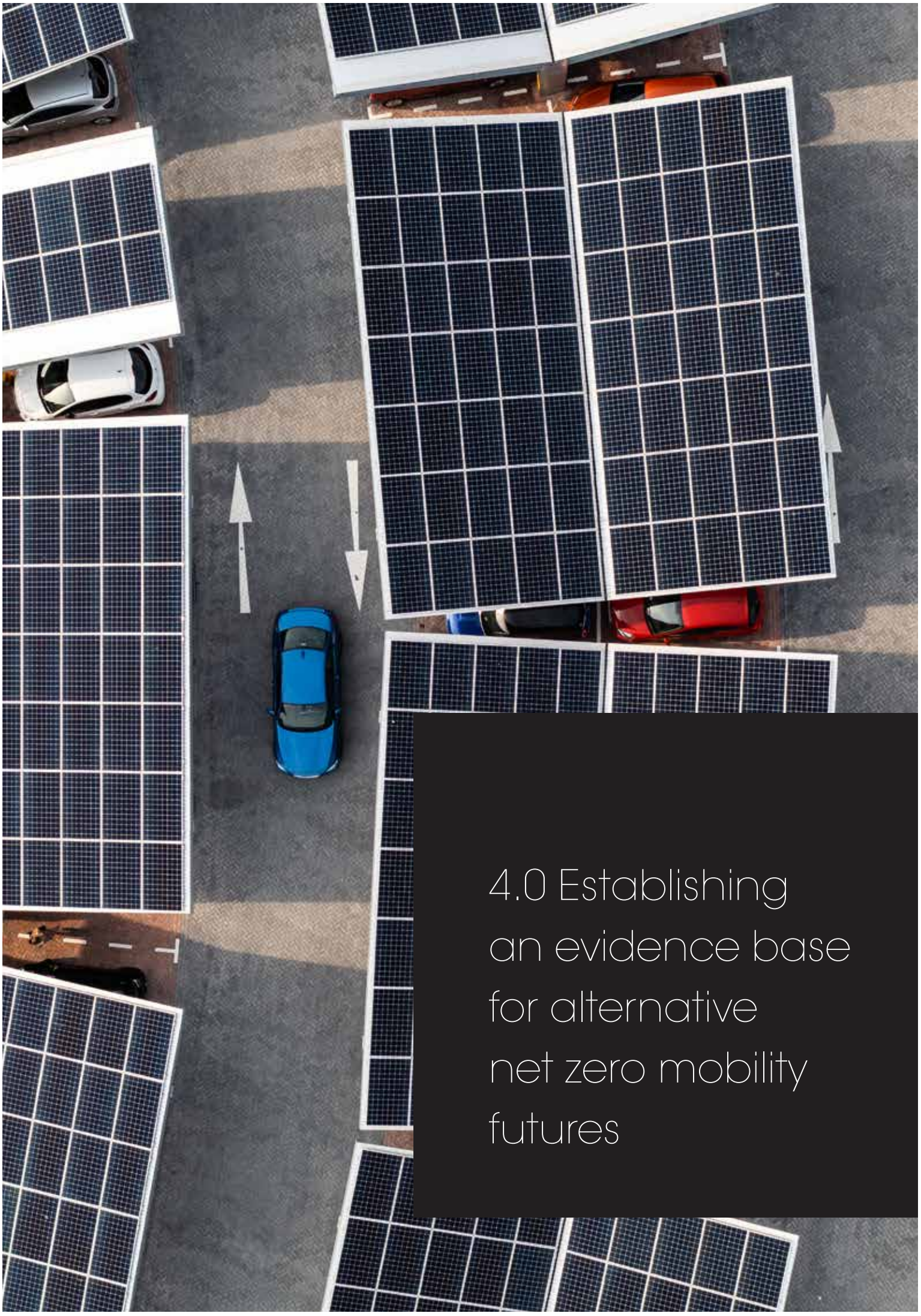
3.18 For the purposes of this study, this assessment provides a framework for the development of alternative local transport and land use scenarios which meet net zero mobility objectives. These will provide a framework for the development of the local transport strategies and local land use and transport futures which will be used for the purpose of assessment in the next stages of the study and the development of a net zero mobility vision:

- Just About Managing: Our baseline.

- Digitally Distributed +: adjusted to deliver at least a 30% reduction in car traffic by 2030, together with 10% reductions for LGV and HGV traffic

- Urban Zero Carbon +: adjusted to deliver at least a 20% reduction in car traffic by 2030, together wth a 10% reduction for LGV and HGV traffic

*Footnote: TfN's current policy on demand reduction is set out in the draft Strategic Transport Plan and is currently under review.



4.0 Establishing an evidence base for alternative net zero mobility futures

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4.1 Addressing the scale of the challenge

4.1.1 Now we understand the scale of the challenge. How can an already ambitious plan for land use and transport planning across the north of England, and within a local area such as Bury, be supercharged in a way that reduces car traffic by at least 20%, (and LGV/ HGVs by 10%)? What can proposed development do to contribute towards these goals, rather than make them harder to achieve? How can development help to bridge the gap?

4.1.2 Planning for development and infrastructure is a complex issue, which requires the balancing of a range of objectives, but unless all our future scenarios have the attainment of net zero at heart, then other desirable outcomes will not be delivered over the long term. This means that the futures we envisage to guide our planning need to place net zero objectives at the forefront.

4.1.3 From a transport perspective, this doesn't necessarily mean that there needs to be fewer cars on the road, or even fewer trips by car, (although these are likely outcomes). What matters is that there is a reduction in overall distance travelled by car, (vehicle kilometres, (vkm)). We have therefore adopted traffic demand reduction targets for each of our two potentially plausible net zero mobility futures:

- **Digitally Distributed +**: 30% reduction in total distance travelled by car, together with 10% reductions for LGV and HGV traffic, when measured against the baseline
- **Urban Zero Carbon +**: 20% reduction in total distance travelled by car, together with 10% reductions for LGV and HGV traffic, when measured against the baseline

4.1.4 The next step is therefore to identify which measures might be adopted as part of future development plans, in addition to those proposed as part of the existing and emerging strategy for the north of England. Greater Manchester and Bury. In considering how to develop a deliverable strategy, it has been recognised that it is simply not practical to assume that every possible additional measure could be adopted. A more systematic approach needs to be used to prioritise the measures that will be most effective in delivering against the target set.

4.1.5 The proposed process for selecting the demand reduction measures needed to meet net zero is as follows:

- **Develop Place Typologies:** What form would development take for each of the future travel scenarios? How would this affect the quantum and distribution of development and infrastructure? How could design help to rebalance the attractiveness of car use, public transport and active modes? How could integrated energy and transport master plan solutions support a switch to EVs?
- **Establish Demand Profiles:** What is the pattern of travel demand in Bury and in particular in the location of future development at Elton Reservoir, (eg number of trips, journey purpose, travel distance, mode, carbon impact). How does this affect selection of potential land use and transport measures aimed at reducing demand through trip substitution and modal shift?
- **Optimise Land Use and Connectivity:** Using specifically developed 15-minute neighbourhood planning tools, can we identify the amenties and local connections that could be made to reduce travel distance by car through trip substitution and modal shift? How can the Better Places Social Value tools enable us to better understand what local needs are and how these might influence master plan provision.

- **Identify potential Net Zero Mobility Measures (NZMMs):** Which measures have already been proposed within our baseline scenario, and which additional land use and transport related measures could be adopted to accelerate the trajectory towards net zero? How would these additional measures be aligned with the Sustainable Access Framework (SAF)?
- **Develop Land Use and Transport Futures.** Review the NZMMs, prioritising those measures that reduce longer distance/ high volume trips by car, LGV and HGV. Categorise these in accordance with SAF Substitute>>Shift>>Switch hierarchy and develop local land use and transport futures.
- **Bridging the Gap:** Estimate carbon reduction efficacy of each local land use and transport future.

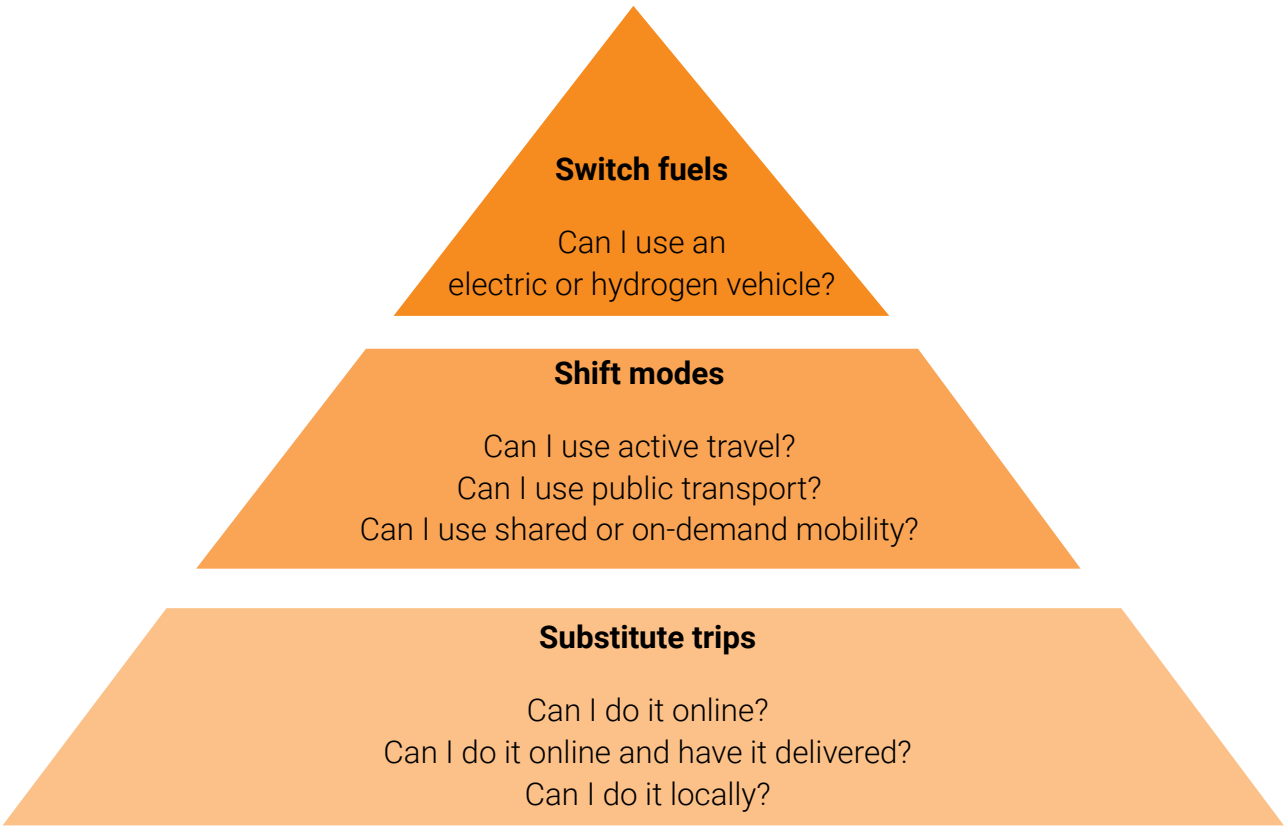


Figure 9: Sustainable Access Framework, a tool designed to help planners and designers prioritise interventions (18)

Figure 10: Just About Managing, Place Typology

4.2 Creating Place Typologies

4.2.1 In order to make an assessment of how the land use and transport aspects of new development might influence future carbon outcomes, it is necessary to make some assumptions about the nature of the place we are considering under each of the Future Travel Scenarios. These assumptions are based on the team's understanding of current development forms, as well as ongoing research into alternative development concepts, in particular responding to the transition to EVs.

4.2.2 Just About Managing

The main assumptions used in our assessment of the Just About Managing scenario are:

- Housing development remains typically sub-urban with housing and streets designed mostly for cars. On average, each house has two parking spaces.
- Each house is provided with an EV charging point which allows the householder cheap access to fuel.
- Two local centres have been provided but they are struggling to survive against competition from the town centre and out of centre development
- One has got some local shops and a primary school. It's quite close to the tram stop, and provides a place where you can leave your bike or pick up a bike, e-bike or e-car from the mobility hub.
- The other has got the doctors' surgery, pharmacy, hairdressers and other local services. It's a fair hike to get there from the other side of the development though.

4.2.3 Digitally Distributed +

The main assumptions used in our assessment of the Digitally Distributed scenario are developed from a Stantec innovation project, Vehicle2Community, (ref Annexe Two):

- Housing development remains sub-urban. Each house has on average one parking space in a shared parking and EV charging area making more efficient use of land.
- Shared parking areas use the collective power of the car batteries to reduce the amount of energy needed at peak times and reduce carbon.
- These areas also provide a great place to co-locate centres for local mobility services, shops and local amenities including local work hubs.
- Home working three days a week is common now, and the local work hub provides a great place to work. You can even pick up your Amazon deliveries there.
- Many cars and vans are now self-driving, so you can order your car to the front door, or pay for the robot delivery service.

Figure 11: Digitally Distributed, Place Typology

4.2.4 Urban Zero Carbon +

The main assumptions used in our assessment of the Urban Zero Carbon scenario are:

- Housing development is higher density and mixed use. It is clustered around public transport hubs which provide access to a range of transport services.
- The development offers a range of dwellings and tenures for families, couples and single people.
- On average, private car parking is limited to 0.3 spaces per dwelling. It is located on the adjacent to development clusters in buildings which support EV charging.
- Within the development and local area, streets are designed to provide for walking, cycling and micro-mobility modes first. High quality finishes create attractive public spaces.
- Higher density development makes efficient use of land, as well as creating extra, well maintained open space which can be used to promote healthy lifestyles, and biodiversity net gain.

Figure 12: Urban Zero Carbon, Place Typology

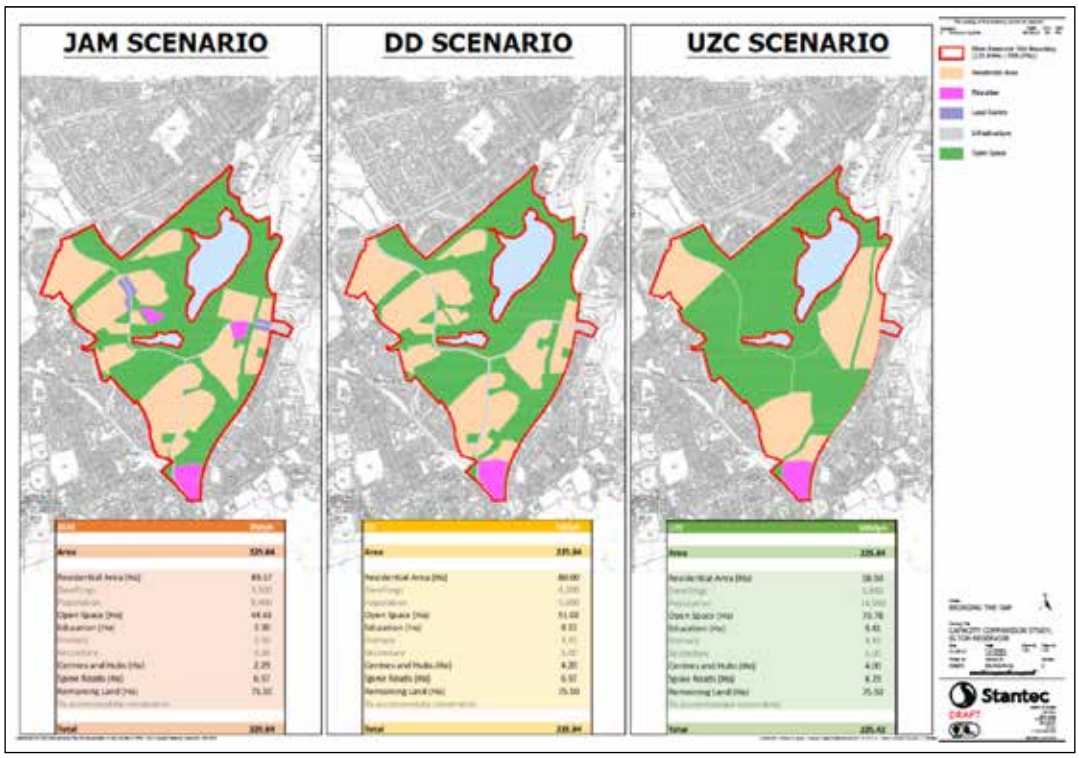


Figure 13: Place Typologies, Development & Infrastructure Budgets

4.2.5 Place Typologies by numbers

These place typologies were used to develop alternative budgets for the primary development and infrastructure elements for use in the development of demand profiles. It is noted that Elton Reservoir is proposed for 3,500 homes in Places for Everyone, the Manchester City Regional spatial plan which has been the subject of public examination, and is now moving to public consultation and Council approval processes. The place typologies used in this report are hypothetical. They result in different infrastructure, open space and housing numbers as a consequence of the alternative assumptions used, and in turn this data forms an important part of the assessment of carbon outcomes.

4.3 Using Demand Profiles to prioritise demand reduction interventions

4.3.1 Understanding travel demand in Bury and Rochdale: The development of demand profiles to underpin this study necessitated transport data to be synthesized for the Bury and Rochdale conurbation, and in particular the interaction of future trips to, from and between the future development areas at Elton Reservoir, Northern Gateway, the town centre and other major destinations. This would ensure that the key local trips could be adequately understood. Annexe Three explains how data from TfN and TfGM's land use and transport models were used to provide the underpinning data for this work, (for Bury – an identical process was adopted for Rochdale).

4.3.2 The preparation of demand profiles for Bury, Rochdale and the surrounding conurbation in a way that could differentiate between each of the Future Travel Scenarios was far from straightforward. This was because the models that make up TfN's Analytical Framework are strategic in nature and therefore do not model to the level of detail necessary to differentiate the rail and highway movements at the local level. It was therefore necessary to use more local data from TfGM's Variable Demand Model (VDM) to synthesize data that could reflect local demand, but also respond to the Future Travel Scenarios.

4.3.3 The models within the TfN Analytical Framework include:

- Northern Integration Tools (NorMITs),
- Northern Economy and Land Use Model (NELUM),
- Northern Highway Assignment Model (NoHAM),
- Northern Rail Modelling System (NoRMS), and
- Northern Carbon Model (NoCarb), as referred to in Section 3.

4.3.4 It was agreed that the strategic data from NoHAM and NoRMS would be adjusted using more detailed local travel patterns by road and rail relevant to the zones relevant to Bury and Rochdale, provided by TfGM from its transport model. Data from the TfGM transport model would be adjusted using data from TfN's EFS model (External Forecast System) to reflect each of the Future Travel Scenarios using factors for 2018 to 2040 and 2050. In addition, matrices for all modes were provided from NELUM for Bury and Rochdale in order to generate mode share data for each of the Future Travel Scenarios.

4.3.5 The following outputs were provided by TfN:

- Rail matrices (the number and distribution of trips) for journeys which start in Bury district for each Future Travel Scenario
- Road matrices for trips with a starting journey in Bury for each Future Travel Scenario (in pcu's),
- Mode shares for each Future Travel Scenario
- Population and job growth for each Future Travel Scenarios.

  Demand data was presented for 3 time periods, (AM, IP, PM), for 2018, 2040 and 2050, and for three journey purposes (Commute, Employer's Business, Other). A more detailed explanation of the method used to prepare the Bury data can be found in Annexe Two. A similar process was used for Rochdale, so as to create a conurbation wide picture of travel demand.

4.3.6 The study area covering the Bury and Rochdale districts, shown in Figure 8 encompasses the development areas at Elton Reservoir and Northern Gateway.

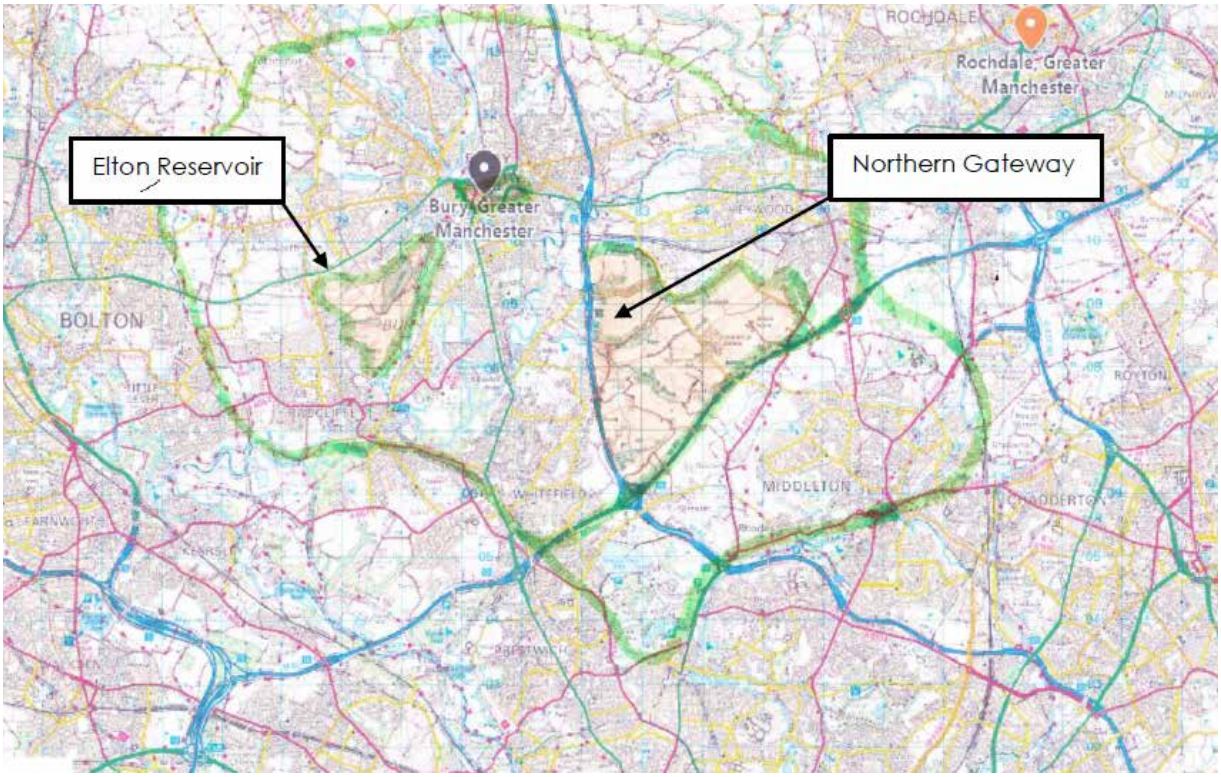


Figure 14: Bridging the Gap Study Area

4.3.7 Estimating demand profiles for development at Elton Reservoir: The data supplied by TfN were used to develop demand profiles for Elton Reservoir. A typical method for this would be to use a relevant zone in the model as a proxy for future development. However, in this case, the transport modelling zone covering the Elton Reservoir area, (TfGM VDM zone 31,) did not reflect the extensive development envisaged in the emerging development plan, so the existing matrices could not provide an appropriate basis for prediction of future travel patterns from the proposed development.

4.3.8 Future trip distribution for the site was therefore estimated using a donor site (zone 25), and future trips predicted by comparing the estimated future population of Elton Reservoir with the donor zone. Dwelling numbers for each scenario were estimated based on the three place typologies which were developed to reflect TfN's three Future Travel Scenarios.

Scenario	Dwellings	Population (at completion)
Just About Managing	3,500	8,408
Digitally Distributed +	4,000	9,609
Urban Zero Carbon +	5,850	14,053

Table 2: Estimated Development Quantum

4.3.9 This provided the basis for travel patterns to and from the future development at Elton Reservoir to be estimated and presented in a way that could help to identify which movements could most effectively be targeted to reduce demand for movement by car, van and HGV. Annexe Four provides further information about the method used. Key assumptions made in the pursuit of balancing accuracy and expediency were:

- The NoHAM matrices consisted of 1,072 highway zones. For this assessment only trips originating in Bury and Rochdale were assessed, and only the car matrices were analysed. Ideally, matrices for LGV and HGV would be assessed to inform consideration of goods and distribution traffic in a more informed way.
- TfGM's Variable Demand Model provides data about peak hour movements. This is relevant for the operational assessments which the VDM was designed for, but it was necessary to convert these to daily demand to allow synthesis with data from TfN's Analytical Framework, and to support assessment of carbon reduction outcomes. Peak to daily factors were therefore established using National Travel Survey data.
- Northern Gateway is a proposed strategic employment site in close proximity to Elton Reservoir which is proposed to provide 22,000 jobs by 2040. It is therefore very likely to be an important destination for trips originating from this development. However, the VDM did not include forecasts for this development, and the distribution of trips from Elton Reservoir were therefore adjusted to reflect the greater attractiveness of this zone.

- In order to assess changes in vehicle kilometres, it was important to be able to calculate changes in travel distance arising from different land use and transport interventions. Distance skims were therefore obtained from the TfGM VDM. These enabled distances to be calculated for all movements for each time period and user class, and in turn to assess the distance travelled for each Origin Destination pair.

4.3.10 On completion of this analysis, a demand profile dashboard was created in Power BI to allow the study team to examine the estimated travel patterns from Elton Reservoir, and to identify which movements might be most effectively targeted to reduce distance travelled by car.

4.3.11 Short Trips (0 – 5kms)

- The number of short trips (0 – 2km) is low, but the contribution to the distance travelled as a result of these trips, (measured in vehicle kilometres (vkm)), is even smaller. Whilst encouraging a shift from car to active modes is worthwhile to deliver health, wellbeing and local amenity benefits, this is not likely to contribute significantly to net zero. However, if longer trips by car were to be substituted by short trips by active modes, this would provide a greater contribution to carbon reduction objectives. As a result, the identification of local services and employment opportunities, together with excellent local connections remains a key issue.

- Trips between 2 – 5km represent a greater proportion of total demand, at around 16 – 17% of total vehicle kms in 2040, depending on which scenario is being considered. This is therefore likely to be a key area of focus, in particular how each scenario responds to the challenge of enhancing connectivity to key local destinations that lie beyond a short walk.

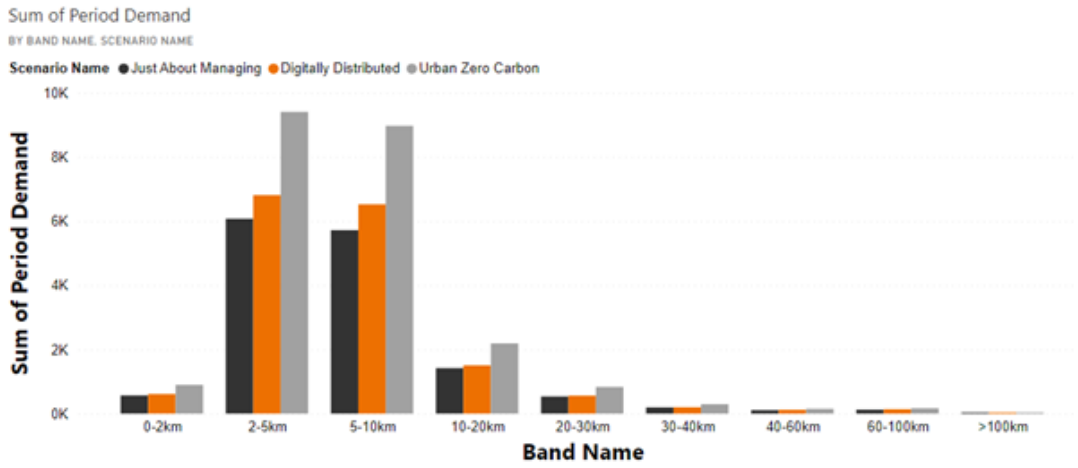


Figure 15: Number of trips from Elton Reservoir, 2040 one way

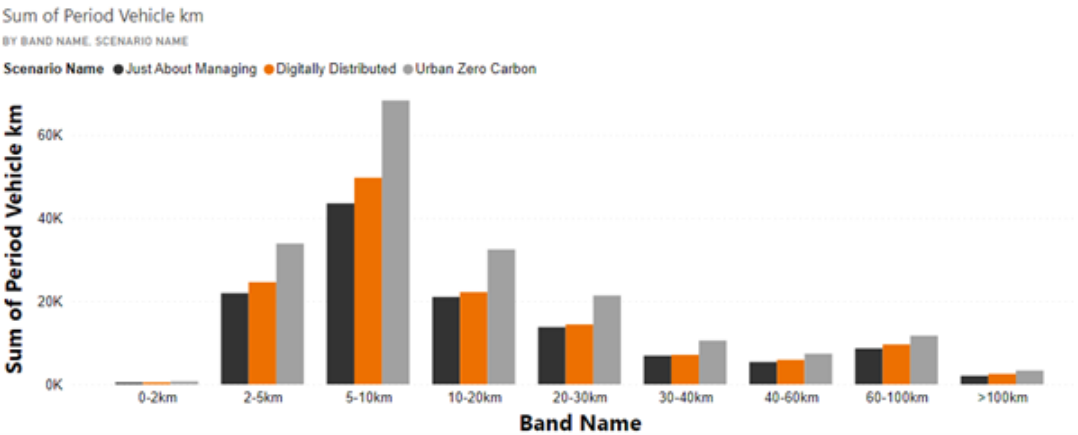


Figure 16: Vehicle kms from Elton Reservoir, 2040 one way

- Schools and Colleges are very likely to be a major attractor of car trips, however the data has not been available to make a specific assessment of this aspect. There is local provision of primary education, and additional provision is likely to be provided on site. The key outstanding issue is therefore likely to be access to secondary education, a significant element of which is located close to the site, south of the town centre

- The Derby High School, Radcliffe Road

- St Gabriel's RC High School, Baron Street

- Bury Grammar Girls School, Tenderden Street, and

- Bury College is located adjacent to the Grammar School on Market Street.

In addition, a new secondary school is planned to open on the site of the former Coney Green High School at Spring Land, Radcliffe by 2023. This will be adjacent to development at Elton Reservoir, and could usefully be considered as part of the development plan for the site.

- Bury Town Centre will be a key destination for trips from Elton Reservoir. However, the town centre is well served by public transport, including by a new stop at Elton Reservoir for Metrolink Services. Our assessment suggests that the total travel by car would be approximately 1.5% of total demand for travel by car. This suggests that the already significant levels of travel by other modes to the town centre, together with proposed improvements are reducing demand for car use. This is therefore unlikely to be an effective target for additional carbon reduction investment.

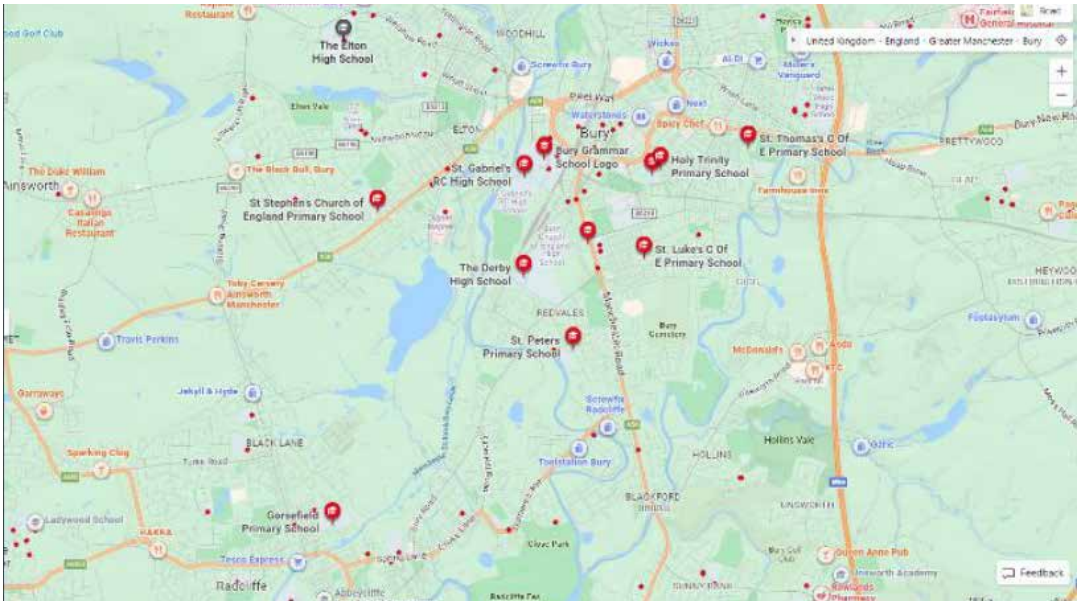


Figure 17: Location of local schools

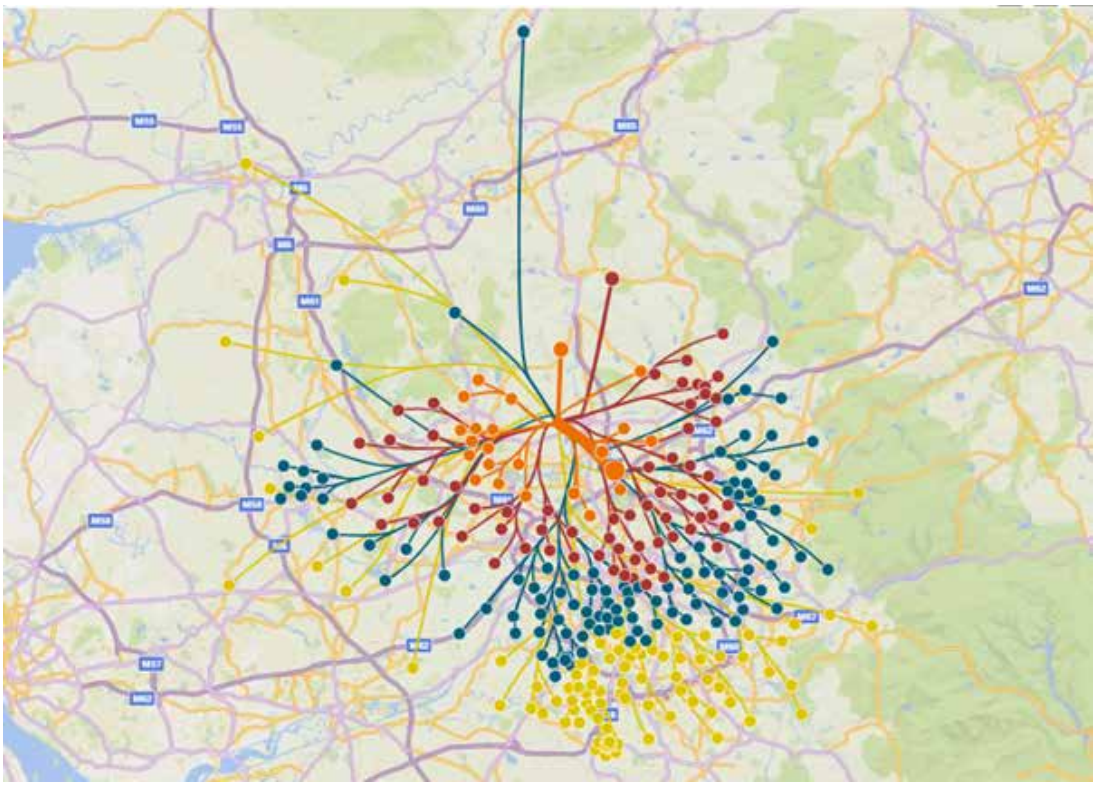


Figure 18: Trip distribution for Elton Reservoir car trips, Just About Managing 2040.

4.3.12 Intermediate trips (5 – 40kms)

- It is clear from the analysis undertaken that the distribution of car trips from Elton Reservoir is widely spread. Even employment trips to Manchester have destinations across the wider conurbation, not just within the city centre (which are most likely to be catered for by Metrolink). This effect can be clearly seen for the JAM scenario, in Figure 18.

- Other key intermediate destinations by car include Bolton and Rochdale. Although these are two of the more significant of intermediate destinations, even these represent only around 6% of daily vehicle kms each, compared to around 45% for the whole of the Bury district. This highly distributed characteristic of Elton Reservoir travel patterns makes it hard to imagine achieving significant reductions of car travel by focussing on particular origin-destination pairs.

- Another way of looking at this is to consider the total proportion of demand which is broadly taking place within the wider Manchester conurbation. Taking 5 - 30km to represent this group of trip, Table 3 suggests that this would represent around 57% to 63% of total travel distance. This illustrates the high proportion of vehicle kms travelled to intermediate destinations, with trips between 5 and 10km contributing most to carbon emissions. What options are there that could provide practical and realistic alternatives to the private car for this group of diverse trips?

Travel distance	% of ER vehicle kms
2-5km	16-17%
5-10km	31-35%
10-20km	16-17%
20-30km	10-11%
30-40km	6-7%

Table 3: Estimated % ER vkms by distance travelled

- Northern Gateway is an exception to this conundrum. This is a proposed major local employment opportunity, located close to the M66/ M62 junction, forecast to accommodate 1,000,000 sqm of employment development. Our estimates suggest that demand for travel by car would equate to between 6400 to 10100 vkm (one way) per day, (representing between 18% and 19% of total vkm). This destination could therefore represent a key target for a contribution to carbon savings.

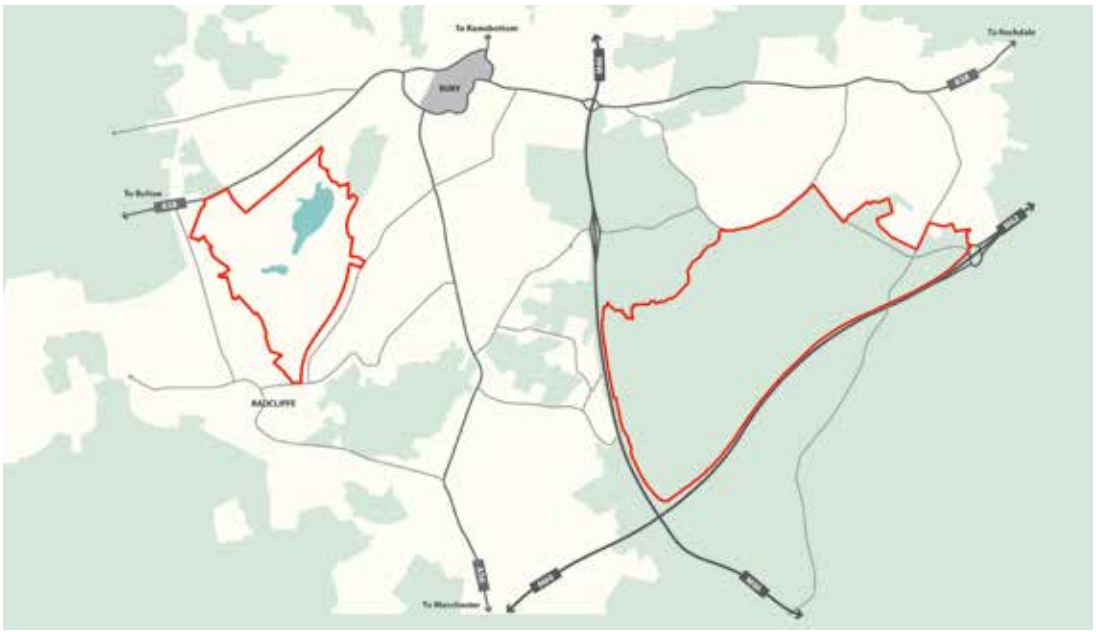


Figure 19: Location of Elton Reservoir and Northern Gateway

4.3.13 Trips using the Strategic Road Network

- Many trips travelling from Elton Reservoir are very likely use the strategic road network to access intermediate and longer distance destinations. At present, there are few alternatives to car use for these trips, but it is at least possible that shared transport could make more of a contribution to travel on the SRN.

- Using Power BI, an assessment has been made of the likely extent of daily travel by car using the SRN from Elton Reservoir. Total vehicle kms arising from trips on the SRN represent between 15 and 16% of total travel distance. Figure 20 shows the VDM zones identified as being accessible from the SRN, and Figure 21 shows how the trip lengths are weighted towards the lower end of the range assessed.

- Given the location of Northern Gateway on the junction between the M60, M62 and M66, is there a role that this site could play in supporting increased use of shared transport on the SRN in the future? Indeed, could this way of thinking extend to the more efficient distribution of goods and services around the Bury conurbation?

4.3.14 Summary of Demand Profile Analysis

Key considerations for the most effective reduction of travel demand by car have assessed to be:

- Trip substitution through local land use change and connectivity

- Short distance trips of between 2 – 5km, most particularly to schools and colleges

- Intermediate trips of over 5km, and upto (at least) 30km

- Effective alternatives to travel by car to Northern Gateway

- Development of more effective use of SRN capacity for people and goods

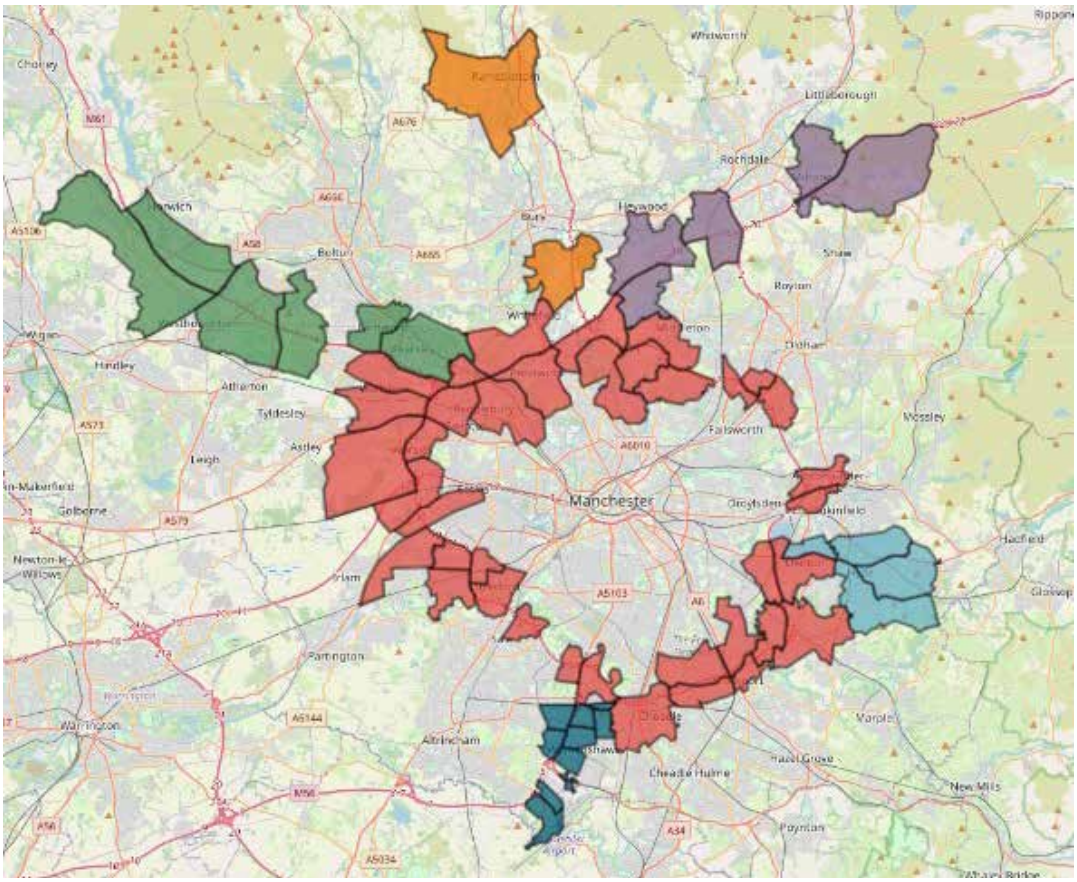


Figure 20: VDM Zones close to the SRN. © Crown copyright and database rights 2023 OS 0100022610.

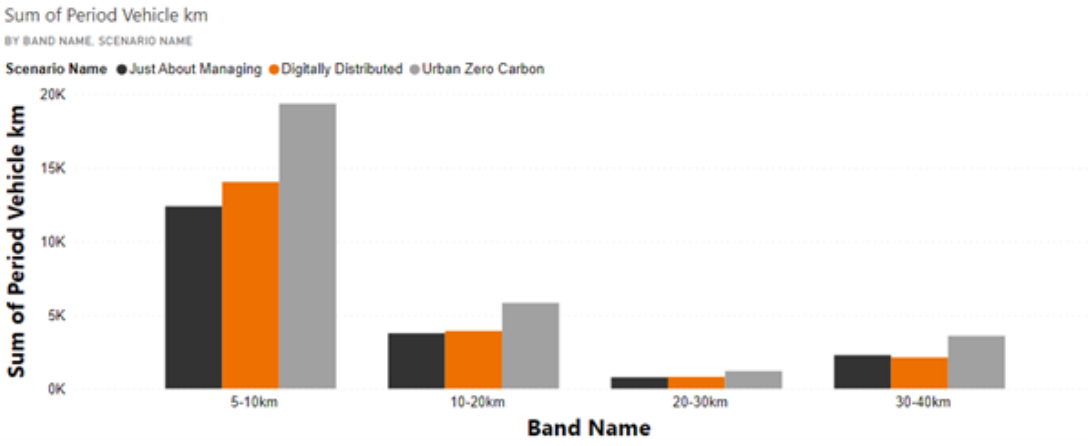


Figure 21: Estimated % ER vkms on SRN

4.4 Optimising local Land Use and Connectivity

4.4.1 An important consideration arising from the analysis of demand above is how best to optimise the use of local facilities and services to enable them to perform a valuable carbon reduction function, as well as for health, well-being, and community benefit. The key to this is to identify local facilities and services that would be both attractive to the local population, but also potentially act as substitute for a longer trip – by car. Could we find a way of looking at this analytically that could also tell us something about the potential for carbon savings through local land use planning?

4.4.2 Stantec has been active in local land use and accessibility modelling and has developed a connectivity-based appraisal framework. This combines bespoke digital tools and processes into the Sustainable Transport Audit & Appraisal Toolkit (STAAT). The toolkit provides the framework to assess transport networks at both the local and strategic level, enabling an agile data-driven and evidence-led methodology for identifying issues in connectivity by sustainable transport modes and their relationship with wider land-use planning.

4.4.3 The STAAT provides the ability to examine the relationship between specific land uses and connectivity, taking account of existing and potential future transport connections. This raises the possibility of assessing 'neighbourhood planning' alternatives to inform the scale of the opportunity for trip substitution and modal shift through various land-use and transport based interventions. This reverse land-use and connectivity optimisation process requires an assessment of both the local and strategic context. A seven-step process was developed to guide this process. Annexe Five provides more detail about the method adopted, and is summarised in Figure 22:

4.4.4 Before considering the delivery of a community at Elton Reservoir, it is first important to understand the current context of the site, in terms of both location and the connections it currently affords. The process adopted therefore begins with an assessment of current provision and levels of connectivity by walking, cycling and public transport to key services and destinations within the Bury conurbation and beyond (Manchester for example).

4.4.5 Once the existing land use and connectivity conditions are understood, this provided the opportunity to inverse the calculation, and therefore identify those facilities and services not reachable within these times (reverse land-use and connectivity optimisation). It also informed consideration of which local connections could be made or improved to establish better connectivity to existing local services, both for the new and existing

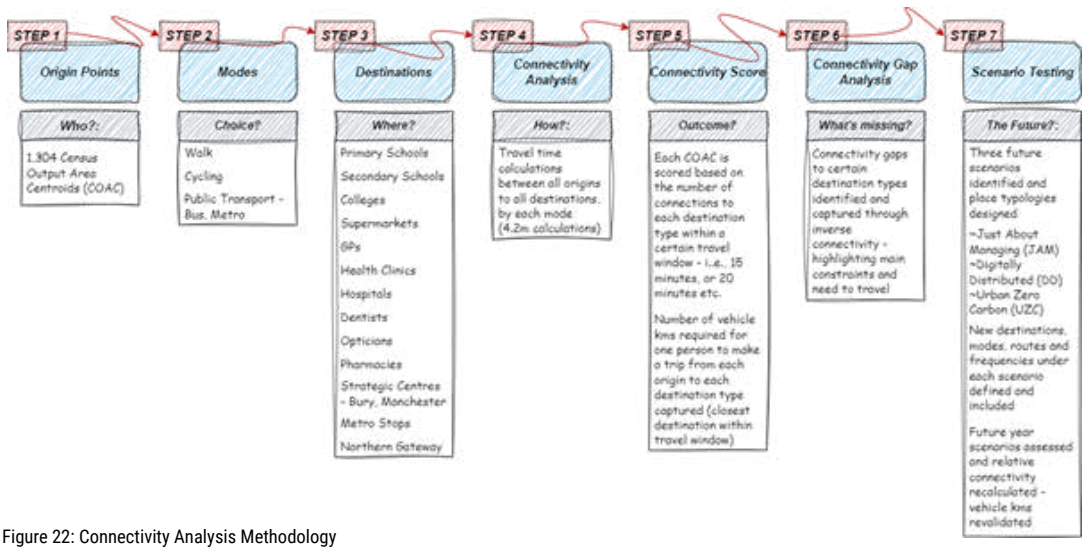


Figure 22: Connectivity Analysis Methodology

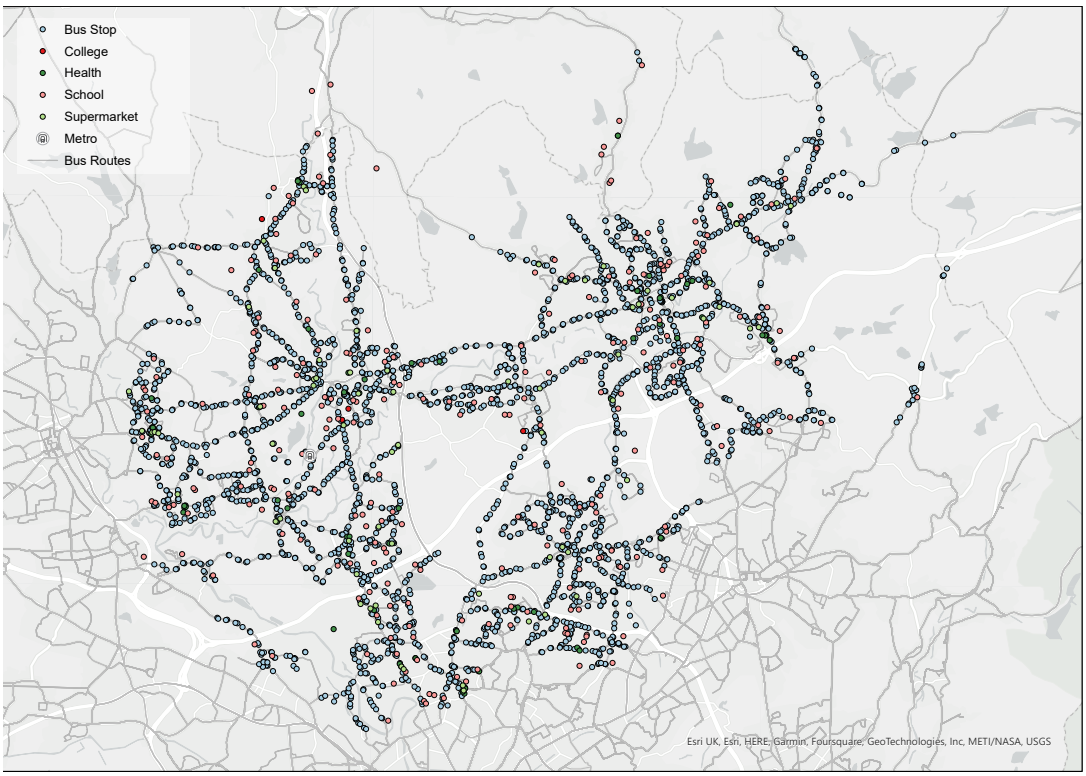


Figure 23: STAAT analysis of land use provision in the Bury conurbation

communities. This analysis informed discussion about which land-uses and/or connections could be provided on site and which could optimise 15 / 20 minute neighbourhood characteristics, both onsite and with neighbouring communities, thereby optimising travel reduction potential as well as reinforcing community cohesion.

4.4.6 Having undertaken a 'current conditions' run, the process highlighted several land-use and transport interventions that could be provided to reduce the number of perverse incentives for car ownership and use for some local journeys. Key land use gaps relating to a predevelopment Elton Reservoir were identified as likely to be access to primary school, local retail, GP clinics and pharmacies, particularly evident to the south of the site. In addition, access to secondary schools and the college would need to be addressed. Further work was undertaken to disaggregate each land use type identified to better inform provisions to be made for each of the three scenarios; Just About Managing, Digitally Distributed and Urban Zero Carbon.

4.4.7 Urban Morphology and accessibility: Stantec has also worked closely with Newcastle University's EPSRC Centre for Doctoral Training in Geospatial Systems to support the development of tools to inform consideration of the impact of urban morphology on accessibility. Access to key amenities was assessed by developing an isochrone map. This allowed us to evaluate the time it would take to reach basic services by different modes of transport and determine which areas present gaps in accessibility based on the current distribution of amenities.

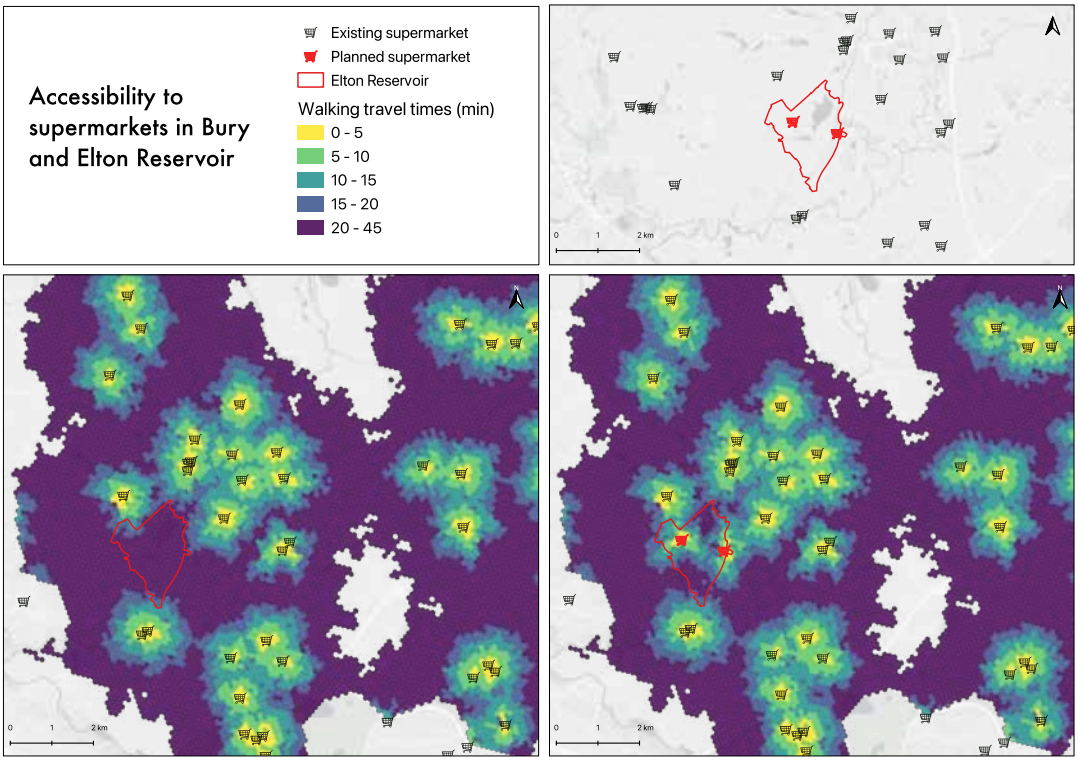


Figure 24 Assessment of Accessibility Levels for Bury, with and without new amenities

4.4.8 This analysis was undertaken for the entirety of the Bury conurbation. This provided a baseline on which the potential increase in accessibility could be assessed, after the new amenities are built, and taking into account the master plan layout. Significant increases in access to basic amenities were demonstrated. Not only would these measures benefit the planned new development area, but also its surroundings, thus making the use of modes other than the car more attractive for these journey purposes.

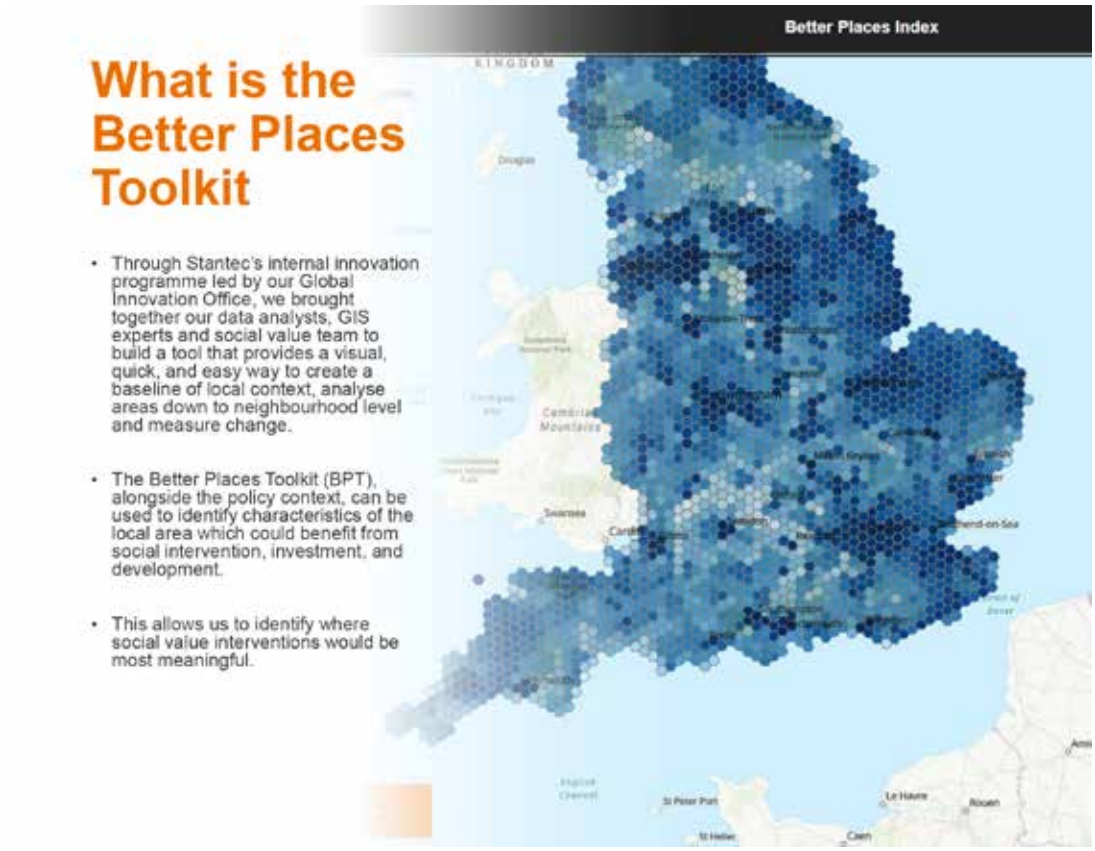
4.4.9 This form of analysis is capable of informing consideration of optimum locations for the local facilities and services proposed so as to maximise accessibility for both future residents and new communities. Figure 24 illustrates the output from this accessibility modelling, in which alternative locations for local shops within the development at Elton Reservoir were considered. This approach helps to optimise the master plan layout from a carbon perspective, providing useful input into the design process. Annexe Six outlines some of the analysis undertaken.

4.5 Using Better Places social value tools to inform place making priorities.

4.5.1 Working with Innovate UK, the Quality of Life Foundation and the University of Reading, Stantec has developed a data driven approach to the assessment of social value priorities in local areas, and methodologies that can be used to identify characteristics which could benefits from social intervention, investment and development(13). Through Stantec's internal innovation programme, we have brought together our data analysts, GIS experts and social value team to build a tool that provides a visual, quick, and easy way to create a baseline of local context, analyse areas down to neighbourhood level and measure change.

4.5.2 Our approach to Better Places blends two key aspects. First, the assembly of relevant 'passive' data sets to create a theoretical overview of the social value characteristics of a local area and second, engagement with local communities to understand the 'active' data – how local people respond to this social value baseline and recommendations for intervention. For

Figure 25: The Better Places Social Value Toolkit



this project, we have focussed on the assessment of the passive datasets within the Better Places Toolkit (BPT) to explore social and community infrastructure that could be provided to support complementary positive wellbeing outcomes, with the intention of considering active data through the Societal Readiness Assessment.

4.5.3 The Better Places Toolkit covers six over-arching themes and 18 sub-themes, some of which make up different requirements for places where 'individuals may feel their lives to be happy, active, sociable, interesting and meaningful'. The scope of this analysis is to provide recommendations on what social and community infrastructure may be beneficial with the Bury and Rochdale area. This analysis has focused on those themes that are most relevant to these issues.

4.5.4 Before turning to this analysis, it is important to address the question about why we should be concerned about social value as part of a project about transport decarbonisation.

- First, as reported by the IPCC(8), having the right policies, infrastructure and technology in place to enable changes to our lifestyles and behaviour can result in a 40-70% reduction in greenhouse gas emissions by 2050.
- Second, as widely reported, and summarised in our report Places First, Creating Communities Fit for the Future, Making the Case for Change(11), many modern suburban developments reinforce car dependent lifestyles with consequentially low levels of physical activity and poor environmental and health outcomes.
- Third, providing local facilities within a new development is no guarantee that these will be used by the local community for a wide range of complex reasons. Creating a sense of community is essential if a new development is to become a place.

4.5.5 It is therefore important to consider what the local needs really are, and to test these assumptions with the local community, before assuming that any local infrastructure provided will have the effect of reducing travel demand. This is also an essential step towards better understanding how new development can add to the social value capital of a place, thereby tackling the suspicion and distrust faced by many local developments which become seen as imposing unwelcome burdens on local communities, rather than delivering benefits.

4.5.6 This analysis is therefore intended as a first step towards these considerations, providing a basis for further development through the planning and design process. The process included:

- Looking at what underlining baseline data is relevant to recommendations regarding both social value and land-use
- Refining what data sets within the Better Places Tool (BPT) drive these outcomes
- Providing focused recommendations on what additional elements could make a more socially valuable place

Annexe Seven sets out the work undertaken in more detail.

4.5.6 Some key outcomes of this work include:

- It is important to look outside of the site boundaries to understand existing communities. Both Elton Reservoir and Northern Gateway site between areas of relatively high levels of deprivation.
- These levels of deprivation are not primarily driven by barriers to access to housing and services, although geographic access to social infrastructure will need to be addressed as both sites are developed.
- Levels of poor health and disability are above average in Bury and Rochdale. In particular, Radcliffe has low level of access to healthy assets and high access to healthy hazards. Place-based design should encourage healthy principles that embed long-term health outcomes.
- Access to local town centres by public transport and active modes from Elton Reservoir and Northern Gateway is poor. Access to green space appears to be good, but will need to be addressed as part of development plans. Linking up areas with updated travel infrastructure would create more opportunities for access to employment and social facilities.
- Employment and income deprivation is prevalent in the outer areas of Bury Town Centre, in Radcliffe as well as in Heywood, Middleton and Whitefield. Fuel poverty seems to follow a similar trend.

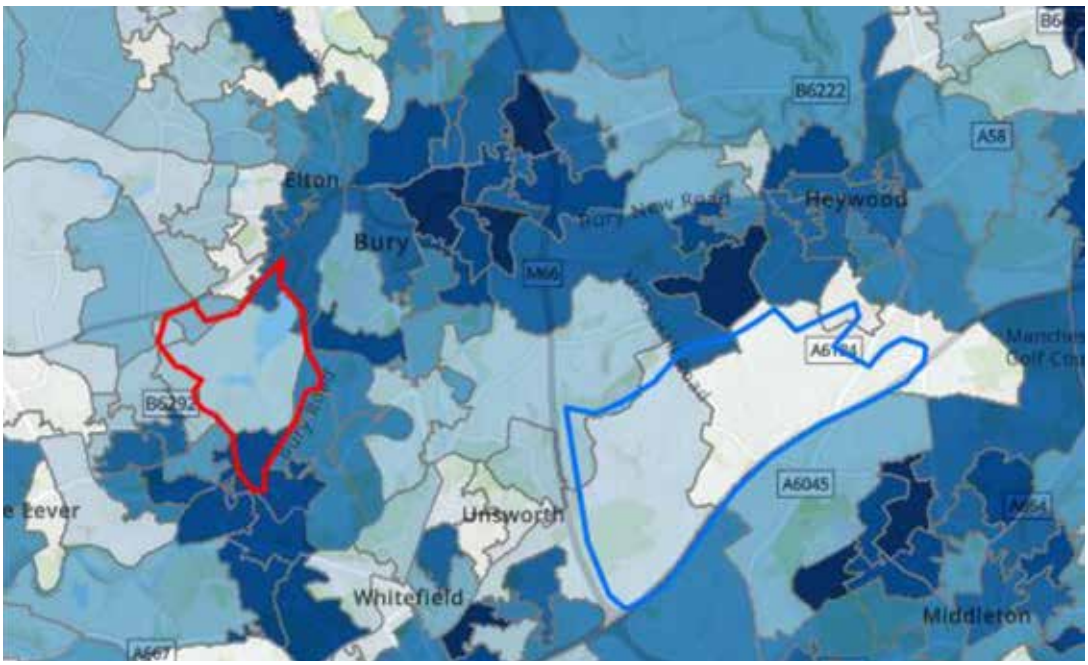
4.5.7 Affordability and opportunity are also important indicators to be considered, as they relate to the ability to achieve a just transition to Net Zero. Access to economically sustainable housing and access to affordable, efficient and safe transport are shown to have profound impacts on people's life chances. Elton Reservoir performs well on these indicators, but there are clear discrepancies around the site, suggesting that connectivity to local areas will be a key factor for the planning and design of the development.

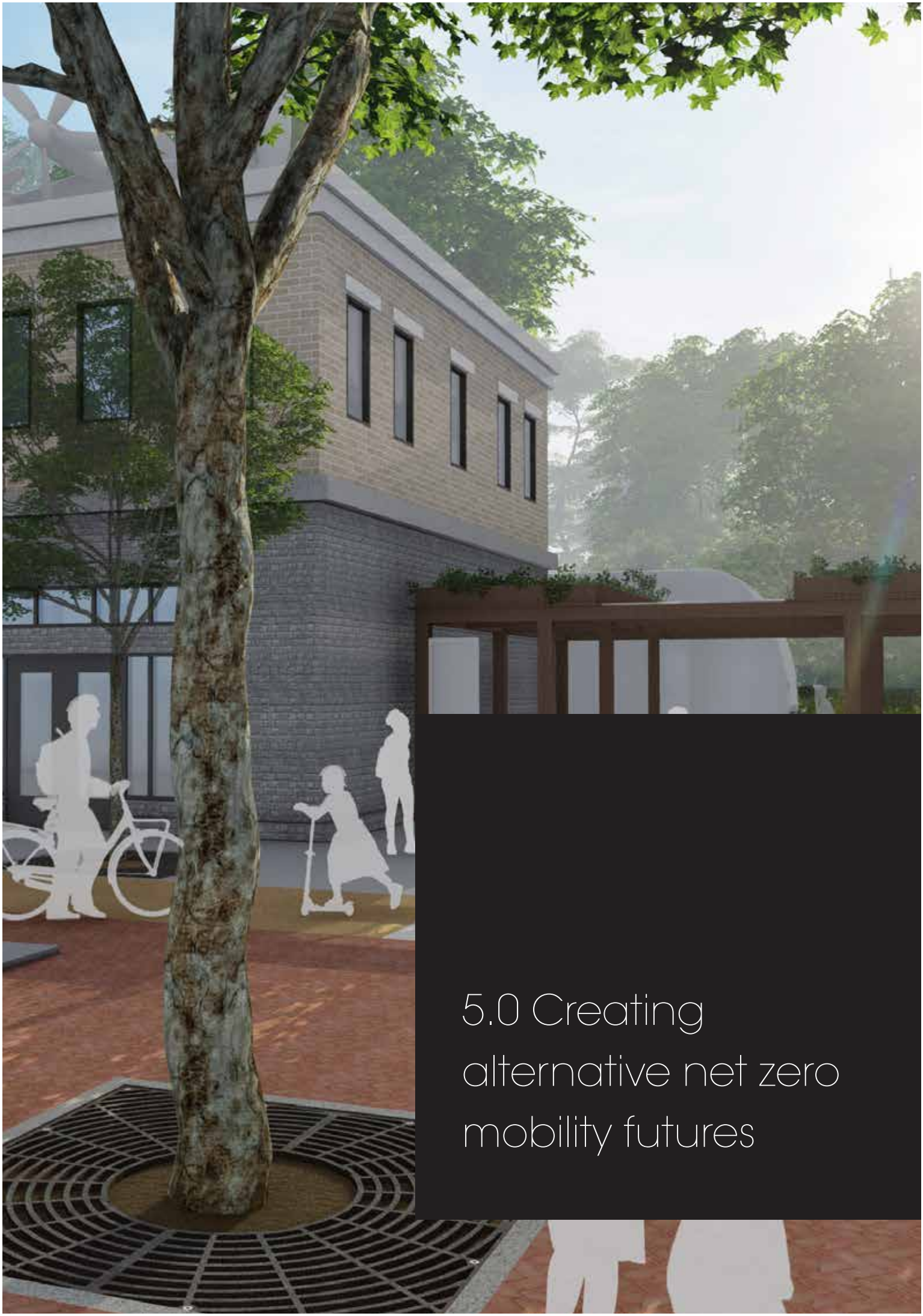
4.5.8 There are clear links with the reverse land use and optimisation work undertaken which identified access to health, dental, education and local retail facilities as where there are likely to be social infrastructure gaps. The Better Places work confirms that there are high levels of deprivation relating to health and economic residency in close proximity to the site, suggesting that there is a correlation between access to facilities and social value outcomes. Whilst there would clearly be more work to be done to better understand and ground truth the data, there appear to be some consistent messages emerging:

- Access to social and community infrastructure for the new and existing population will be a paramount consideration for the development, including recreation and green spaces.
- Co-location of services in community hubs, providing for integrated services across health, wellbeing, elderly care, sports, arts and culture will maximise access and reduce the need for chain journeys.
- Design codes which encourage an integrated approach to active travel (and local mobility services), accessible streets and nature-based solutions are needed to put healthy lifestyles at the centre of the design approach.
- Opportunities should be sought to improve access to, and extend higher education opportunities, including specialist skills centres with links to employment opportunities.
- Transport interventions should create opportunities to provide affordable connections between areas of deprivation and the new facilities that could support better life outcomes.

4.5.9 Whilst much of this will need further consideration at the planning and design stages, the emphasis on health and education infrastructure and connectivity, on provision of integrated community hubs and green spaces with access and connectivity to local communities, and on design principles to encourage active travel and healthy lifestyles can be considered as an integrated part of the creation of alternative net zero mobility futures in the next stage of the project.

Figure 26: Better Places Social Value Tool, Fuel Poverty.





5.0 Creating alternative net zero mobility futures

5.0 Creating alternative net zero mobility futures

5.1 Identifying potential Net Zero Mobility Measures

5.1.1 This study has now developed three alternative place typologies aligned to three of the TfN Future Travel Scenarios, established a good understanding of the likely demand relating to each of those futures, and has made an assessment of the main land use and connectivity gaps for each that could, if resolved, have a positive impact on travel reduction by car. This provides a helpful evidence base for an initial assessment of the land use and transport measures that would be needed to move away from our hypothetical Just About Managing scenario towards another, more radical future that might be equipped to meet net zero transport objectives. These became known as the Net Zero Mobility Measures, (NZMMs).

5.1.2 For the purposes of this study, this was achieved by holding a collaborative workshop with key stakeholders, including representatives from Stantec, University of Leeds, University of Lancaster and Bury Council. The process adopted was as follows:

- A list was made of all the likely potential land use and transport measures that could be used as a Net Zero Mobility Measure, based on a literature review of available carbon calculators.
- These were aligned to the Sustainable Access Framework, ie whether or not the measure would be primarily targeted as trip substitution, modal shift or fuel switching.
- Each of the transport and land use measures contained within the Draft Bury Local Transport Strategy, 2040, (subsequently approved by Bury Council on 5th October 2023), and any relevant proposals contained in the Greater Manchester Transport Strategy, 2040, were identified, and assumed to be implemented as part of the Just About Managing (baseline) future.
- Net Zero Mobility Measures, (ie potential measures which would go beyond the baseline measures assumed for Just About Managing) were identified. Many of these would be important for both Digitally Distributed and Urban Zero Carbon futures, but others would be more distinctively associated with one or the other.
- Distinctively Digitally Distributed NZMMs reflect the market led, technology-led future envisaged in TfN's Future Travel Scenarios. The switch to EVs, development of autonomous shuttles (shared autonomous vehicles (SAVs), and mobility services leads the way, but regulation lags behind.
- The Urban Zero Carbon distinctive NZMMs reflect the high density urban form driven future, supported by investment in active modes and mass transit, supported by robust government policy in favour of road space reallocation and road user charging.

5.1.3 Table 4 summarises the workshop outcomes. These were used to develop alternative land use and transport futures for the 'supercharged' Digitally Distributed and Urban Zero Carbon Future Travel Scenarios.

5.1.4 These scenarios are intended to reflect two quite different futures that can be tested in terms of their carbon and societal characteristics. The aim is to assess the performance of these different approaches to bridging the carbon gap before considering their operational and planning effects. This allows us to contrast and compare each vision of the future and set objectives before the more 'real world' assessments develop and refine these into plans designed for implementation.

Substitute trips	Included in baseline?	NZMM	Shift modes	Included in baseline?	NZMM	S
	Y/N	Description of any measure not included in the baseline that we consider would have a high impact on vkm		Y/N	Description of any measure not included in the baseline that we consider would have a high impact on vkm	
Active travel infrastructure			Shared mobility			E
Cycling infrastructure - genuine connected network - integrated with other transport modes	Y	Ensuring high quality connections to local amenities	Bike share	Y	Integrate bike share with mobiliity hub provision	E
Walking infrastructure - genuine connected network	Y	Ensuring high quality connections to local amenities	eBike share	Y	Integrate e-bike share with mobility hub provision	E
Launch bike hire	Y	Assumed to be part of mobility hubs	Car share (club)	Y	Integrate car share with mobility hub provision	H
Invest in cycle parking and storage	Y	Cycle parking in public spaces and close to front doors	Electric vehicle car share (club)	Y	Integrate car share with mobility hub provision	C
Encourage cycle to work schemes	N	Travel Plans (NG)	Mobility hubs - integrated network	Y	Integrate mobility hubs with V2C provision where possible	C
Ensure micro-climate, navigation, wayfinding and overall design of streets encourage walking and cycling	Y	Assumed forms part of future integrated mobility tools	Modern public transport			C
Land use planning			Rail: New Central Interchange	Y	New services to Rossendale and Rochdale	C
Co-working spaces (local, in new developments / disused shops)	N	Integrate with local centres	Tram: New Tram Stop at ER	Y	Metrolink extension to Middleton and Oldham, via NG	E
Mixed use developments meeting a greater range of local needs	N	Land Use Gaps on or nearby ER, NG or TCM	Demand Responsive Transport & Rideshare		Autonomous shuttles provide demand responsive services	E
Recreation space embedded in neighbourhoods	Y		Bus Rapid Transport	Y	A56 and A58 routes become high frequency, flexible autonomous shuttles	F
Local amenities within short walk and cycle (15-minute neighbourhood)	Y	Revenue support for local amenities to ensure they are viable from the start	Bus priority traffic lights	Y	Priority for all non car modes	G
Prioritise strategic planning and investment in walking, cycling and public transport	Y	Avoid investment in new road capacity. Increase capacity for other modes	Automated vehicle shuttles - last mile connectivity	N	Shuttles to new tram stop and across to NG and the SRN	I
IT infrastructure			Mobility as a Service - integrated public transport, on-demand and shared mobility services	Y	New local fleet of micro EVs and micro mobility aimed at the 5 - 30km market	A
Home working (superfast broadband and house design to allow for work space)	N	Assumed to be delivered as part of ER	Subsidise/invest in bus routes including community-based bus schemes.	Y	Autonmous shuttles provide low cost bus services	L

Key: Just About Managing; NZMM for both futures; NZMM for DD; NZMM for UZC

Switch fuels	Included in baseline?	NZMM	Freight	Included in baseline?	NZMM
	Y/N	Description of any measure not included in the baseline that we consider would have a high impact on vkm		Y/N	Description of any measure not included in the baseline that we consider would have a high impact on vkm
Electric vehicle (EV) charging infrastructure			Hubs		
EV charging (residential) + vehicle to grid technology	Y	V2C++ Reduce energy demand through EV storage capacity	Trial consolidation hubs for freight.	N	Freight interchange on NG
EV charging (stations / shops / work / mobility hubs)	Y	Social Service Stations. NB - what is the scale of provision needed?	Invest in rail cargo hubs for cluster cities.	N	
Hydrogen fuel cell charging (stations / shops / work)	N	Northern Gateway - to serve industrial and distribution hub	Logistics infrastructure	N	
Conversion of fleets			Micro-consolidation - cargo bike / electric vehicle last mile delivery	N	Freight Interchange on NG
Convert commercial delivery and servicing fleets to EVs	N	Assume out of scope	Flexible pick up / drop off points for home deliveries	N	Integrate with mobility hub provision
Convert municipal delivery and servicing fleets to EVs	N	Assume out of scope			
Convert public transport fleets to EVs	Y- GM level	Assume out of scope			
Encourage green taxis through licensing	N	Assume out of scope			
Encourage switch to EV through corporate leasing	N	Assume out of scope			
Fiscal measures					
Grants to trade in petrol / diesel for EVs	N	Assume out of scope			
Incentivise partners to invest in EV charging points.	N	Assume out of scope			
Access restrictions					
Low emission zones - Clean Air Zones	GM Level				

Table 4: Identification of proposed Net Zero Mobility Measures (NZMMs)

Substitute trips	Included in baseline?	NZMM	Shift modes	Included in baseline?	NZMM
Remote study and 'blended learning' for further and higher education	N	Assumed out of scope	Match population growth and density allocation to connectivity and public transport	Y	Assumed out of scope
Digital public services (e.g. GP online)	N	Assumed out of scope	Ensure strategic investment in public transport routes aligned with growth areas	Y	
Trial Smart Driving Tools in cars	N	Assumed that future scenarios benefit from greater level of autonomous capability	Street design & access restrictions		
			Low Traffic Neighbourhoods - active travel priority	Y	
			Car free zones	Y	Built into design of ER and NG, peripheral car access only (Vauban)
			Street space reallocation from car to active and public transport	Y	Roadspace reallocation to provide for active modes and shared mobility between ER, NG and TCM
			20mph zones	Y	Central Development Zones
			Controlled parking zones	N	Use parking outside V2C to create revenue stream for SUMP
			Congestion charging zones	N	
			Design streets that safely mix modes of transport rather than creating specific networks for individual modes	Y	Central Development Zones
			Consider physical intervention to reduce severance created by large scale highway infrastructure	Y	A58 BRT and Elton Tram Interchanges
			Develop a Sustainable Urban Management Plan (SUMP)	N	Yes, but needs revenue funding to support monitoring and management
			Fiscal measures		
			Workplace Parking Levy	N	Road User Charging

Key: Just About Managing; NZMM for both futures; NZMM for DD; NZMM for UZC

Switch fuels	Included in baseline?	NZMM	Freight	Included in baseline?	NZMM

Table 4: Identification of proposed Net Zero Mobility Measures (NZMMs)

5.1.5 How do the NZMMs identified in Table 4 compare with the key considerations for the most effective reduction of travel demand by car as previously assessed and described in paragraphs 4.3.11 – 4.3.13, and 4.4.6? Table 5 below provides a brief summary:

Demand-led NZMM consideration Digitally Distributed Urban Zero Carbon Trip substitution through local land use change and connectivity	Digitally Distributed +	Urban Zero Carbon +
	Local Centres providing local facilities & amenities, including work hubs. Connections to adjacent facilities and amenities, eg Radcliffe, Redvales and Ainsworth)	Local Centres providing local facilities & amenities, including work hubs. Connections to adjacent facilities and amenities, eg Radcliffe, Redvales and Ainsworth)
Short distance trips of between 2 – 5km, most particularly to schools and colleges	Connections for local mobility services to adjacent facilities and amenities, (eg Radcliffe, Redvales and Ainsworth) Priority facilities for access to nearby secondary schools and college for local mobility services and priority for SAV connections	Walking and cycling connections to adjacent facilities and amenities, (eg Radcliffe, Redvales and Ainsworth) Segregated walking and cycling routes to nearby secondary schools and college for local mobility services and priority for bus services.
Intermediate trips of over 5km, and upto (at least) 30km	Introduction of comprehensive local mobility services, including e-bike, e-scooter, EV car hire and car share, and an 'EV Light' service. The EV Lights will be 1 – 2 seater vehicles with a reliable range of 80km. EVs and EV lights can be booked as part of the local mobility services, and either picked up at the local mobility hub or ordered to your front door. Alternatively, regular SAVs provide a convenient service at the mobility hub. In combination with a master plan which places personal EVs in communal parking areas, and non EV cars on the periphery of the development, local mobility services are more convenient to use.	Investment in new rail and tram connections: • Rossendale – Bury – Rochdale • Metrolink extension to Oldham, via Middleton BRT services along the A56 and A58 providing high frequency connections between Bury, Botlon, Rochdale and Ramsbottom. Together, these new services provide a high density mass transit network that enable people to get around the sub urban area. In combination with a masterplan that provides limited peripheral parking for cars, mass transit is more convenient that using the car.
Effective alternatives to travel by car to Northern Gateway	Priority routes have been provided between Elton Reservoir and Northern Gateway for local mobility services, including e-bikes, EV lights, and SAVs.	The Metrolink extension to Oldham provides a direct rail connection between Elton Reservoir, Radcliff and Northern Gateway. A BRT connection has been provided from the A56 to Northern Gateway.
Development of more effective use of SRN capacity for people and goods	Northern Gateway is served by a network of SAVs An interchange provides connections to an on-site shuttle service which connects employment buildings around the site to peripheral parking areas, SAV routes and onward SRN services. Freight consolidation centres at NG use overnight SAV capacity is utilised for last mile freight deliveries to a network of local delivery hubs, including at the Elton Reservoir.	Northern Gateway is served by BRT and tram services. An interchange provides connections to an on-site shuttle service which connects employment buildings around the site to peripheral parking areas, the BRT and tram services. Freight consolidation centres at NG use overnight tram capacity is for last mile freight deliveries to a network of local delivery hubs, including at Elton Reservoir.

Table 5: Comparison of proposed NZMMs against demand analysis

5.1.6 Most of the NZMMs identified could be considered to be a development of existing technologies or policies, and therefore would be low risk from a delivery perspective. Other measures identified can reasonably be considered to require significant technological, attitudinal, market or political shifts to delivery. A brief assessment of the most obvious risks was undertaken and recorded, as contained in Table 6.

5.1.7 For the purpose of this study, no heroic assumptions were made about the extent to which autonomous car operation would be progressed, but it was assumed that current testing of SAVs, autonomous shuttles and delivery robots have been developed into an operating model, that integrated freight delivery solutions would be developed, and that communal EV charging hubs and social service stations(18) would be deliverable by 2040. These were considered to be reasonable assumptions given the progress that might be expected over the next 17 years or so, and the intended radical change these futures were intended to represent.

Future Travel Scenarios	JAM/ Baseline	DD +	UZC +
Central Interchange	Includes provision for existing services	As JAM	Provides access to new rail provision to Rossendale and Rochdale
Rail improvements	Elton Tram Stop	Elton Tram Stop	Elton Tram Stop New route to Rossendale and Rochdale via Bury Interchange Metrolink extension to Oldham via NG
Quality Bus Corridors	A56 and A58. Priority provided where possible	SAVs replace QBCs, priority provided where possible. SAVs connect to NG and onward SRN services. No vans.	BRT replaces QBCs. Priority provided, road spaces reallocated to BRT where necessary. BRT connects to NG and onward SRN services
Mobility Hubs (walking & wheeling/ e-car clubs/ e-car share, delivery hub etc)	General provision, not required for new development	Interchange between active modes and tram at all tram stops.	Interchange between active modes and tram at all tram stops.
EV charging to support EV transition	Limited public provision, plus support for domestic provision for new housing	EV charging hubs provided to meet demand	EV charging hubs provided to meet demand
Radcliffe township plan	Improved local amenities, including construction of new secondary school and leisure centre	As JAM – ER development directly connected to Radcliffe	As JAM – ER delivered as extension to Radcliffe
Shared streets and spaces, LTNs and 20 mph zones in existing areas	In accordance with available budgets	As JAM	More aggressive approach to road space reallocation to support active modes supports increase walking and wheeling
Demand Management	GM clean air zone only	Optimised road pricing, disconnected from other mobility services. Road space allocation for key destinations and SAV routes along A56/ A58	Integrated mobility services and road pricing used to manage demand. Road space reallocation for BRT/ SAV routes and active modes in urban areas
Urban freight distribution	No change	Local urban freight consolidation centres services provided at edge of conurbation, with network of local delivery hubs served using overnight capacity of SAVs/ Drones	Local urban freight consolidation centres services provided at edge of conurbation, with network of local delivery hubs served using overnight capacity of tram/ BRT

Technology Risk
Market Risk

Table 6: Summary of technological and market risks to delivery of proposed NZMMs

5.2 Developing alternative local land use and transport futures

5.2.1 Just About Managing 2040: This future assumes that the Bury Local Transport Strategy 2040, and the relevant parts of the Greater Manchester Transport Strategy 2040 have been implemented. It is intended to provide a baseline for this study, from which the two other future land use and transport futures can be constructed.

5.2.2 Whilst this future fails to meet net zero mobility objectives, it does represent a high level of ambition in terms of promoting sustainable travel options. The main proposals assumed to be included in Just About Managing are:

- The Town Centre Interchange has been built and the town centre regenerated.
- The proposed new tram stop has been built at Elton Reservoir.
- Quality Bus corridors provide priority for bus services on the A56 and A58.
- Good provision has been made for walking and cycling along the existing highway network and at interchanges.
- One new local centre and a local hub are planned to provide access to local shops, education, health and recreation facilities.
- The secondary school has been built in Radcliffe, and there are plans for two primary schools on site. The High School in Radcliffe is under construction and due to open in September 2024.
- About half of all cars are now Electric Vehicles, but progress is slow with vans and HGVs, and charging points are not keeping up with demand.
- Parking for 2 cars is provided close to every home, car remains the dominant means of travel and congestions remains high.

5.2.3 Getting about to and from Elton Reservoir by means other than the car would be easier in 2040's Just About Managing future than it is now. The proposed new tram stop would be great for getting into Manchester City Centre and the town centre, (so long as it's not raining). Provision has been made for buses, walking and cycling, but these feel like a choice to be made only if you don't have access to a car.

5.2.4 There are 3500 homes planned for the site on around 60% of the available land. Around 30% of the site is open space, with the remainder being used for schools, local centres and infrastructure. The new local centre has now opened, but is struggling to find its place in the community. There's a walking bus for primary school children, but getting to the secondary schools and college without a car is a challenge. It's better to have two cars to allow for trips to be made to a combination of work/ school/ shops/ leisure for a busy working family. Travel by car remains first choice and congestion remains high.

5.2.5 Despite the progress made, JAM does not propose either:

- A concerted strategy to accelerate the take up of EVs and technologically driven mobility services, or
- Major investment in rail, tram and BRT transit services to a level that delivers a convenient network providing access across the sub-urban conurbation.

These would require significant funding and policy support that would need to be supported at all levels of government.

5.2.6 The next two futures have been enhanced to represent how a digital future and an urban future might be 'supercharged' to meet net zero mobility objectives.

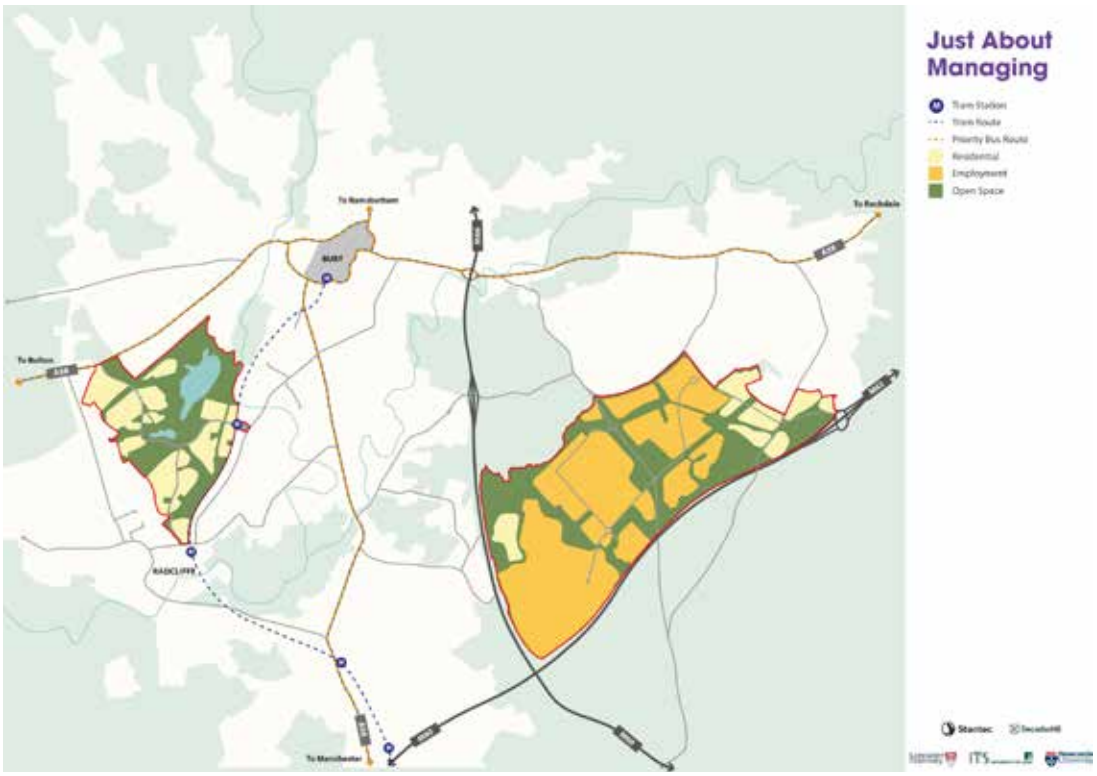


Figure 27: Just About Managing 2040: Transport Future

Figure 28: Just About Managing 2040: Land Use Future

5.2.7 Digitally Distributed + (2040): This future assumes that the Just About Managing transport proposals have been delivered, and that the TfN Digitally Distributed scenario proposals apply. Locally, we assume that our DD+ local land use and transport future assumes that:

- The market has driven rapid digital and technological advances, transforming how we work, travel and live. Mobility services are widely available, but these are yet to be connected with charges for road uses, creating confusion and inefficiency.
- Most cars and vans are EVs, and charging infrastructure has kept pace with demand ensuring that there is sufficient charging capacity for the growing EV fleet.
- 2 new local centres are planned, together with two primary schools one in each centre, and a secondary school in Radcliffe.
- Parking on site is in communal V2C hubs for a maximum of 1 space per home. These provide V2G charging facilities (explained further in Annexe Two). Mobility Hubs have been rolled out across the conurbation and provide access to e-scooters, bikes and e-bikes, and a fleet of 'EV light' vehicles.
- EV car clubs and car sharing are widely available. It has become easier & cheaper to order a car to your front door when you need one rather than owning one, which together with other alternatives, has made one car parking space per household a practical proposition.
- Autonomous shuttles, (SAVs), have largely replaced buses, and provide a good way of getting around, including to Northern Gateway.
- SAVs also connect to the new Motorway Flyer service via an interchange at Northern Gateway, creating a network of suburban services across the North.
- There is little appetite to reallocate road space for non car modes, and congestion remains high with many vehicle types competing for road space.
- Cycling and walking remain a challenge on main roads, not helping to make it a desirable way of getting around the conurbation.

5.2.8 At Elton Reservoir, there are plans for 4000 homes on 53% of the available land. 34% of the site is open space, with local parks and allotments providing valued places to be on site, with the remainder being reserved for schools, local facilities and infrastructure. Revenue support has enabled advance opening of two new local centres, plus an extended Radcliffe centre. These provide a focus for work hubs, shops, education and health facilities, and opportunities to access local amenities without a second car.

5.2.9 Autonomous shuttles, (SAVs) stop at the local centres and provide services to local destinations, including local secondary schools and Northern Gateway. There is also a mobility hub within a 10 minute walk of every home. These provide access to local mobility and delivery services, including EV light vehicles which can be delivered to your front door.

5.2.10 Mobility services operate on a 'pay as you go' basis which you operate from your mobile device. What you pay varies depending on time of day, journey purpose and vehicle type. Your car is parked in a communal area which is within a five minute walk of each home. These provide charging facilities as well as reducing energy demand for residents, creating an incentive for leaving your car at home and/ or using pay as you go services.

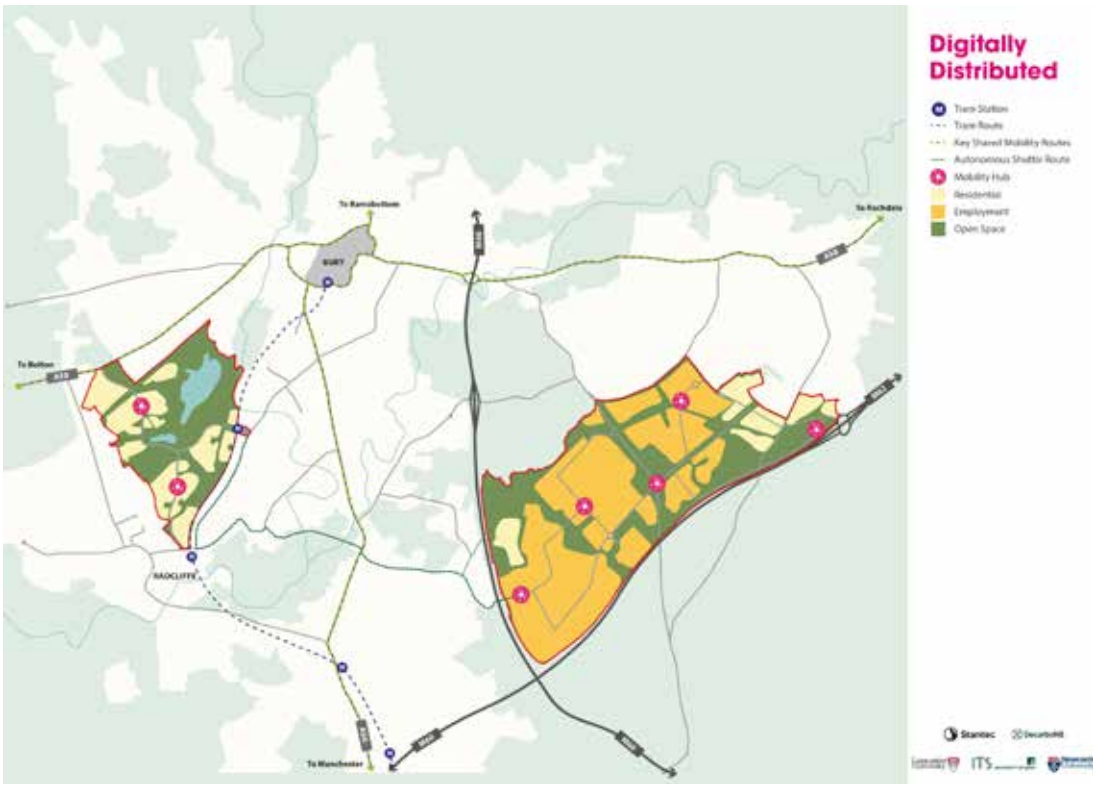


Figure 29: Digitally Distributed + (2040): Transport Future

Figure 30: Digitally Distributed + (2040): Land Use Future

5.2.11 Urban Zero Carbon + (2040): This future assumes that the Just About Managing transport proposals have been delivered, and that the TfN Urban Zero Carbon scenario proposals apply. Locally, we assume that our UZC local land use and transport future includes:

- There has been a strong Government action and a shift in public attitudes towards action on climate change. Integrated charges are in place for road users and transport services are now in place.
- Investment in rail has seen the construction of new railways to Rochdale and Rossendale, providing access to the wider metropolitan rail network.
- A new metro extension has been built providing a new route to Middleton and Oldham which connects with services from Bury and Manchester.
- The Metrolink extension provides access from Bury to Northern Gateway where a shuttle service provides access to employment and connects to the shared mobility services on the SRN.
- Quality bus corridors on A56 and A58 connecting Bury with Bolton, Rochdale and Ramsbottom have been upgraded to high frequency BRT routes, and a connection provided to Northern Gateway.
- Parking for a maximum of 0.3 spaces per home is provided in parking buildings on the edge of the development areas, and is subject to a charge making the car the choice for trips that can't be done another way.
- Payment for transport services, including car and other modes, are charged on a consistent basis, allowing price to better reflect total cost, including its social and environmental impacts.

5.2.12 At Elton Reservoir, 5,800 homes are planned on less than 40% of the available land. 50% of the site is open space with the remainder being used for education, local centres and infrastructure. The open space provides a range of running trails, wellness walks, and opportunities to engage with the natural world, making this a community where people want to live work and play.

5.2.13 Higher density development supports a wider range of local facilities, reducing the need to travel further. There is a substantial local centre adjacent to the Elton tram stop, and investment into Radcliffe town centre is benefiting from close connections to the south of the site. There are a range of local hubs around the site providing access to work hubs, health facilities and 3 primary schools. Cycle parking and local mobility services are provided within the development areas, making these choices more attractive for local travel, such as to school and work hub.

5.2.14 Residents live close to the tram stop at either Elton or Radclliffe, or the BRT stop on the A58. It's an easy walk to catch the tram or BRT, and these services provide access to an integrated and comprehensive network of transport systems across the local conurbation. Trams and BRT services now take more space on the roads, leaving less available for cars making moving around by car less attractive.

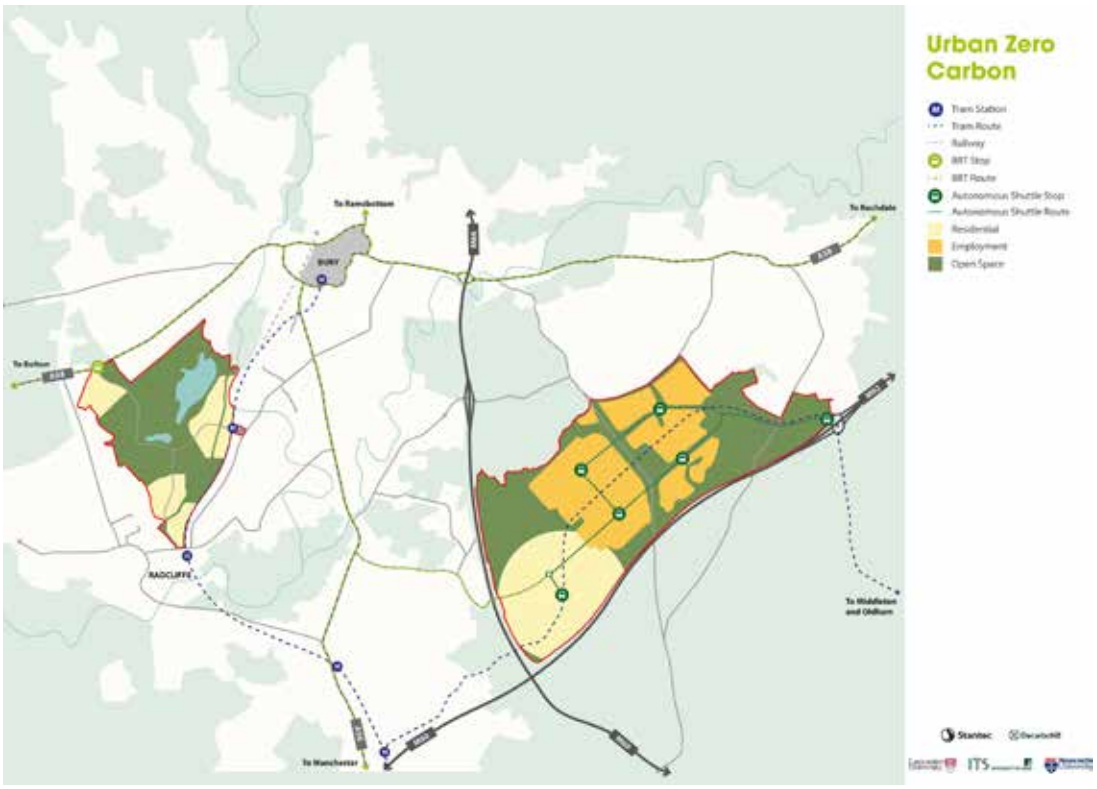


Figure 31: Urban Zero Carbon + (2040): Transport Future

Figure 32: Urban Zero Carbon + (2040): Land Use Future

5.2.15 Neither of these 'supercharged' futures are intended to represent a future reality. They are hypothetical scenarios intended to draw out two quite different ways in which land use and transport might evolve, assuming that there is a concerted effort to drive change in response to the climate emergency. They have been developed to test how our future plans may need to change in response to the needs of communities, and to inform what this means for the planning and design of future places and transport services.

5.2.16 Both of these 'supercharged' transport futures have been developed with the intention of meeting an objective of reducing demand for travel by car. As indicated in Chapter 2, at least a 20% reduction is needed for the Urban Zero Carbon Future, and at least a 30% reduction for Digitally Distributed. Neither of these futures would do this without other supporting policies, but in order for these to provide the basis for the development of future places that can thrive, each must be able to bridge the gap.

5.2.17 Annexe 8 provides further information about the 'supercharged' land use and transport futures that emerged from this exercise.

5.3 Bridging the Gap: Reducing demand for travel by car

5.3.1 Our challenge was to make an assessment of the impact of the NZMMs on the additional reduction of vkms, and carbon, over and above that achieved by the TfN DD and UZC Future Travel Scenarios. This is an extremely complex matter, and it is not feasible in the context of this study to enter into extensive modelling to undertake a fully robust assessment. Therefore, for the purposes of this assessment, we have adopted a high level 'vision and validate' approach to make an assessment of the scale of change that would need to be delivered by the primary NZMMs for DD+ and UZC+, and the potential contribution that could make on demand reduction at Elton Reservoir.

5.3.2 TfN data includes forecasts of vkms for each of the scenarios based on assumptions for 2040. We have assumed that these do not include any of the NZMMs and can therefore act as a baseline. The assessment of the demand reduction effects of the NZMMs has therefore been based on estimated changes from the TfN forecasts for the Digitally Distributed (2040) and Urban Zero Carbon (2040) scenarios. Figure 33 illustrates the vision and validate approach, and Table 7 explains the NZMMs which form the basis of the assessment.

5.3.3 There is one important proviso that requires some explanation. The assessment year selected allows us to assume, (optimistically), substantive completion of development at Elton Reservoir and Northern Gateway, together with the changes in land use and mobility services anticipated in each of the scenarios. This is obviously helpful in assessing the effects of the NZMMs. However, it is not consistent with the urgent requirement to meet demand reduction objectives car by 2030, and this clearly creates a logical inconsistency in our assessment.

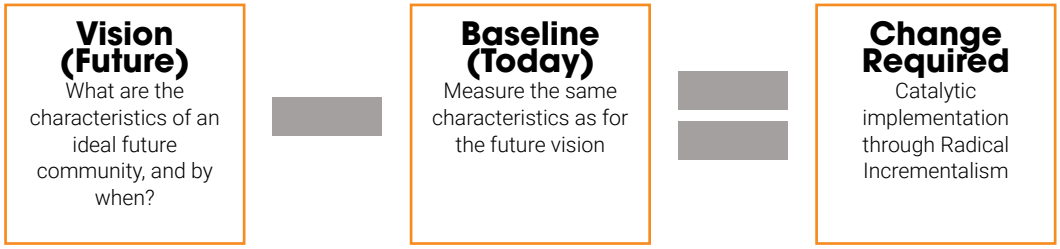


Figure 33. The Vision and Validate Approach

Trip length	Digitally Distributed +	Urban Zero Carbon +
	Trip Substitution	**Trip Substitution**
Short trips	Effects of additional land uses included in local centres, together with effects of additional connectivity	Effects of additional land uses included in local centres, together with effects of additional connectivity
0 – 5km	**Modal Shift**	**Modal Shift**
	Improved connections to secondary schools and college for local mobility services, and priority for new SAV services	Improved connections to secondary schools and college for walking and cycling, and priority for new bus services.
	Modal Shift	Modal Shift
Intermediate trips 5 – 40km	Introduction of: (i) Comprehensive mobility services across the conurbation and on site, including EV Lights providing convenient alternatives to the car for local travel (ii) SAVs replacing bus services providing more responsive and frequent services, aligned to demand. (iii) Separate road user charging and residential parking restrained to 1 space per dwelling in shared parking hubs	Improvement of mass transit through: (i) New rail services to Rossendale and Rochdale, and Metrolink extension to Oldham via Middleton. (ii) Upgrading of Quality Bus Corridors to Bus Rapid Transit with road space reallocation along the A56 between Bolton and Rochdale, and A58 between Ramsbottom and Manchester (iii) Integrated road user and transport charging and residential parking restrained to 0.3 spaces per dwelling in parking buildings
	Provision of : (i) Priority routes to Northern Gateway for walking, cycling, local mobility services and SAV services. (ii) No on plot parking provided adjacent to employment buildings, replaced by an on-site shuttle from transport interchange and parking areas	Provision of: (i) Metrolink extension to Oldham provides services from Bury to Northern Gateway, together with an on-site shuttle. Segregation provided for BRT services from the A58, together with walking and cycling. (ii) No on plot parking provided adjacent to employment buildings, replaced by an on-site shuttle from transport interchange and parking areas
Longer distance trips	**Modal Shift**	**Modal Shift**
	SAV connections to destinations along the SRN via an interchange at Northern Gateway	Access to wider rail connections via new rail and BRT services and tram connections via Oldham, Bolton, Rochdale and elsewhere.

Table 7: Demand Reduction – NZMMs to be assessed

5.3.4 In effect, the TfN futures assume that there has been very significant transition to electric vehicles by 2040, so the net additional impacts of demand reduction will be considerably reduced by this point in time. This discrepancy is an inevitable consequence of the length of time it takes to effect significant change to land use and transport infrastructure, and the short space of time we have left to take carbon reduction action.

5.3.5 Despite this apparent temporal anomaly, developers need to set down the principles for their future communities early, and these need to be consistent with the strategy being adopted in the local area, so design principles need to be established now to ensure consistency of approach, and to provide the opportunity for development to set the foundations for net zero mobility from the start, both within the site and elsewhere.

Trip length	NZMMs	Assessment Methodology
Short trips 2 – 5km (16 – 17% of total vkms)	Provision of new local land uses (ie school, local shop, GP surgery, pharmacy, work hub) on the Elton Reservoir development Provision of improved connectivity for walking, cycling and local mobility services to Elton Reservoir and adjacent areas	**Trip Substitution:** Assessment of reduction in vkms created by new land use or connection to existing and new development, adjusted by a factor relevant to the likely use of each land use and the housing density in each scenario
		Modal Shift: Assessment of changes in access time arising from better connectivity to new land uses by foot, bike and local mobility/ public transport services, and potential impact on car use. Intermediate trips 5 – 40km (60 – 63% of total vkms)
	Increase attractiveness of alternative modes created through: (i) Provision of improved alternatives to the car (ii) Reduced attractiveness of car use through changes in parking access, availability and relative cost of use	**Modal Shift:** A vision & validate approach has been taken. First the total intermediate trip lengths were calculated from the demand profiles, and the target trips identified based on the focus of each NZMM. Second, the vkm reduction for each NZMM was then assessed to meet the required demand reduction objective. This was undertaken for three alternative scenarios resulting in different levels of demand reduction required from each measure. Last, standard logit model modal factors were used to understand 'what would need to be true' in order for any of these scenarios to be delivered. **This does not result in a forecast of modal shift, but seeks to provide an understanding of the potential of each scenario to sufficiently reduce demand.**
	Increased attractiveness of alternative modes to Northern Gateway created through: (i) Provision of improved alternatives to the car (ii) Reduced attractiveness of car use through changes in parking access and availability at both origin and destination, and relative cost of use	
Longer distance trips	Increased attractiveness of SAV services along the SRN from Northern Gateway interchange (DD+), or increased rail connectivity via new rail connections, (UZC+)	

Table 8: Demand Reduction Assessment Methodology

5.3.6 Table 8 summarises the assessment methodology adopted, and this is further explained in the following section. Demand reduction outcomes for the DD+ and UZC+ futures have been assessed on a per dwelling basis to allow a comparison of relative effectiveness between the alternative futures.

5.3.7 Short trips (0 – 5kms): The NZMMs affecting these trips relate mainly to changes in land use and connectivity at the local level. The aim is to provide alternative, attractive facilities close to people's homes, thus reducing trip length and improving the attractiveness of alternative modes for these trips. The land use and connectivity model was used to identify those trips that would become more attractive by virtue of shorter journey times as a result of proposed changes in land use and connectivity. This was undertaken for both existing trips and new development trips. The method used and principal outcomes are set out in Annexe 9. Table 9 summarises the outcomes.

Short Trips (one way vkms)	DD+		UZC+	
	Annual	Daily	Annual	Daily
Trip substitution	562,441		668,449	
Modal Shift	49,395		49,395	
Schools	736,384		873,379	
Sub Total Short Trip Reduction	**1,348,220**	**3,694**	**1,591,223**	**4,360**
One Way / 1000 dwellings/ annum	**337,055**	**923**	**274,348**	**752**

Table 9: Assessment of demand reduction potential of short trips

5.3.8 Intermediate Trips (5 – 40kms): The NZMMs affecting these trips relate mainly to changes in transport provision aimed at providing more attractive alternatives to the car together with car restraint measures including road user charging, road space reallocation and reduced parking provision. Together, these are designed to change the balance of attractiveness between car and alternative modes. Alternative scenarios have been developed for DD+ and UZC+, based on the measures set out in Table 7. These have been used to establish the additional change required, ie 'what would need to be true' if net zero mobility objectives are to be met, assuming that the NZMMs for short trips had been implemented.

5.3.9 In a vision and validate approach, this requires a broad assessment of alternative scenarios, first to inform the definition of the vision, and then to support the development of the more detailed strategies that support the delivery of the vision. Whereas there are now more sophisticated tools available to support scenario assessment, a simple spreadsheet-based approach has been adopted here to assess the combination of NZMMs that could deliver the demand reduction necessary to meet net zero mobility. The approach adopted is set out in more detail in Annexe 9.

5.3.10 It is accepted that overall, this methodology has limitations and potential overlaps that need to be considered. However, the purpose of this assessment is to understand the scale of change that could be engendered through a more radical approach to land use and transport provision. The aim is to assess which combinations of NZMMs could stimulate an environment in which distance travelled by car could be sufficiently reduced, assuming it forms part of a wider, consistent approach across the conurbation.

5.3.11 Our assessment of the carbon gap (section 3) suggested that it would be necessary for the Digitally Distributed Future to deliver an additional reduction in vkms of 30%, and 20% for the Urban Zero Carbon Future. Table 10 illustrates the impact of local land use and connectivity improvements on short trips, and the remaining vkm saving required from intermediate trips.

Daily One Way Assessment - Elton Reservoir vehicle km	DD (1 space)	UZC (0.3 spaces)
1 way veh km - Daily	136,482	189,682
% reduction required	30%	20%
Vkm reduction required (a)	40,945	37,936
Short Trips		
Trip substitution	1540.5	1831.5
Modal Shift	135	135
Schools	2017	2393
Sub Total Local Journeys (b)	3692.5	4359.5
Reduction in total veh KM (%)	9%	11%
Remaining demand reduction from intermediate trips	**37,252**	**33,577**

Table 10: Assessment of residual vkm reduction required from intermediate trips

5.3.12 This results in the following residual requirements for vkm reduction:

- **Digitally Distributed +:** 37,252 daily one way vkms, or 9,313 daily one way vkms per 1000 dwellings

- **Urban Zero Carbon +:** 33,577 daily one way vkms, or 5,789 daily one way vkms per 1000 dwellings

5.3.13 This confirms that the total trip length from intermediate trips that would need to be 'saved' is higher for DD+ than UZC+, both in absolute terms and in terms of trips per dwelling. Even though the number of dwellings is higher for UZC, the lower percentage saving needed for UZC makes an important difference. Savings from measures targeted at short trips amount to around 11 – 14%, thus reinforcing the point that the intermediate trips are likely to be the key target for trip distance savings, and of those, the largest group is 5 – 10km. **There are many other benefits of pursuing policies to make local movement by modes other than the car more attractive, but its carbon reduction contribution is likely to be less effective than a focus on intermediate trips.**

5.3.14 For DD+, the daily trip distance saving required from Elton Reservoir is 37,252 vkm. This would need to be delivered mainly by transport and land use measures targeted at 5 – 40km trip lengths (39,452 vkm) through local mobility services, and through specific measures targeted at attracting trip to Northern Gateway (28,536 vkm) and the SRN (20,781 vkm) to alternative modes. A total saving of 41% would be required from these trips, a very significant challenge.

5.3.15 For UZC+, the daily trip distance saving required from Elton Reservoir is 33,577 vkm. This would need to be delivered mainly by transport and land use measures targetted at mode shift to rail and tram for destinations including local towns (34,366vkm), Manchester City Centre (815 vkm), Northern Gateway (39,168 vkm) and beyond via shared mobility services on the SRN (29,930 vkm). A total saving of 47% would be required from these trips, also a very significant challenge.

5.3.16 To better understand the challenge of demand reduction for each of the DD+ and UZC+ futures, alternative scenarios have been considered. Table 11 below illustrates this assessment.

Assessment of alternative demand reduction scenarios						
DD+ Daily One-way Assessment	**Scenario 1**		**Scenario 2**		**Scenario 3**	
	%	veh km	%	veh km	%	veh km
Mode Share Adjustment	5%	4,672		4,672		4,672
Northern Gateway Scheme	80%	22,829	65%	18,548	51%	14,553
Connections to SRN SAV Routes	20%	4,156	30%	6,234	40%	8,312
5 – 40km Mobility Services	30%	5,918	40%	7,890	51%	10,060
Total demand reduction implied	**Total**	**37,575**	**Total**	**37,345**	**Total**	**37,598**
UZC+ Daily One-way Assessment	**Scenario 1**		**Scenario 2**		**Scenario 3**	
	%	veh km	%	veh km	%	veh km
Northern Gateway Schemes	61%	23,892	53%	20,759	40%	15,667
Interchange to the SRN routes	5%	1,497	10%	2,993	15%	4,490
Manchester City Centre	5%	41	10%	82	20%	163
New Rail/ Tram to local towns	5%	1,718	10%	3,437	20%	6,873
Mode Share Adjustment	10%	6,283	10%	6,283	10%	6,283
Total demand reduction implied	**Total**	**33,431**	**Total**	**33,553**	**Total**	**33,476**

Table 11: Alternative Futures' Scenario Assessment

5.3.17 As can be inferred from this assessment, even the radical transport and land use interventions considered in each of the land use and transport futures would struggle to deliver the very significant changes indicated in the scenarios assessed. Where this might be possible is where there is significant control over both the origin and destination parking provision, and the capacity provided for car travel through charging or road space reallocation. It does, however, rely on these measures being acceptable to society, policy makers and crucially – the market.

5.3.18 In DD+ scenario 1, even if the Northern Gateway scheme could deliver 80% of trips from Elton Reservoir by modes other than the car, 20% of trips to zones close to the SRN and 30% of other intermediate trips would need to be undertaken using the local mobility and SAV services, rather than by using a car. As the proportion of Northern Gateway trips by car decreases, so the need to capture intermediate trips elsewhere onto local mobility services increases, until DD+ scenario 3 has around 50% by non car modes for Northern Gateway, and other intermediate trips, and 40% of trips using the SRN Motorway Flyer.

5.3.19 In the UZC+ scenarios a similar trend can be seen. If the Northern Gateway schemes can attract over 60% of trips to tram and active travel, the required contribution of other interventions would be relatively low, but if only 40% is attracted to the Northern Gateway alternatives as suggested by UZC+ scenario 3, upto 20% of other intermediate trips would need to be attracted to rail, and 15% using shared transport on the SRN. Given the dispersed nature of these trips, this would appear to be difficult to deliver.

5.3.20 None of this assessment is, however, a forecast of what would happen given the delivery of measures associated with the DD+ and UZC+ futures. Undertaking the operational transport planning modelling of these scenarios is beyond the scope of this work, so it is not possible to provide an informed commentary on whether or not any of these scenarios would deliver the necessary demand reduction. Indeed, it is uncertain how such an exercise could be done, given the scale of change needed in terms of travel behaviour inferred, and the nature of modelling which uses empirical data about historic behaviour to inform future decision making.

5.3.21 Nevertheless, this process does begin to inform the 'what would need to be true if these futures are to deliver the demand reduction needed to meet net zero requirements' questions that would need to be considered as part of a vision-led planning and assessment process, and points to some important initial conclusions:

- From the Elton Reservoir perspective, making provision for alternative modes to and from Northern Gateway is the most important consideration from a demand and carbon reduction perspective.
- The ability to exercise restraint on parking at both the Elton Reservoir and Northern Gateway ends of the trip, together with reallocation of road space in favour of the alternatives would appear to be a critical to success. Without this, there would be little prospect of delivering the necessary switch to the alternatives.
- Particularly in the DD+ scenario, the SRN plays an important role in accommodating intermediate trips. There is a real need for the SRN to begin to provide capacity for shared transport, SAV's in the world of DD+, particularly given the potential role of Northern Gateway as an interchange.
- UZC+ does, on the face of it, appear a more likely route to the necessary demand reduction, (from a transport planning perspective, not necessarily in terms of cost, risk etc), requiring less of the heavy lifting being needed from other, more disperse parts of the transport network.
- The delivery of rail and tram projects in UZC+, and a network of local mobility and SAV services in DD+ provide an important role, but these could not be achieved without a consistent local and regional approach to policy and planning.

5.4 Bridging the Gap: Other carbon reduction factors

5.4.1 Given the potential of the DD+ master plan to deliver additional carbon savings through its conceptual place typology, how might these factors compare to the CO2 savings resulting from demand reduction? Do they create alternative arguments for pursuing DD+ place typologies, or elements of these typologies within a UZC environment? To evaluate this, it is necessary to compare the CO2 savings from demand reduction with those from other factors.

5.4.2 **Demand-led carbon reduction:** Assuming for a moment that the DD+ and UZC+ futures can meet the required level of demand reduction, this could then be equated to an annual carbon saving. The UZC+ CO2 reduction requirement is perversely lower than for DD+, not that it doesn't deliver greater potential for CO2 reduction, but that it has less need to because of its underlying better CO2 performance.

5.4.3 TfN's Northern Carbon Model (NoCarb) Development Report (November 2021) (19) estimates 26 Million Tonnes of CO2 generated by 126 Billion road vehicle kilometres across the North of England each year. In sub-urban areas 13.7 Million Tonnes of CO2 are generated by 70 Billion road vehicle kilometres. Both lead to a conclusion that carbon emissions by road vehicles in Bury can be estimated to be 0.2 Tonnes of CO2 per 1000 vkms, approximately.

5.4.4 Using this factor to calculate the CO2 per 1000 dwellings leads to the conclusion that the:

- **Digitally Distributed +** CO2 requirement could be equated to daily savings of about 4,000 Kgs of CO2 per 1000 dwellings (two way), and

- **Urban Zero Carbon +** CO2 requirement could be equated to daily savings of 2,600 Kgs of CO2 per 1000 dwellings (two way)

5.4.5 Vehicle2Community: An assessment has been made of the carbon reduction contribution that could be made through the application of the V2C (Vehicle2Community) master plan design proposal assumed as part of the DD place typology. This assessment consists of two elements:

- Carbon savings arising from the V2G (Vehicle to Grid) technology (ie the technology part of the V2C proposition). This utilises solar energy and pooled car batteries to provide energy for the development. This reduces electricity demand, particularly at peak times, and therefore carbon impacts.

- Acceleration of the transition to EV use. JAM assumes 76% zero emission vehicles by 2050, and DD assumes 95% zero emission vehicles by 2050; but the speed of transition early in the process is important. Could the prospect of reduced energy bills create an incentive for faster transition?

5.4.6 Vehicle2Grid savings: Stantec has been working with industry partners Indra* to develop the use of its V2G (Vehicle to Grid) technology in residential master plans (ie V2C). The master plan concepts assume communal parking areas for EV charging with pooled V2G technology placed within a short walk of each home. In addition, these areas become places with the potential for other community facilities. Whilst it would be possible to include V2G design concepts in UZC+, lower levels of parking being provided in buildings more remote from each home would reduce the efficiency of the system, and limit the extent to which they could become community hubs. V2C/ V2G was not therefore included as part of UZC+, thus creating two distinctly different futures.

5.4.7 Indra's assessment of the operational carbon saving when accounting for the car battery storage and solar elements, produces a carbon saving of 1.724 tonnes per annum per parking space.

*Footnote: Indra is an EV charging and smart technology business, https://www.indra.co.uk/about/

Assuming a DD+ ratio of one parking space per dwelling, this equates to around 4.700 daily tonnes per 1000 dwellings. The total energy offset is assessed to be 9.78 MWh per annum per space – as a comparison a typical four bed electrified house would consume about 7 MWh p.a., (Annexe 2). This is considered to be a high-end estimate of potential carbon savings based on an assumption that the V2G facilities are being used in an optimum way.

5.4.8 There are other potential benefits of V2C, including the reduction of carbon impacts of potable water provision and greater potential for Biodiversity Net Gain. These are discussed further in Annexe 8, but not included in this assessment.

5.4.9 Accelerating the EV Transition: The TfN Future Travel Scenarios make assumptions about the transition from fossil fuel powered vehicles to battery electric vehicles that were consistent with national policy at the time. Subsequent policy changes delay the cessation of fossil fuel powered vehicle sales, thus increasing the likelihood that the EV transition will be slower than originally contemplated*. A key objective of the V2C proposition (assumed as part of the Digitally Distributed + future) is to take a different approach to accelerate the transition from fossil fuel powered vehicles to battery electric vehicles. The V2C concept seeks to align home energy reduction and car travel - the more the EV battery is connected to the shared car parking and V2G facility, the greater the cost and carbon saving arising to home energy use – thus making battery electric vehicles a more economically attractive option.

5.4.10 Indra has undertaken research into UK driver attitudes towards energy costs and electric vehicle ownership, published in its Indra-dex Report, 2023 (21). This reveals a level of concern about transitioning to EV based on the cost of buying a vehicle, the cost of electricity, and charging speed and availability; it also suggests that this is exacerbated by misunderstanding about the comparable costs of motoring by fossil fuel and electric vehicles.

5.4.11 Indra's research was clearly instigated to explore attitudes to its V2G bi-directional charging system, so any results should be interpreted with care. However, the possibility of using a car battery to reduce the cost of motoring and home energy use met with a favourable response. Half of the respondents claimed that their vehicle was parked for at least 50% of the week, raising the possibility of significant benefit to both customer and carbon reduction objectives.

5.4.12 IPPR's assessment of the effects of EV transition suggests that there is the possibility of an increase in car use of around 11% by 2050 reflecting the lower, (and guilt free?) costs of EV motoring(22). Whilst this is at the upper end of the predicted effects of the EV revolution, there are clearly well founded risks that marginal cost and behavioural factors could worsen congestion and create greater demand for further road capacity increases. Given the benefits of leaving an EV on charge within the V2G bi-directional charging system, does this potentially provide a counterweight to this concern by creating an incentive to leave the car at home?

5.4.13 In any event, both of TfN's Digitally Distributed and Urban Zero Carbon Future Travel Scenarios have already assumed rapid transition to EVs together with ongoing efficiency improvements in the existing fleet, (both delivering 95% zero emission vehicles by 2050). Whilst V2G technology might help to accelerate EV take up within the new development, taking account of this as a net additional NZMM benefit seems to be an overly brave assumption to make, even in the context of this study. It has therefore been decided to assume that the potentially positive and negative consequences of EV transition on demand cancel each other out.

*Footnote: TfN is in the process of updating its Future Travel Scenarios to reflect changes in policy, including the delay of the cessation of fossil fuel powered vehicle sales.

5.4.14 We can see in Table 12 that the potential of designing places to support the fuel switch is potentially of more importance to carbon reduction than the demand reduction which is the focus of the NZZMs which underpin the DD+ future. This is not accruing, in this assessment, as a result of accelerating the transition to EV's, but because of the opportunity it brings to reduce other power requirements by using the V2G technology.

	Digitally Distributed +	Urban Zero Carbon +
	Carbon Savings Kgs/1000dw	Carbon Savings Kgs/1000dw
Demand Reduction (two way)	4,000	2,600
Fuel Switch (V2C)	4,700	0
Total	8,700	2,600

Table 12: Total estimated daily carbon savings for DD+ and UZC+

5.4.15 It is, of course, true that V2G technology has been developed as part of a DD+ place typology - and that it could be integrated into other versions of the future such as UZC+. The place-based characteristics of the V2G approach (ie the V2C concept) has potentially important associated benefits, including the arrangement for communal parking providing the framework for pooled parking areas co-located with local mobility services provision.

5.4.16 There are challenges that would need to be overcome if the V2G technology was to be implemented across the wider urban conurbation (other than at the individual property level), suggesting that the wider benefits of V2C are more likely to form part of strategies for new development rather than at the conurbation level.

5.4.17 Despite the relatively smaller demand-led carbon savings, the impacts of investment in demand reduction measures such as either local mobility services or public transport could have wider impacts that could facilitate the adoption of a consistent local or regional strategy, thus acting as a catalyst for a wider strategy to bridge the gap across the wider conurbation.

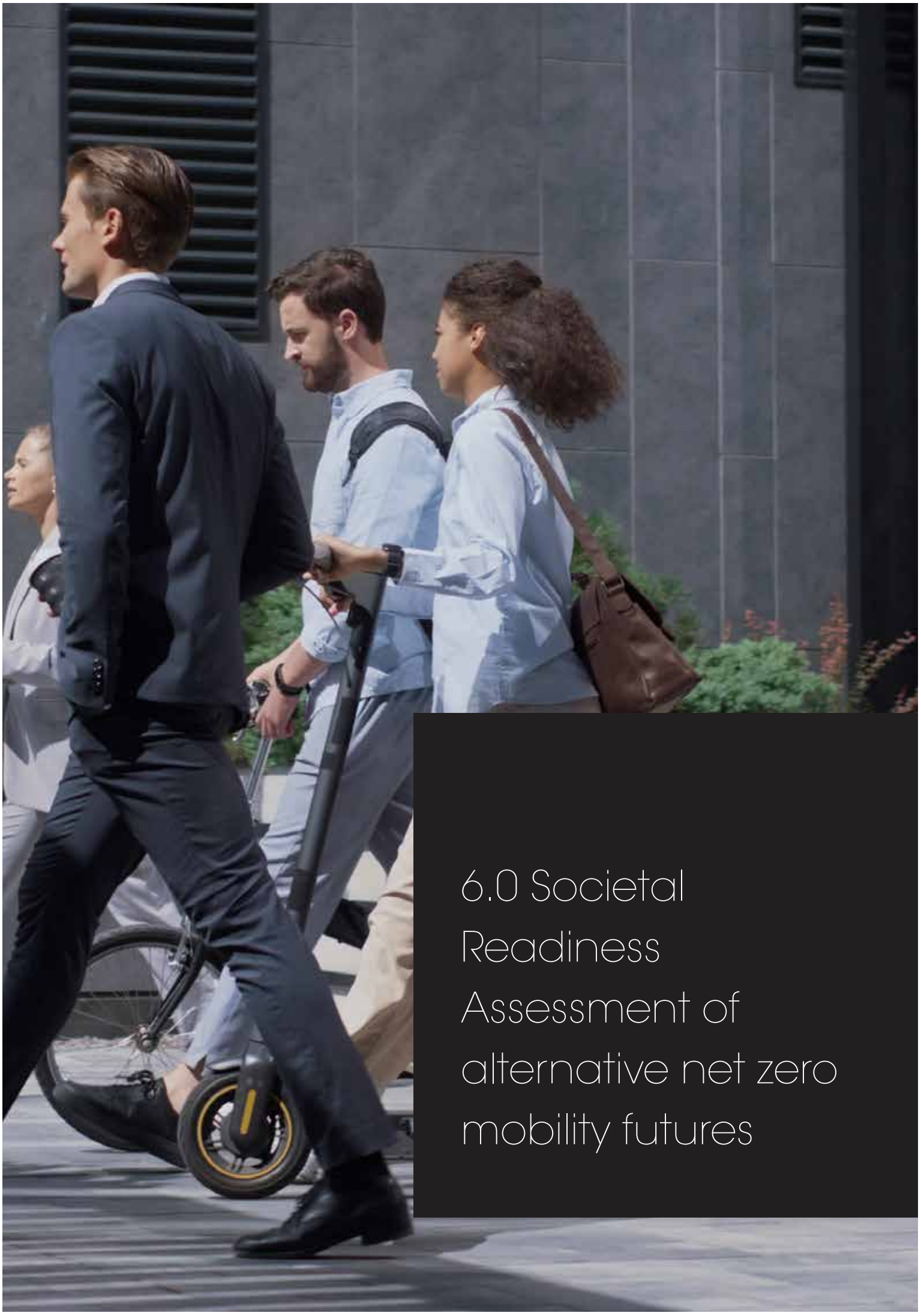
5.4.18 Embedded Carbon: One potential impact of the DD+ and UZC+ place typologies is the potential to reduce the design requirements for streets within the development, not in terms of quality, but in terms of the width and depth of streets if car traffic is not being provided for within the main development areas. An assessment of the impact on embedded carbon for two different street typologies suggests that a saving of over 50% could be made for this component of the plan (Table 13).

Street Typology 1 Embodied Carbon (tCO2e/m3) (Standard Street)	Street Typology 2 Embodied Carbon (tCO2e/m3) (V2C Street)
0.44	0.19

Table 13: Embedded carbon for alternative on site street typologies

5.4.19 The more significant consideration of a demand reduction strategy should be that there would be no justification for additional highway capacity on the local highway network to be provided, other than to provide for access requirements. Depending on the local circumstances, there could be significant savings from reduced provision of infrastructure – for cars, and for energy provision (in the context of V2C).

5.4.20 This has not been assessed in any detail for the DD+ and UZC+ development masterplans, but the significance of this goes beyond the carbon savings and opens up the possibility of reducing costs for infrastructure, and creating greater potential for supporting the delivery of alternative transport services. However, this would not necessarily be a simple swap of roads for public transport infrastructure, because many of the important elements of the UZC+ and DD+ futures relate to service provision, which brings added complications. Further consideration of these issues is picked up as part of the development of a shared vision in Section 7.0.



6.0 Societal Readiness Assessment of alternative net zero mobility futures

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6.1 Introduction

6.1.1 Inger Andersen, Executive Director of the United Nations Environment Programme (UNEP) introduces the 2022 UNEP Emissions Gap Report with the stark warning that:

> Existing policies point to a 2.8°C increase, highlighting a gap between national commitments and the efforts to enact those commitments. … To get on track to limiting global warming to 1.5°C, we would need to cut 45 per cent off current greenhouse gas emissions by 2030. For 2°C, we would need to cut 30 per cent. A stepwise approach is no longer an option. We need system-wide transformation. (UNEP, 2022)

6.1.2 Transforming mobility systems is particularly difficult because mobility matters immensely to people; it provides access to education, social relationships, social mobility, a sense of well-being, autonomy and choice. The BTG futures address the scale and urgency of changes needed for a net-zero mobility system, but they also assume significant social change. How ready are we for such change?

6.1.3 The 'we' is problematic, but appropriate in this context. It hides huge diversity and inequalities. Those least responsible, locally and globally, often suffer the most from the consequences of climate change. Studies find that poverty, disability and car dependence are correlated. The zero-carbon calculator shows a complex tapestry of how socio-economic status and carbon emissions are linked, with affluent areas more likely to have high emissions, (Figure 34).

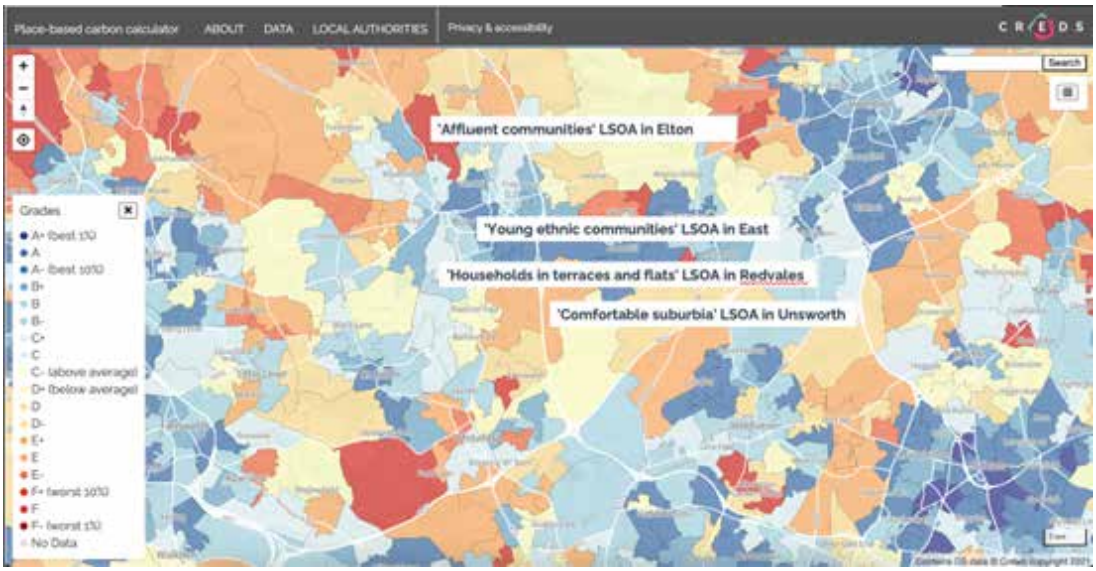


Figure 34: Carbon emissions mapped onto Lower Super Output Area (LSOA) in England

6.1.4 However, like racism and misogyny, climate change and environmental destruction 'are not only bad for some of us, they are bad for all of us' (Halberstam in (Harney and Moten, 2013)). Hence, 'we must all change things' (ibid) to safeguard humanity, both as a species and as a value, with careful responsiveness to diversity and inequalities. To account for these conflicts and disparities, mitigation and adaptation needs to be devised with a place-based approach and multi-scalar attention to climate justice. This can translate into complex challenges.

6.1.5 A key difficulty is that societal readiness is all too often construed as a public deficit. Society could deliver 40–70% of low carbon transformation through demand reduction and behaviour change (IPCC 2022), but people are said to be 'not ready' for this. Conspiracy theories about 'climate-lockdowns' and vociferous protests against 15 minute city plans in the UK in 2023 may be the tip of an iceberg of public inertia.

6.1.6 However, suppressing dissent or 'blaming' citizens for ignorant or irrational positions, or reducing them to consumers who are making 'the wrong' choices' does not resolve tensions. Indeed, it can be misleading and counter-productive to promote discourses of delay, or perhaps be in the interests of those who have an interest in maintaining business as usual (Shove, 2010; Swyngedouw, 2015; Willis et al., 2022). We argue that it is too simplistic to expect societal readiness only from individuals and groups. It is important to understand why people are reluctant, or unable, to change and to also consider how ready innovations are for people to accept them into their everyday lives, and how good they are for society.

6.1.7 For example, reflecting on the BTG 'Urban Zero Carbon±' scenario, a working parent of three children attending different schools as well as after school sports activities described how, with her current living and working arrangements, the UZC+ active travel and shared/public transport options would not offer safe, reliable, and secure travel. Much more would have to change to make it viable, including changes to residential and other arrangements that are often linked to socio-economic status, such as choice of type of dwelling, neighbourhood, schools, and after-school activities. Such changes are hard to imagine and incentivise.

6.1.8 These are factors that influence how society views their ability or willingness to change. In turn, these are factors that affect how politicians or the market views their willingness to drive the change needed to deliver net zero mobility. If a politician sees that his electorate is reluctant to move away from car dependence, then they are unlikely to support the policies needed to deliver this. Witness government proposals to review 'anti-motorist' policies on the basis that they fail to take account of how 'families live their lives' (Daily Telegraph, 29 July 2023). Was this in response to concerns raised about London's ULEZ during the Uxbridge by-election?

6.1.9 Many developers hold the view that they have similar constraints. They are listening to their market in a similar way to the way a politician is listening to its electorate. No matter how keen they may be to support a more climate active approach or demonstrate their ESG credentials, lack of attention to the market can be commercially fatal for them.

6.1.10 As we are finding out, progress towards meaningful transport decarbonisation has been painfully slow. Some would suggest that the journey began with PPG 13: Transport. Published in 1997, it set its objectives as being:

"to integrate planning and transport at the national, regional, strategic and local level and to promote more sustainable transport choices both for carrying people and for moving freight."

6.1.11 Political support and market drive are essential if we are going to accelerate decarbonisation generally, and more specifically in relation to transport, but unless we address the societal readiness of the land use and transport changes that are needed to deliver reduced use of the car and accelerate the move towards lower carbon travel choices, we will continue to be frustrated about the slow pace of change.

6.1.12 Increasing people's motivation for change in a fair way is tightly coupled with increasing their capacity and desire for change. In the words of Lorrainne Smyth, Zero Carbon Cumbria Partnership, an experienced UK community engagement leader, social change harbours 'opportunity for massive impact', but requires 'complex conversations, [where] societal readiness is about both society to be ready to integrate innovation and innovations to be ready (and good!) for society and the climate'.

6.1.13 In response to this complex challenge, we have developed a Societal Readiness Assessment (SoRA) framework to enable reflexive formative evaluation of the societal readiness of decarbonising transport innovations.

The term 'innovation' captures a wide range of discrete innovations and systemic approaches, including technical, social, policy, design and creative innovations designed to reduce carbon emissions from transport, such as autonomous vehicles, walking bus schemes, land-use policies and masterplans, and systemic combinations. SoRA enables consideration of societal readiness across these (Figure 35).

6.1.14 To develop and incorporate SoRA into the BTG project, we carried out a pilot workshop. The aim was to test the SoRA process in the context of a vision-led planning process. Would SoRA provide a way of engaging society about complex and controversial issues in a way that would contribute to a better shared understanding of the issues, and constructive feedback that would enable more deliverable future to be developed.

Figure 35: SoRA enables assessment of discrete and systemic innovations.

Figure 36: The four areas of SoRA assessment

6.2 Societal Readiness Assessment - Overview

6.2.1 Many zero-carbon innovations are not ready for society, even if they score well in terms of Market or Technology Readiness Assessment (MRA/TRA), because many zero-carbon policies, technologies, business models, products, and services are too difficult to implement as part of everyday life, they have unanticipated consequences, and they fail to deliver sufficient carbon savings. Societal Readiness Assessment (SoRA) is designed to support innovation in decarbonising transport through an iterative process of societal readiness assessment (Buscher et al 2023). Assessment explores four key areas (Figure 36).

6.2.2 SoRA is an iterative process designed to provide formative evaluation and facilitate inclusion and constructive dissent through a set of methods/tools and resources. A general overview of the journey is summarised in Figure 37 and supported by an online portal. This is under construction, a prototype is available at https://www.isitethical.org/. Screenshots presented in this report are from a new prototype that will be released in September 2023.

6.2.3 Local Authorities may, for example, invite suppliers of decarbonising innovations to conduct a self-assessment of the Societal Readiness Level (SRL) of their innovation, as well as carrying out their own assessment. For each party, this would lead into a Summary Assessment (Figure 38) and a set of recommended activities to develop (understanding of) the societal readiness of the innovation through 'Deeper Dive questions', or activities like Stakeholder or Value Mapping, or consideration of equality, diversity, and inclusion.

6.2.4 A Stakeholder Reference Group may be formed to assist in co-design. This may also involve a wider and more open group of stakeholders. Different parties who have conducted SRL assessments from their perspectives are supported in a dialogue that actively invites dissent to be voiced through tools and activities that foster responsive, productive, and imaginative exchange.

6.2.5 This provides a framework for reflexive, constructive, creative dialogue and co-design to increase the societal readiness of innovations and thereby expand people's capacity and desire to change their practices and choices. Journeys through the SoRA process differ and should be adapted to local contexts.

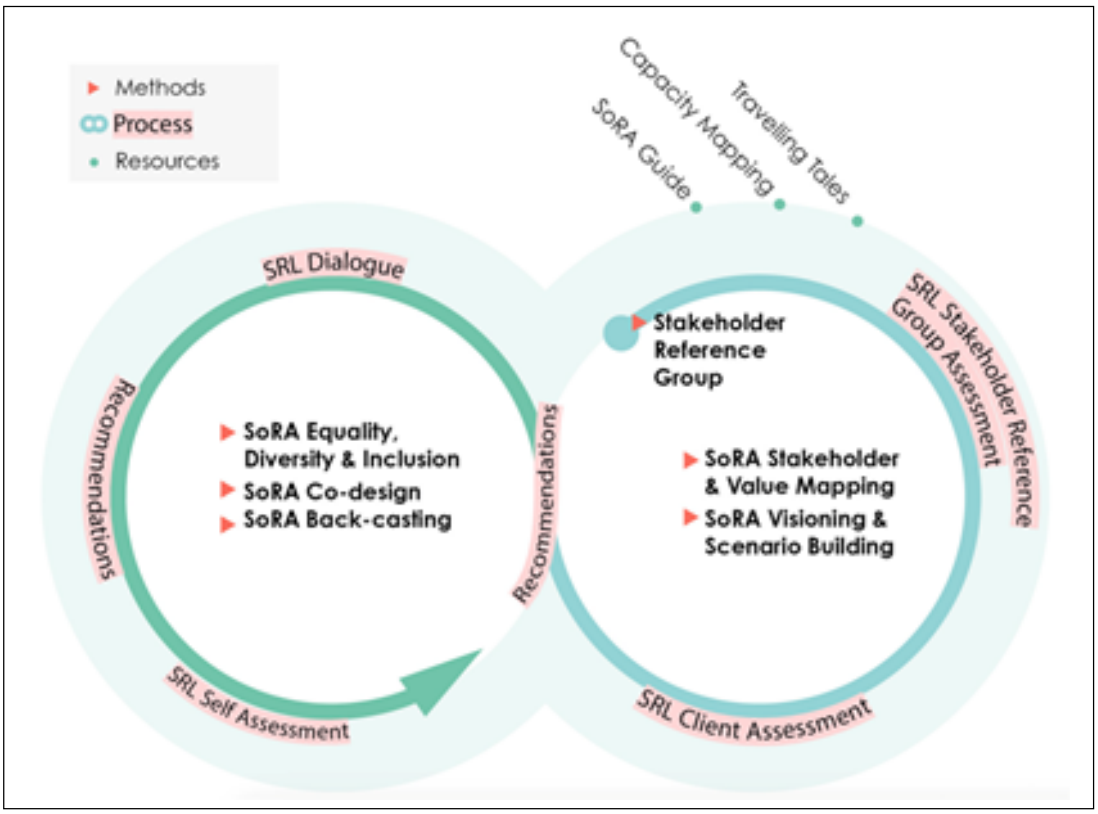


Figure 37: SoRA process, methods, and resources

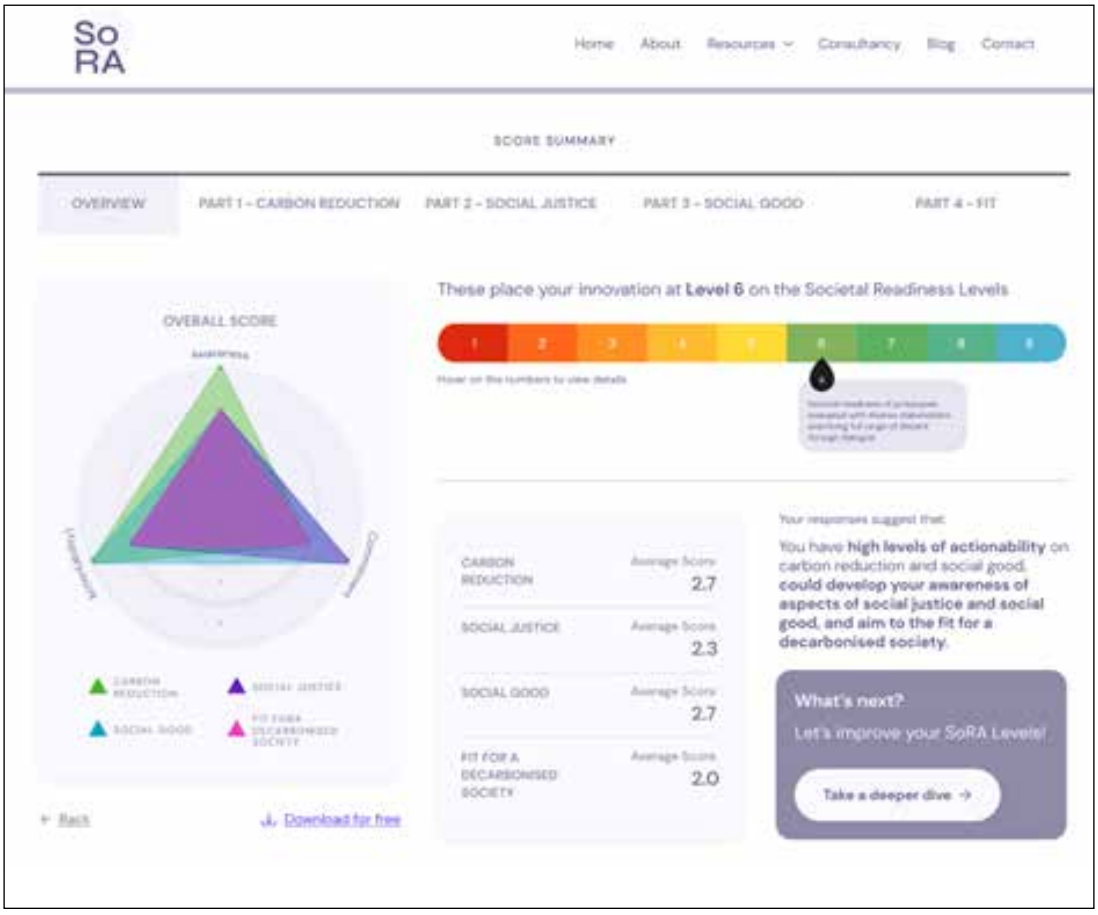


Figure 38: A screenshot of a SoRA Summary from the online portal

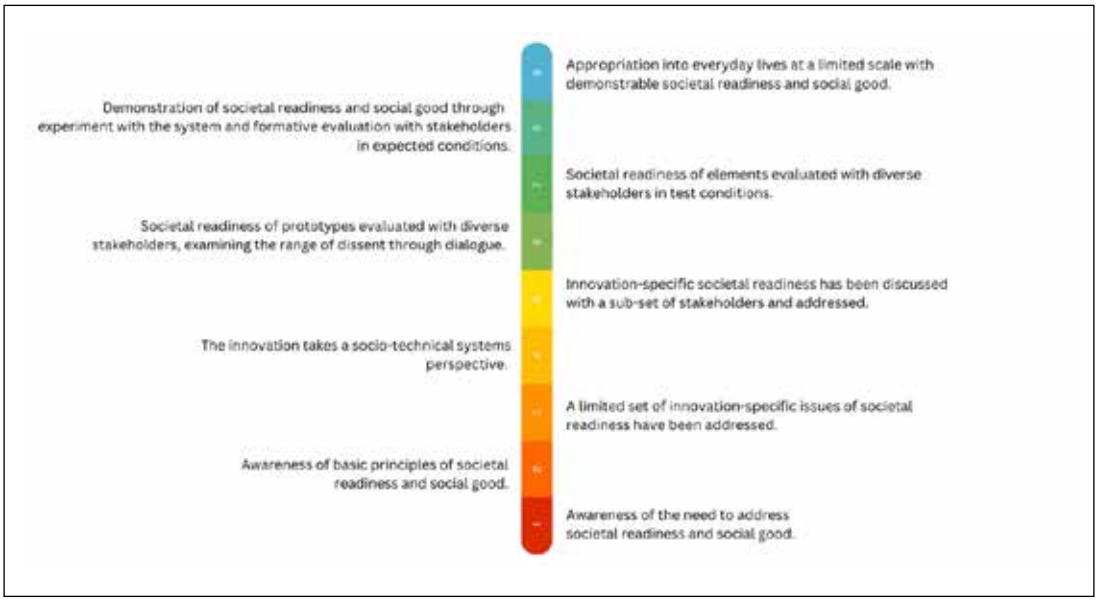


Figure 39: Societal Readiness Levels

6.2.6 Designed to complement Technology Readiness Levels (TRL), SoRA includes a process of gauging 'Societal Readiness Levels' (SRL,) (Figure 39). However, Societal Readiness Assessment provides a means of developing societal readiness in a reflexive iterative and collaborative process, and measurement of SRL should not be separated from the reflective and dialogic process, because this would reduce the process to a meaningless tick-box exercise.

6.2.7 Since the publication of the Department for Transport's 'Decarbonising Transport' strategy, research has been published suggesting that current plans will fall short of the UK's legally binding carbon reduction targets and that greater emphasis will be needed on changing patterns of demand if this gap is to be bridged (Marsden and Anable 2021).

6.2.8 The Bridging the Gap (BTG) project has developed alternative futures to illustrate how planning and design of places and infrastructure can accelerate the transition to a net zero mobility future. The BTG futures are based on careful, and importantly, systemic analysis that explores how the gap between necessary, committed and prospective actual carbon reductions could be bridged. Design-led research has produced detailed place-based futures that are calibrated to local demographics and constraints. However, the question of how ready society is to accept the solutions woven together in these visions is a source of great uncertainty and risk. It is also a potential source of inspiration and creativity.

6.2.9 SoRA requires us to turn the question around, and to ask how ready and good these futures are for society. This provides a unique opportunity to increase the ambition and fit of the designs envisaged. SoRA has been integrated into the BTG design process from the start to provide the opportunity for society to challenge the professionally developed view of what is needed, and thus to move towards a shared vision which can more readily be used to guide our emerging vison-led planning process.

6.2.10 In the next sections, we describe the pilot workshop, analyse results and present an assessment by the BtG SoRA team. Further details, notes from the workshop and suggestions of future work can be found in Annexe 10.

6.3 The BTG SoRA Pilot Workshop

6.3.1 A three hour pilot workshop was designed to introduce the Stantec team, members of Bury Council, and a small selection of stakeholders to the idea and practical process of SoRA by facilitating a first exploratory formative evaluation of three alternative futures 'Just About Managing' (JAM), 'Digitally Distributed +' (DD+) and 'Urban Zero Carbon +' (UZC+). As a result of local constraints associated with the formal planning process, it was accepted from the outset that it would not be possible to conduct a full presentation or evaluation of the complexity, or to engage a representative group of stakeholders.

6.3.2 The programme (Annexe 9.1) combined discussion and creative modelling/mapping of existing mobility experiences for people living, working, or visiting Bury, and visions for land use and mobility futures. The latter included a short presentation of the three scenarios - JAM, DD+ and UCZ+ by members of the Stantec team. Two groups of Bury Council Officers and stakeholder participants then discussed DD and UCZ respectively, aiming to score the 'Societal Readiness Level' of each.

Plate 1: SoRA Pilot Workshop: explaining the SoRA process

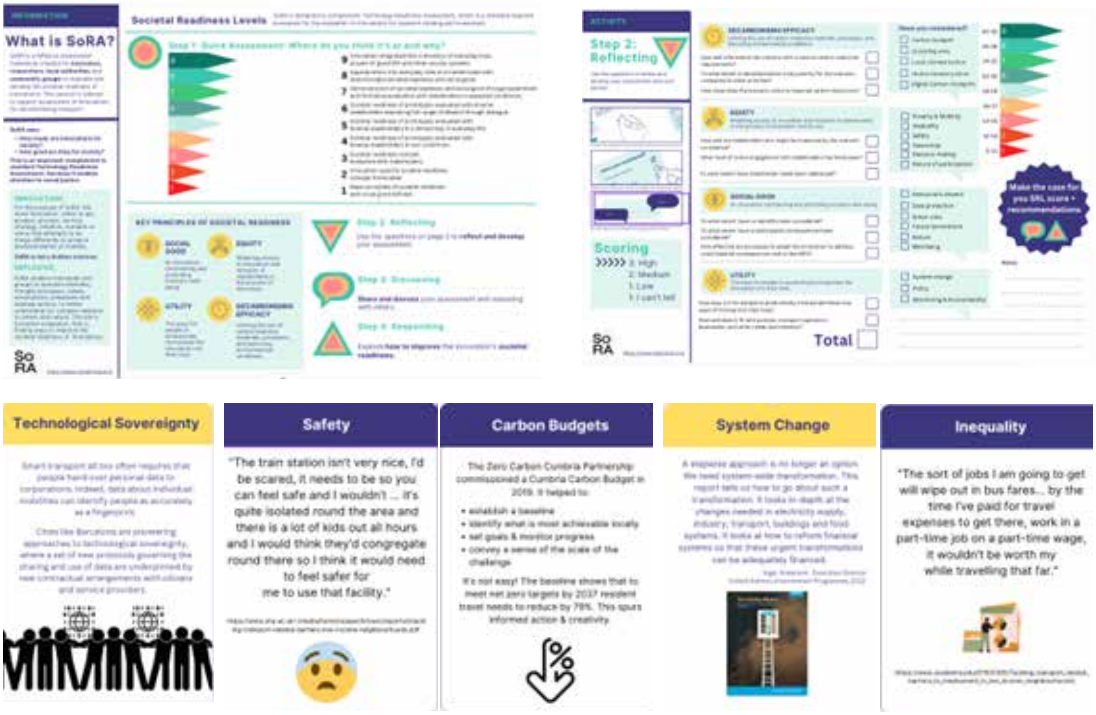


Figure 40: a selection of visual materials used in the SoRA pilot

6.3.3 A variety of visual and creative materials were used, including two worksheets. In addition, a set of yellow 'Key Value' and purple 'Travelling Tales' cards was prepared, but in the end not used at the workshop (a selection is shown in Figure 40).

6.3.4 Initial Insights from the Pilot Workshop: Despite its short and intense nature, the workshop produced rich insights into the complexities of developing equitable and positive systemic change. Here we selectively list some of the significant issues arising in the discussions that we consider particularly significant.

- **The lack of societal readiness NOW -** Workshop attendees gave many examples of how the current mobility system fails to support sustainable travel practices for many. Typically, low-carbon travel support, whilst it exists, is ill-suited to requirements: e.g. the local bus service was described as "awful" - buses run but infrequently, the routes are convoluted; shared bicycle schemes exist but the geographical confines of the scheme don't permit travel to and from work (if travelling from Manchester to Bury, for example); there is lack of provision for cyclists in terms of safe routes and safe and weatherproof storage. Furthermore, whilst acknowledging that cars dominate the roads in a manner that is undesirable, many feel they are dependent on car travel as it is often more comfortable, reliable, efficient, and versatile than present alternative modes of travel.

- **Behaviour change -** There was much discussion about what might be done to 'make people change', and ideas were put forward about measures that could be imposed to encourage shifts in behaviour (e.g. the removal of bus stops to stimulate increased active travel). Others suggested that a 'sharing economy' mindset just had to be communicated and learnt; everyone would love it if only they would try it, and it would be good for all. This 'public deficit' line of reasoning is evidently part of both common sense and expert thinking, but it is blind to the power of systemic lock-ins that constrain behaviour, everyday discourse and social practices. It is closely aligned with 'American Dream' ideologies that suggest that individual well-being and growth is a matter of individual effort and choice. It is a powerful narrative, but it diverts attention from structural

exclusion and inequality, the power of vested interests to shape mobility systems and of material design to influence outcomes. Examples such as fossil fuel and automobility industries lobbying to sustain their markets, roads generating more traffic, traditional housing models sustaining car dependence lifestyles, all serve to advertently or inadvertently facilitate misinformation and discourses of delay. Many participants mentioned these contradictions in the 'behaviour change' narrative, and reflected that our political systems are unsuited to the kind of discourse needed to address such complex and controversial issues.

- **Informing and inspiring investors and developers -** the power of investors and developers was seen as a barrier to change - what does it take to change their business models? This is a complex question, with no easy answers. Investors and developers of land use and transport projects are likely to enjoy increased returns and greater uptake if their products and services are inclusive and accessible, but they have many reasons to focus on the affluent customer and establish services that aim to serve that market rather than provide advantage, for example, the less affluent. Access to an EV for example is not a universally accessible ambition for everyone, nor are detached homes with EV power sockets with an off street parking space. Without investment in more affordable mobility services, this leaves many unwilling or unable to participate in the carbon transition. It is important to note that inclusivity and accessibility are not axiomatic tick-box concepts - they are relational and mean different things to different people at different times and in different places - therefore, there is a need for iterative engagement with all stakeholders - and a need to understand their values, needs, and practices.

- **Trust, Safety and Security -** Trust was a major issue cutting across many different dimensions, from trust in government to trust in services, business and in other people. Many participants also raised that they felt unsafe when using a bike. Some questioned why priority appeared to be given to car users rather than cycle users given the benefits of promoting more active travel. Policy changes such as "All new A and B roads should have a cycle lane" were explored. Trust and safety were also raised in the context of personal security, for example on shared forms of transport. There was clearly a feeling that these issues create a significant barrier to behaviour change, and that both trust and safety issues could be addressed through alternative delivery models.

- **Shared ownership** was seen as appealing (enabling trust, enhancing social good and providing access to things that might otherwise be financially inaccessible, such as an e-car) but not always practical, particularly due to concerns regarding safety (e.g. sharing a car journey with a stranger), availability (vehicles in use when required, unsuitable timings and routes), and trust: "How will you build trust into the contract?". A workshop participant suggested that in order to be viable and attractive to Bury residents, car sharing schemes would need to be "backed by local stakeholders/ambassadors, not a private external firm". Furthermore, in order to be successful, sharing schemes and sharing economy "Would require a massive communications strategy and mindset change to reduce antisocial behaviour".

- **Commoning & Sharing Economy -** There was discussion about commons e.g: community greens in Prestwich currently work as cooperatives, funded by residents. This highlights the scope for community-led and operated, grassroots initiatives (such as mobility hubs or mobility libraries) that are supported by larger bodies, such as councils, and corporations. Support doesn't have to be exclusively financial; time, skills, and facilities can be offered. Financial support may take the form of grants, subsidies, and matched funding to allow community-led, collaborative governance.

Plate 2: SoRA Pilot Workshop - assessing the readiness of DD+

- **Opposition, Dissent and Unintended Consequences -** A 15 min neighbourhood plan was abandoned in Heaton Park because of wide community opposition. One view expressed was that 'If everything one needed was in the area, people may become insular as they don't need to travel elsewhere for anything.' Despite coercion clearly not being part of the proposal, is there a 'social engineering' perception barrier to land use change as part of the solution?

6.3.5 Evaluation of Pilot Workshop: After the workshop, workshop participants were sent an evaluation questionnaire, (Annexe 9.2). Acknowledging that this was a pilot 'taster' workshop, initial 'hotwash' reflections by the SoRA and design team highlighted a range of opportunities for improvement of the SoRA process. Annexe 9.3 details the SoRA teams reflections on the pilot workshop, and notes shared between the teams are included as Annexe 9.4. Some of the issues raised related to how the workshop was organised and delivered. Others related to the usefulness of the SoRA process for the specific challenge of assessing the Societal Readiness of complex land use and transport futures. These are the issues we focus on here.

6.3.6 The concept of 'societal readiness' is easily misunderstood. There was lots of discussion about 'how to get people ready'. Some of the group were very keen on imposing measures that would encourage behaviour change e.g. removing bus stops to increase walking. Others suggested that a 'sharing economy' mindset just had to be learnt, everyone would be likely to love it if only they were forced to do it, and it would be good for all. There was little consideration of the systemic lock-ins that railroad behaviour and how these might be unpicked. The fact that SoRA actually turns the table to ask how ready innovations are for people who are locked into systems needs more introduction and guidance.

6.3.7 It was proved beyond doubt how difficult it is to do a SoRA on multiple complex alternative futures, each one consisting of quite radically different, unfamiliar and interdependent concepts. The team used maps and diagrams to help with interpretation, as well as providing a range of other creative materials. These proved quite difficult for people to engage with. Not only are the futures conceptually very hard to grasp in a short space of time, it is further complicated by how different people might view individual elements of the future very differently e.g. one person might think e-scooters are very societally-ready but have a low opinion of autonomous delivery robots, for example, making it hard to balance

across all the various integrated elements of the future.

6.3.8 Brief discussion took place about whether or not it would have been helpful to have more detail in the futures presented. Someone said they felt SoRA would work "quite well" for existing innovations but that it was hard to use in relation to a made-up world. It might be helpful in future sessions to give people an example or a demo of how they might think through a scenario. It felt like a lot for people to take on board and process in a short space of time.

6.3.9 Conversations about the alternative futures led to conversations about place-specific politics, and comments were often couched within thoughts about what might work in Manchester (being 'very Labour') and what might work in Bury (being more politically precarious). This influenced the interpretation of the scenarios as people placed a political interpretation alongside the social readiness considerations. SoRA should be able to enable a more constructive, less helpless way of dealing with these challenges.

6.3.10 Some people found it very hard to score using the scale definitions, partly because of the potential for different levels of societal readiness applying to different parts of each future, but also because the scenarios were hypothetical and involved many unknowns. Some people chose to fill in the blanks by creating an imaginary story about 'how the overall future might work as an integrated whole', but others found it harder to speculate. It was also suggested that a SoRA should be undertaken on SoRA as they found the wording of the SoRA scale too difficult to easily understand. Changing this is already in hand!

6.3.8 What could have been better: How can the use of SoRA techniques add greater value to the assessment of alternative land use and transport futures?

- **Avoid a 'public deficit' approach -** Common sense ideas about societal readiness naturally assume that society has to make itself more ready to accept the 'solutions' that experts propose are ready to fix the problem. Our version of SoRA actually turns the table to ask how ready innovations are for people who are locked into systems. This is a provocative approach that capitalises on the constraints and contradictions that people discover when they try to enact or bring about behaviour change. But more time is needed to enable participants to embark on this line of reasoning in their own way. SoRA should be discovered, not imposed.

- **Facilitate an iterative and inclusive approach -** SoRA is intended to infrastructure creative, constructive dissent and collaborative design over the whole course of the innovation process, from ideation to implementation and evaluation, adaptation. The full range of stakeholders should be involved to foster inclusion, local, global and intergenerational justice. This includes geographically and temporally distant stakeholders - difficult in a pilot and in a public atmosphere of concern.

- **Limits of Imagination -** All participants' imagination is limited by what they know - while Bury residents know much about the practicalities of their everyday lives, they know less about the potential of discrete and systemic innovations, similarly, while the Stantec team and Bury Council Officers know much about decarbonising transport innovations, they know less about the lived practices of residents. Actually no-one can know how systemic futures will form, and SoRA could be an instrument to shape them responsibly. It implies that knowledge exchange has to be an integral part of the process, without taking an educational approach where experts tell people what to think or give them 'the science'. Exchange has to be dialogical.

• **Limits of Concern -** many participants rated the DD scenario quite highly, assuming that the technologies will work and disregarding dangers of surveillance capitalism. This may have been a feature of the kinds of participants, but it also suggests that media discourse about 'solutions' is promoting a partial picture. Knowledge exchange and collaborative learning is required, avoiding a public deficit approach.

• **Beyond Comparison -** SoRA is a mobile method that can be applied in different contexts at different times but that doesn't mean the findings (e.g. SRL scores and comments made by workshop participants) are transposable. As an example, it may be the case that a Societal Readiness Assessment in Town A scores an e-scooter scheme quite highly. This does not mean that the e-scooter scheme 'has' high SRL across different contexts. SoRA emphasises the need for place-based engagement and assessment. Town B, with a different infrastructure, different demographic, different terrain, etc. may assign a low score the same e-scooter scheme. SRL are an invitation for ongoing formative evaluation, creative design and appropriation.

6.3.12 Delivering benefit from SoRA - SoRA aims to unlock benefits for the process of innovation and visioning. Did the pilot provide insights into how this can be done?

• **Can SoRA stretch the imagination,** widen the envelope of creative thinking, inspire socio-technical innovation? Whilst we can see how SoRA might work to achieve this, it will need a more deliberative approach to introducing each of the futures, and how each part of the land use and transport systems they consist of could be used in people's daily lives.

• **Can SoRA be used to facilitate productive engagement** with a full range of stakeholders throughout the lifespan of the project, embracing dissent. Whilst this was not possible in terms of the pilot, the level of engagement achieved illustrated that avoiding a public deficit approach could be successful in avoiding destructive confrontation. Asking 'what would this future need to be like to meet your needs' offers more opportunity for a constructive response than other forms of engagement.

• **Could the SoRA process begin earlier in the development of alternative futures?** Each of the scenarios was first developed to meet the requirement of demand/ carbon reduction. Each of the DD and UZC futures represented a different view of the world, neither likely to represent a future reality. Future development of the scenarios capable of being embraced by future communities will need to take account of stakeholder views about the sort of future they are able or willing to embrace.

• **Can SoRA embed climate and intergenerational justice, enhance dignity and health, liberty and enfranchisement, social inclusion?** The pilot has identified how these issues can be considered as part of a planning process, and importantly how dissent can be successfully managed.

• **Can SoRA be used to heighten the ambition of procurers, designers, investors, developers, etc. to make innovations societally ready in the four dimensions of SoRA (carbon reduction, social justice, social good, fit for a decarbonised future)?** Future stages of this work aim to address this as a key step in the process of creating the conditions for change.

6.4 The BTG Futures - Societal Readiness Levels & Observations

6.4.1 Despite the difficulties of a short pilot workshop and the challenge of explaining both BtG and SoRA, the workshop was very useful. The participants' feedback confirms the need for an iterative process of societal readiness assessment, which is what SoRA is for. At the end of the workshop, participants scored the two scenarios as ranging between SRL 2 (as described) and SRL 6 (with adjustments discussed) (Figure 41).

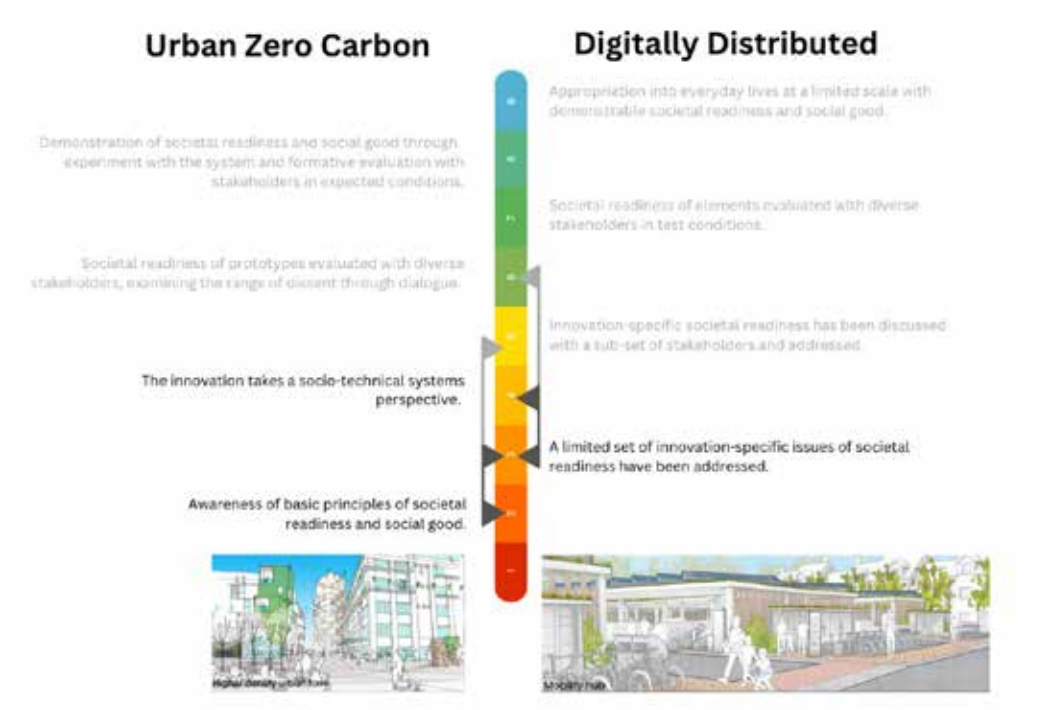


Figure 41 Participants' SRL scores for UZC+ and DD+ scenarios

6.4.2 Reflections from the design team following the workshop suggested that the alternative futures discussed 'were rightly judged to be miles short of being societally ready', whilst the SoRA team considered these scores to be a good start considering the level of complexity and available time! However, as each of the alternative futures considered were deliberately seeking to represent quite different and idealised ways of meeting net zero mobility objectives, the inevitable consequence was that more development would be needed to align them more closely with societal needs.

6.4.3 The other simplistic observation of the design team was that the DD+ future appeared at first sight to provide for the existing travel needs of participants more closely, replacing personal transport options with technology driven solutions. These were judged to allow lifestyles to be less affected than by the UZC+ future, which would require a shift towards a more urban and mass transit focussed way of life. There was less focus on how the DD+ technology solutions might affect social justice or deliver social good, or the systemic changes that would be required to deliver it, so perhaps this felt more familiar than the UZC+ world.

6.4.4 To explore reasons and opportunities for improvement, the SoRA team has used the prototype SoRA Societal Readiness Levels Gauge to score the scenarios from our perspective as social science consultants and participants in the workshop. This involves responding to a set of 'indicator' questions. This assessment represents the views of the SoRA team and is limited to what we know.

6.4.5 Diverging from the workshop participants' assessment, the SoRA team scored the UZC+ scenario higher than the DD+ scenario. Table 14 presents our Summary SoRA Assessment. Annexe 9.5 explains briefly how and why JAM, DD and UCZ have been scored as indicated for each indicator question. This also leads into an outline for a plan of work, which is described in Annexe 9.6.

Societal Readiness	JAM	DD	UZC
Carbon Reduction	Levels of awareness of the carbon reduction challenge implied by 2015 Paris Agreement are low. Decarbonisation aims are balanced against other objectives, and commitment to regulation and delivery is low. .Actionability on targets is low.	Both scenarios There is a medium level of awareness commitment and actionability, with room for improvement on all three counts. Decarbonisation has been prioritised over other objectives in the design of the futures, but the innovations proposed are at low levels of development or actionability	
Social Justice	All three scenarios: Levels of awareness, commitment, and actionability on social justice are low. Stakeholder engagement comes late, the range of stakeholders considered is limited, and there are no clear mechanisms of accountability for how concerns are addressed.		
Social Good	All three scenarios: There is some awareness of co-benefits, unanticipated consequences, ethical or wider societal implications, but low levels of commitment to defined processes of exploring these aspects and low actionability in relation to them.		
Fit with a decarbonised future	Levels of awareness of potential future changes in social practices are low, there is a low level of commitment to system change and low levels of actionability on the challenge of systemic change.	There are low levels of awareness of future social practices, medium levels of commitment and actionability to address the emissions gap.	There are medium levels of awareness, commitment, and actionability in terms of systemic change.
Societal Readiness Level	2	3	4

Table 14: SoRA Summary Assessment

6.4.6 Below, we detail some of the reasoning behind these summary assessments.

- **Carbon Reduction - Maximising carbon reduction through reducing the use of carbon intensive materials & enabling low-carbon practices.** To serve society well, solutions must address the urgency and scale of the challenge posed by climate change mitigation and adaptation. There should be high levels of awareness, commitment and actionability in terms of the carbon reductions the innovation enables. At this early stage of the process it is clear that all the futures have yet to benefit from wider awareness about how decarbonisation is to be delivered. However, both DD+ and UZC+ have prioritised decarbonisation objectives over other objectives, whilst JAM balances decarbonising goals against other priorities. JAM assumes low levels of policy and regulation to drive change, whilst DD+ incentives change through service provision and UZC+ contemplates greater commitment to demand management.

- **Social Justice - Embedding consideration of equity, inclusion, and fairness, engaging a wide range of stakeholder views in the innovation's design and development.** Social justice is not a provision to be granted on the basis of exclusive analytical capacity, but an effect of democratic and participatory processes. In all three scenarios, there is recognition of the need to work with stakeholders, but efforts to engage are thus far limited and little has been done to take account of stakeholder views. Arguably, UZC+ represents a future in which government is more engaged with society, whereas DD+ sees the market leading the way. One may be more prone to a 'public deficit approach' (eg demand management) whilst the other advertently or inadvertently excluding less affluent or informed sectors of society from the decarbonisation transition, (service provision).

- **Social Good - Optimising the innovation's contribution to broader social, environmental and economic outcomes, such as democracy, transparency, accountability.** Social good implies the attainment of co-benefits in our alternative futures, for example alleviation of poverty and delivering better health outcomes through the land use and mobility choices available to the community. These considerations are not yet well developed in our futures, but unless decarbonisation is addressed robustly there is highly likely to be co-dis-benefits for all. JAM represents a world in which carbon targets are not achieved, and social good outcomes are therefore low, whereas net zero mobility is delivered in DD+ and UZC+ futures and there is a prospect of better social good outcomes. However, these are yet to be explored in any real depth and a means of delivery identified.

- **Fit with a Decarbonised Future - Ensuring the innovation resonates with social practices that lead to decarbonsiation and aligns with and contributes to relevant policies.** Without knowing what social practices will be like in 2040 and beyond, this can only be assessed on the basis of what we know now. This is question is also complicated by the gradual dilution of transport decarbonisation policy, moving away from the policies and commitments needed to meet net zero mobility goals, leading to concern that alignment with government policy may not, at this point, be a 'good thing'. Yet is can reasonably be surmised that both DD+ and UZC+ are seeking to create the conditions for rapid decarbonisation of transport systems, both potentially with drawbacks relating to how each future impacts on society in a way that has yet to be fully understood. A distinction is however made between the lighter regulation and unintended consequences of the DD+ future and the greater integration and co-ordination of the UZC+ future to create a future that fits the needs of society.

6.4.7 Overall, the SoRA team have scored the alternative futures to reflect the early stage of their development. It takes a view that UZC+ has greater potential to meet society's needs; whereas the design team, and stakeholders, seemed to take a view that DD+ might provide ways in which their existing lifestyle and mobility needs can be met, without having to change too much – without overly worrying about the potential unintended consequences. Either way, both would need intensive detailed work with stakeholders in order to better understand these issues, and develop elements of each alternative future into a vision that is capable of bridging the gap to meet society's needs.

6.4.8 One consideration that arises from this exercise is whether or not the method used to employ SoRA as part of the visioning process should place the burden of using SoRA tools on stakeholders, (as was the case during the pilot workshop), or if it might be more appropriate in the context of the planning process to place the onus on the professional team to formulate its own view on SoRA responses and levels based on stakeholder feedback during the engagement process.

6.4.9 Our post workshop reflections revealed concerns about how reliance of stakeholder views led to some misunderstanding about some important aspects of the futures being assessed, and missed important assessment criteria. The tendency for stakeholders to focus on aspects they are either familiar or enthusiastic about seemed to lead to other key issues being skipped. Our experience supports the view that stakeholders find the combination of complex futures and complex process a real challenge.

6.4.10 However, reliance on the professional team also had drawbacks. Stakeholders clearly had anxieties about adaptation to an urban lifestyle in what is hitherto a sub-urban place, yet the SoRA team's professional analysis placed greater emphasis on the potential for technological solutions to lead to concerns about surveillance and data security. With a different group of stakeholders, the balance of views might have been different, but the SoRA team sought to balance these issues with a professional understanding of the issues.

6.4.11 If SoRA is to provide a useful function as part of a vision-led process of planning and design, it will need to be accommodated in our already complex and time consuming plan making and development planning processes. Given that the pressure on delivery of transport infrastructure and housing is high, and the urgency of the carbon transition becomes yet more apparent, this will inevitably be a challenge.

6.4.12 There would therefore seem to be some merit of the professional team led approach in terms reliability and consistency of outcomes, and in terms of comprehension and speed for all those involved. However, there would need to be checks and balances to ensure that the breadth of stakeholder views had been taken into account and balanced in the outcomes.

6.5 The need for a strategic framework

6.5.1 Bridging the growing gap between local/regional/sub-national ambitions for transport and national policy is part of a complex, changing context for developing sustainable land use and transport objectives. However, the task of local planning and development teams is made almost impossible unless there is a clear national framework within which local assessment priorities can be set.

6.5.2 Changing mobilities is risky for governance actors, because mobility is an existential need and societal flashpoint (Hage, 2009). Dissensus and uncertainties affect many politicians' willingness to commit to anything but ambitious goals (Willis, 2020). For some, the gap between climate commitments and actions is the result of 'organised hypocrisy' (Egnell, 2010), while Levin et al. call it a 'policy-making tragedy' where policy-makers become trapped by short-term horizons even when the implications of doing so are catastrophic (Levin et al., 2012).

6.5.3 The pioneering 'Future Generations Act' in Wales enshrines in law a requirement for local authorities to consider the well-being of future generations in decisions. According to Jane Davidson, one of the driving forces behind this act, it is 'not about tick-box compliance in a traditional regulatory way, but a reframing of the idea of 'democracy for long-term good' by government and decision makers prepared to own the responsibility for decisions made now, by owning also their potential impact on the future – even if the full extent of the effects cannot be known' (Davidson, Jane, 2020).

6.5.4 This framework resonates with efforts established through the UK Social Value Act (2012) which articulates a model that has been applied at the local council level. It is specifically designed to support the evaluation of social values in tenders for the public sector. Themes include, among others, Fighting Climate Change, Equal Opportunity, and Wellbeing.

6.5.5 Now, something else is needed to set the strategic goals that allow or institutionally require longer term carbon reduction objectives to be placed at the forefront of planning and development. Without this, planning and design will remain in the stasis that has gripped it since the advent of sustainable transport policy in 1994. Governance has always been a matter of 'muddling through' (Lindblom, 1959; Scott, 2010), but now the pressure is on to design new ways of living (UNEP, 2022).

6.5.6 This requires consideration of the 'societal readiness' of innovations not just the readiness of the public to 'accept' so-called 'solutions' (Bernstein et al., 2022). However, systematic methods for analysing and increasing the societal readiness of low carbon innovation are missing. SoRA provides a structured approach to do this. It aims to support more creative and ambitious design and equip investors, developers and local authorities in articulating what they need to make designs more acceptable. How can this be integrated into our planning and development processes in a way that delivers more a rapid and effective transition to net zero mobility?

6.5.7 Doughnut economics(24) is a visual framework for sustainable development, (Figure 42). It is shaped like a doughnut or lifebelt – combining the concept of planetary boundaries with the complementary concept of social boundaries. The name derives from the shape of the diagram, i.e. a disc with a hole in the middle. The centre hole of the model depicts the proportion of people that lack access to life's essentials (healthcare, education, equity and so on) while the crust represents the ecological ceilings (planetary boundaries) that life depends on and must not be overshot.

6.5.8 Doughnut economics recognises that consumption is at the heart of the issue, and that there is a need to rebalance economies. It sets an aim for 'thriving economies' rather than GDP growth, and seeks to deliver a high quality standard of living globally within the means of the planet. This has begun to gain momentum, mostly at the local level, with cities like Copenhagen and Barcelona placing it at the heart of their policy making.

6.5.9 Could we think about mobility in this way? Is there a section of society which has insufficient access to life's essentials and are therefore excluded from a thriving society, and is there a limit to which mobility or travel can take place without breaching our planetary boundaries? How might this affect different sectors of society? How might this influence environmental and economic outcomes of our alternative futures? Could this help to provide a framework which can be used to shape an objectives-led vision capable of guiding development in a vision-led planning process?

6.5.10 Whilst SoRA can help to steer change through turbulent times by providing a process for iterative formative evaluation of innovations in a way that supports formative evaluation of unanticipated consequences, a shared vision needs to be developed framed by a wider range of objectives. Without this to guide the vision, planning and transport authorities often take what is perceived as a risk averse approach to the definition of planning permissions, requiring provision for highway capacity improvements in case the alternatives 'don't work', thus prioritising delays to car users above other important environmental and community objectives.

6.5.11 The next section looks at how the alternative futures, and the SoRA outcomes could help us move towards a shared, objectives-led vision.

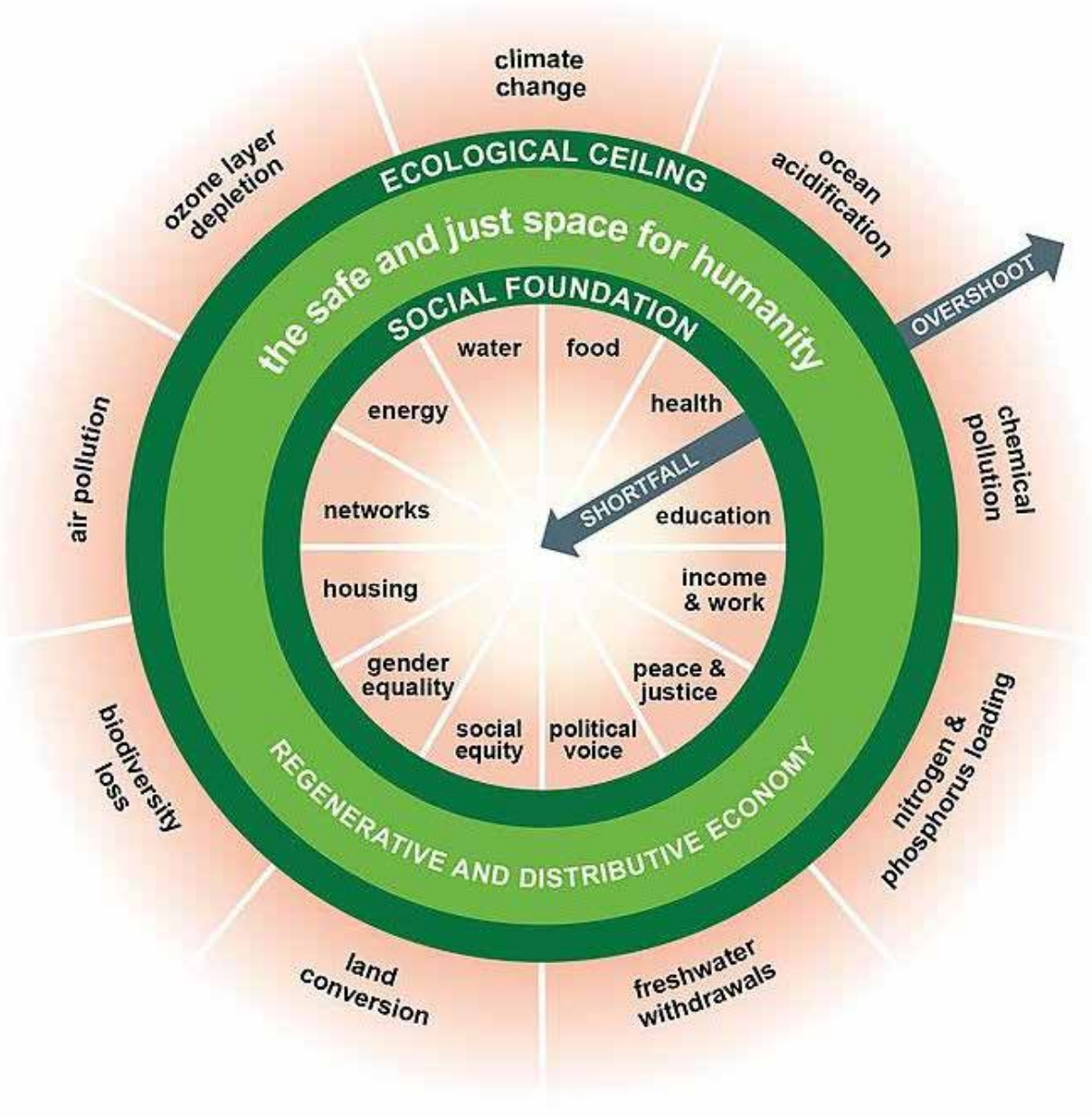
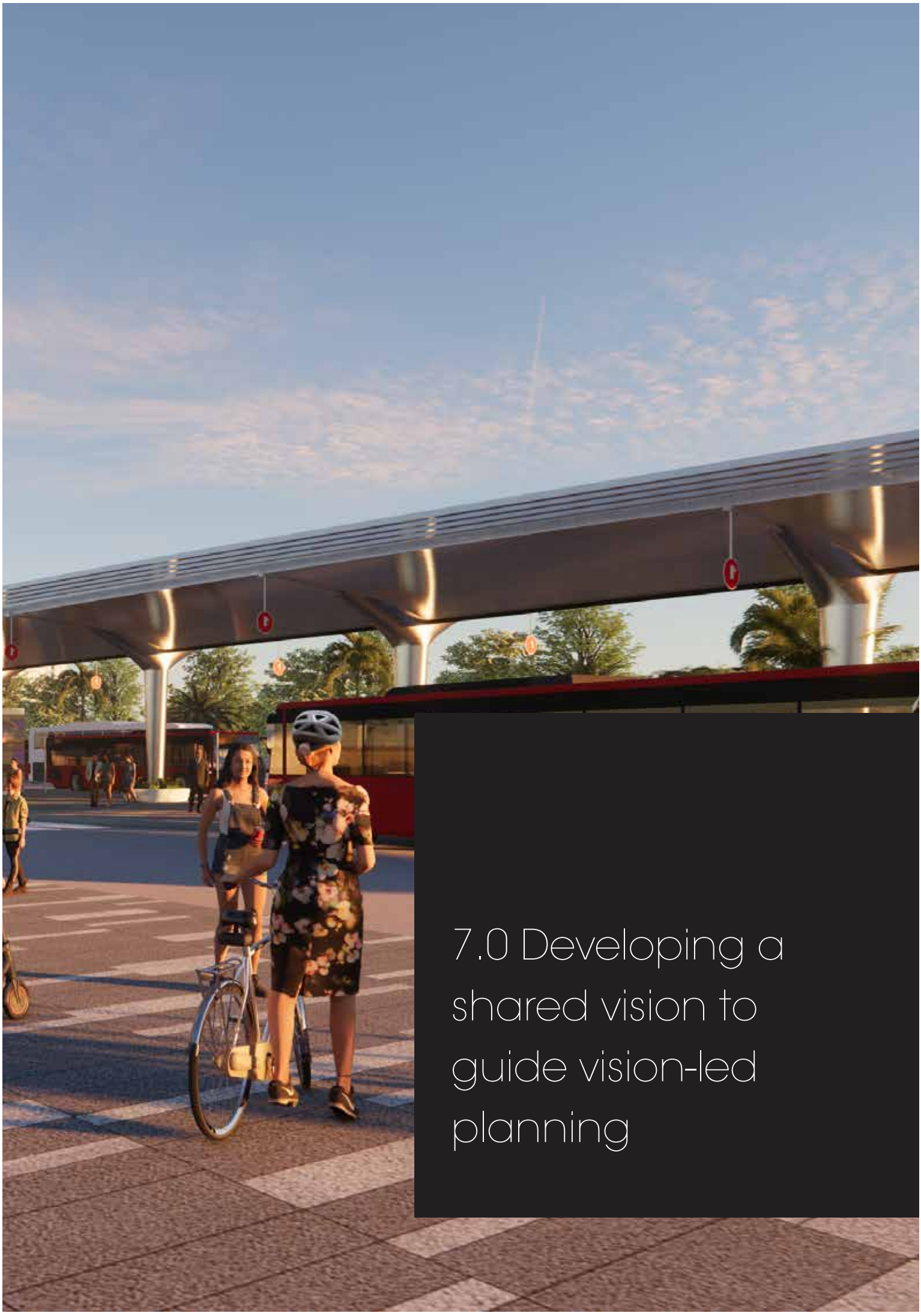


Figure 42: The Doughnut Economics framework



7.0 Developing a shared vision to guide vision-led planning

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7.1 Creating an objectives-led, shared vision capable of guiding the development planning process is something that the UK has found to be both controversial and time consuming. Yet, as we move towards a vision-led planning system, there is a need to develop our approach to these challenges, and address the existential gap between professional strategy and community need. Our pilot SoRA workshop illustrated that the gap between a technocratic approach to what is needed to meet net zero, and the creation of places that meet the needs of society, is a large one. There is a long way to go.

7.2 This study has made use of the TfN Future Travel Scenarios to develop two supercharged futures capable of meeting net zero objectives, but the SoRA workshop demonstrated that neither of these would pass the community hurdle. To do so, it is necessary to move from artificially constructed alternative futures towards a deliverable shared vision that not only meets carbon reduction requirements, but also provides a sustainable place to live, in the widest, place-based sense of this over-used word.

7.3 This will require a broader assessment of the alternative futures developed against a wider set of criteria, reflecting operational, financial, economic, delivery risk, environmental and social factors. This would help to inform the iterative development of a shared vision through a SoRA approach to engagement which would inform the planning process and provide a basis for monitoring outcomes post implementation, both at the Development Plan and development project level.

7.4 Multi-Criteria Analysis (MCA) frameworks would seem to be well suited to this task. They have been used for many years to compare alternative schemes when more than monetary objectives need to be considered. There are many formats to support decision making of many kinds, all encompassing an objectives-led approach. Unlike the development of our two radically different futures, MCA would be looking to balance judgements about the outcomes and effects of alternative elements that would combine to create a broad strategy for a deliverable future, which could be developed further through engagement with society, policy makers, developers and investors.*

7.5 Useful guidance on MCA can be found in Multi-Criteria Analysis – a manual, published by the Department of Communities and Local Government in 2009(25). It provides information about analysis techniques which do not necessarily rely on monetary objectives. It identifies the process of MCA, and notes that the identification of objectives is the important first step, 'Good decisions need clear objectives'. It goes on to state that 'Treasury Green Book distinguishes between ultimate, intermediate and immediate objectives, but it is particularly useful to distinguish between ultimate and immediate ones':

- Ultimate objectives usually being framed as strategic or higher-level variables
- Immediate objectives linked with the output of the policy, programme or project.

*Footnote: This is the approach adopted by TfN when building the Future Travel Scenarios, providing an appraisal toolkit with which to test the robustness of its plans to ensure they are reslient and support the regional vision.

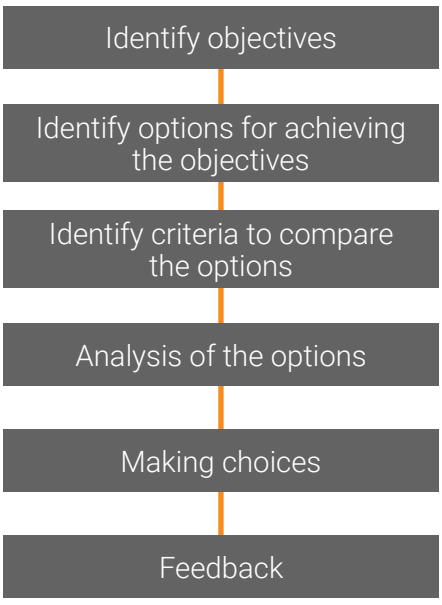


Figure 43. MCA Process(25)

7.6 As we are working at the highest level in a scheme identification process, (ie establishing the vision), it is not feasible to undertake a detailed analysis of all parts of each future as the data is not yet available to do so. Therefore, judgements need to be made based on high level objectives, rather than those that might be associated with plans or projects emerging from this process. Even so, it is important that the criteria used to make judgements against these high level objectives allow decision makers to understand the trade-offs between different elements of each future, and how this might influence the development of the vision. Taking the carbon reduction objective as being the Ultimate Objective, Intermediate Objectives will be needed to cover a range of other outcomes to help to define the co-benefits of the vision.

7.7 In setting objectives, there is an important question about whose objectives we are setting for the purpose of describing any vision. So long as the monetary or economic objectives are clearly expressed, they do not generally present analysts with the problem of making judgements about the varying interests of different groups in society. However, as we move towards Multi-Criteria Analysis and subjective judgements based on non-quantifiable criteria, so we move towards making distributional judgements about whose preferences the outcomes best represent.

7.8 This becomes an important question when considering one climate related Ultimate Objective, the attainment of which is seen as being the primary goal and therefore impacting on the ability to deliver the Intermediate (and subsequently Immediate) Objectives. It therefore raises the possibility that there will be differing impacts on different parts of society at different times depending on the nature of the vision, or the plan/ project.

7.9 This issue can be seen when considering Intermediate Objectives, and how they might embrace relevant economic, environmental and social factors. For example. the primary goal of our DD+ and UZC+ futures is to reduce demand by 20 – 30% by 2030, (ie rapidly), when compared to the TfN DD and UZC Future Travel Scenarios, or an equivalent net additional reduction in carbon as a result of the NZMMs. This doesn't require every trip to be substituted, shifted or switched. Indeed, it could be argued that, (as illustrated in Figure 34), it is the most affluent who have the greatest consumption of travel and carbon impact, and a focus on their intermediate trips might well provide the catalyst for change needed.

7.10 How might these issues be resolved through an MCA process? Can it be argued that social justice might be sacrificed on the altar of carbon reduction for one part of a strategy if it creates a route to a future that can more readily, and rapidly be fit for a decarbonised world? For example, even if EVs are imperfect and accessible only by the better off in society, does this mean that a strategy that places EVs at its heart is intrinsically unacceptable. If carbon reduction is paramount, then perhaps the end is worth the means? Community engagement must surely be an essential component of this process, with Societal Readiness providing a means of managing the potential for conflict.

7.11 Based on the work undertaken in developing the two net zero mobility futures the Intermediate Objectives might be:

- The vision needs to be capable of being delivered as part of an economically sustainable future ie working within the environmental limits of our planet - even if this requires systemic changes of current planning or project orthodoxy to achieve it.
- Together with other elements of our future, the vision should meet the needs of society and avoid exclusion or harm - even if the route to net zero affects different sectors of society at different times.
- The vision should seek to reduce impacts on local communities from the environmental effects of infrastructure and services, and contribute to biodiversity net gain objectives.

7.12 MCA judgements would usually be facilitated using a performance matrix which describes performance of the option being considered against the objectives using a range of pre-determined criteria. However, we are now in a vision and validate environment, and the ability of each future to meet these objectives will not be just a matter of the design of each future, but will also be conditional on the process of implementation over time through a manage and monitor process. This process has to understand and respond to the delivery risks associated with the emerging vision. As a result, the vision should include measures that are effective agents of demand and/or carbon reduction which can be delivered as soon as possible, taking account of:

- Technology Risk
- The ability of the plan making and planning process to accommodate them.
- The ability of Government/ the market to deliver development and infrastructure.

7.13 The process of developing a shared, objectives vision might therefore be described by the diagram in Figure 44.

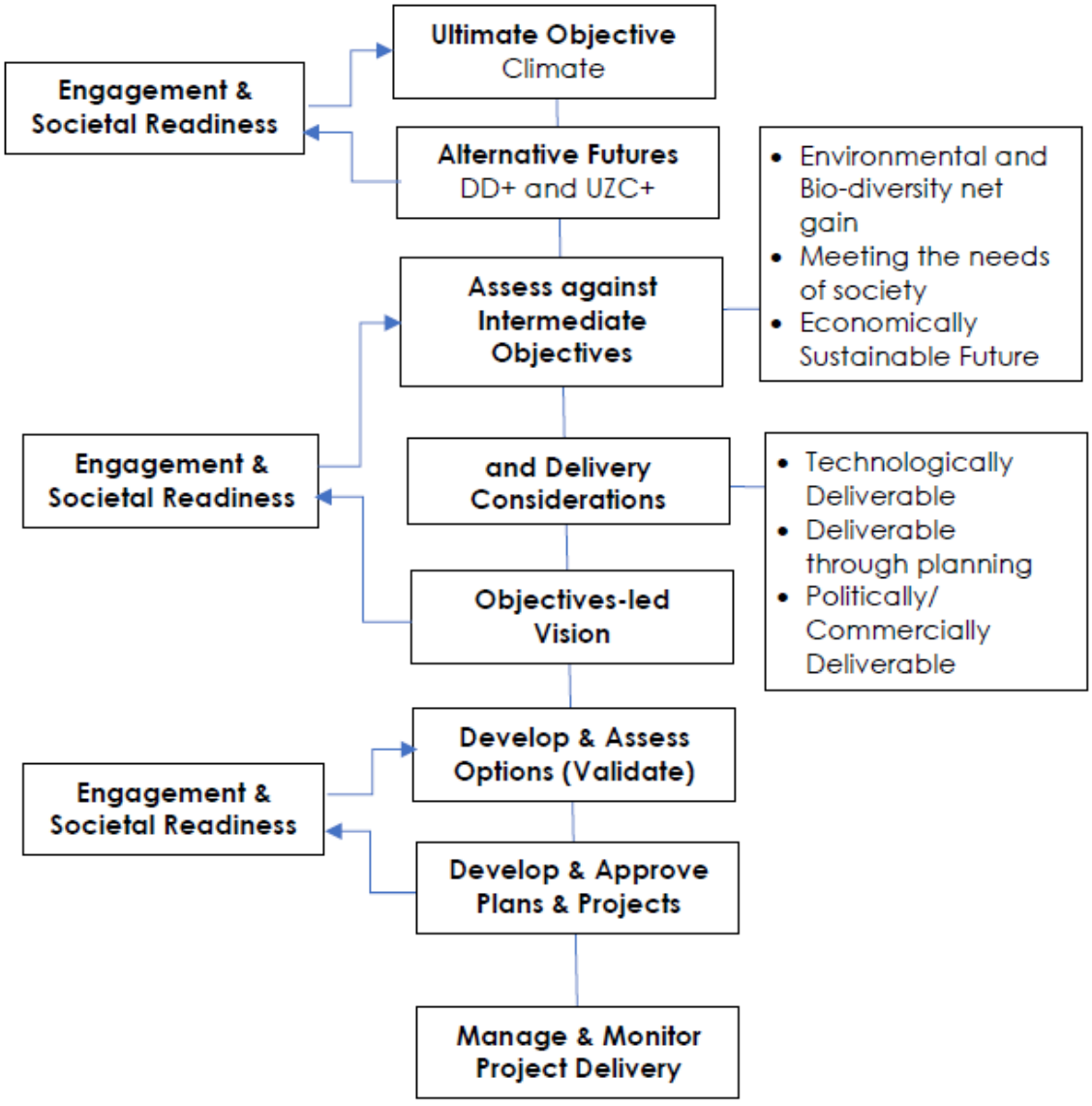


Figure 44: Developing a shared, objectives-led vision

7.14 Guidance on which criteria could be used to support judgements in this process can be found in a range of relevant policy documents, for example the National Policy Statement for National Networks, Transport Appraisal Guidance, the National Planning Policy Framework and local planning documents. Annexe 11 contains some of the criteria that that are used in MCA techniques today. These would need to be considered in more detail in order to align these with the rigours of the Ultimate and Intermediate Objectives. This is not something that has been attempted here, but will need to be done if land use and transport decision making is to take greater account of harder to define objectives, thus enabling a break away from the status quo.

7.15 For the purposes of this study, a Preliminary Performance Matrix has been developed, (Table 15 overleaf). Its purpose is to stimulate discussion about the alternative futures, the constituent NZMMs and how an objectives-led vision might emerge. Clearly, in practice, this exercise would need to be enriched with more objective criteria to make judgements about whether or not any of the objectives had been met in whole or part, but in this case a subjective approach has been adopted. Nevertheless, the performance matrix does illustrate where there are more significant risks relating to the attainment of the future, and enables broad comparisons to be made.

7.16 In making judgements against the objectives, the economic, social and environmental objectives have been treated as aiming to deliver benefit to the community, whereas the deliverability objectives have been considered from the point of view of either the developer, investor, planning authority or whoever else is likely to be leading the delivery process.

7.17 The assessment of whether or not one of the NZMMs meets the needs of society is particularly problematic. Where there is evidence that societal benefits can be derived, then this would objectively over-ride the potential for lack of perceived readiness of an NZMM in this assessment, but where the evidence is yet to be corralled, (through SoRA and other assessments), then that measure or intervention is not considered to have demonstrated that it can deliver the societal benefits intended.

7.18 There are some observations that can be made having completed this exercise that might be useful in stimulating further debate:

- **Place Typologies:** Both DD+ and UZC+ place typologies were assessed to score relatively low in terms of their societal readiness. This is not to say that the individual NZMMs necessarily would do too. Indeed, whether they do or not could be very contextual, and dependent on the rigour of SoRA led engagement during the planning, design and delivery processes.

- Both place typologies and futures can deliver demand reduction, so long as there are both convenient land use and transport alternatives and demand management measures delivered as an integral part of the plan. The choice between place typologies is more likely to be driven by contextual factors. For example, a suburban DD+ place typology may be most appropriate around the community hub adjacent to the A58 BRT/ SAV service, whilst a more UZC+ style place could be appropriate around the tram stops at Elton Reservoir and Radcliffe.

- Creating co-benefits through V2G technology and cheaper charging could counteract the perceived disbenefits of remote, constrained parking provision. This could be integrated into either DD+ or UZC+ futures, but it would also need to be complemented with very attractive alternatives. If possible, the alternatives should be more convenient, to the front door if possible, with the design of streets and spaces focussed on people, active modes and access to mobility services or other alternative modes.

- **Land Use and Transport Futures:** DD+ is a technology led future requiring market-led innovation. This brings concerns about technology, market and planning risk, as well as about uneven social equity and the risks associated with personal data, the role of AI etc. UZC+ is an urban living led future with major mass transit provision required to create the level of connectivity

needed across an otherwise sub-urban area. It seems hard to envisage this level of cost being borne by the public sector, or the necessary projects being delivered soon enough to make a difference. Perhaps these risks lead us towards a strategy of urban living where this can be delivered around existing and improved transit, but to facilitate the technology led future to facilitate more rapid service-led change.

- There is a clear need to address intermediate trips. In this case, these are very disperse and hard to deal with in a targeted way. This need to be dealt with at the local and sub-regional level. However, the Northern Gateway Link is a specific measure common to both DD+ and UZC+, albeit using different technology. It involves the delivery of new infrastructure and transport services that will require the reallocation of road space, capital funding and revenue funding of services (at least for a time), and a co-ordinated parking and access strategy at both ends of the journey. Without these aspects, it would not deliver the level of demand reduction required.

- The SRN provides access to the Bury and Rochdale conurbation from a wide range of places. As yet, there is no strategy to increase the efficiency of how this is used, either by passenger or freight vehicles. In this situation, there would seem to be an opportunity to create access from the SRN to local public transport or SAV services which could be used to encourage modal shift or increase vehicle occupancy; also to provide interchange between HGVs from the SRN and a fleet of zero carbon delivery vehicles and a network of local delivery hubs.

- **Demand Management:** Parking restraint and demand management are key interventions which provide critical support to the demand reduction objectives in both DD+ and UZC+. The policy of parking restraint has been scored as part of the place typologies, whereas the provision of communal parking facilities, parking buildings or roadspace reallocation has been scored as part of the relevant NZMM, reflecting the level of risk associated with delivering a successful project. However this is scored, demand management creates a problem for the developer and planning authority who realise that this could be controversial and could impact viability.

- **Funding and Viability:** Either future would require significant investment in infrastructure and services. Unless there is a move away from investment in highway capacity and other utilities in favour of demand management and measures that lead to demand or carbon reduction, this will not be affordable. There are clearly concerns that this strategy will lead to unmitigated congestion and worsening road safety, so the process of Monitoring and Management against appropriate objectives through the delivery process is an essential part of any future.

- There is clearly a requirement for local community and mobility services common to both DD+ and UZC+. This needs revenue funding early to enable services and behaviours to be established early. However, we don't yet have the planning tools that can deliver this effectively, and the commonly used commercial models make this hard to embrace by developers. This is something that would need to be addressed as part of either future.

- Ideally, high carbon behaviour (eg ownership/ parking of fossil fuel vehicles, use of single occupancy vehicles etc) should come at a cost. As might have happened in a Garden Settlement, revenue raised could be used to support revenue funding of community amenities and mobility services. Could this provide the basis for a community ownership model which supports the need for shared use of services?

- Whether or not this is achieved, a wider strategy of pay as you go mobility services, or an integrated road user and transport charging system is needed to ensure that pricing supports the demand/ carbon reduction objectives. This can only happen as part of a wider regional or national strategy. As suggested in Section 6.0, a national framework akin to the Welsh Government's Future Generations Act might provide that framework needed to support such difficult decisions.

BRIDGING THE GAP: PRELIMI						
				Ultimate		
Alternative Future		**NZMM**		**Demand/ Carbon Reduction**	**Economically Sustainable Future**	**Meeting the Society**
			Lead responsibility for delivery	**The extent to which the NZMM could rapidly contribute to Demand/ Carbon Reduction**	**The extent to which the NZMM contributes to a thriving but sustainable economy**	**The extent NZMM mee of society**
DD+	**Place Typology**	Suburban densities with V2C parking and mobility hubs	Developers	2	2	-2
	Short trips	New local land uses	Developers	1	2	3
		Improved local connectivity	Developers	1	2	3
		Local Mobility Services	Developers and Local Authority	1	2	2
	Intermediate trips	Pay as you go Mobility Services including EV Light Fleet	Developers and Local Authorities	2	2	-2
		SAV services replacing Bus and BRT	Local/ Regional Authorities/ STB and Service Providers	1	2	-1
		Residential V2C/ V2G parking hubs	Residential Developer	3	3	0
		Segregated Northern Gateway SAV route incl road space reallocation	Developers	3	3	2
		Parking areas and on site shuttle service at Northern Gateway	Employment Developer	3	0	2
		SRN interchange and provision for shared transport	Employment Developer and National Highways	2	2	2
		Urban freight consolidation and distribution	Developers, Local Authorities and National Highways	2	3	3

Table 15: BTG Preliminary Performance Matrix

NARY PERFORMANCE MATRIX

Intermediate						
e Needs of	Environmental/ Biodiversity Net Gain	Technologically Deliverable	Commercially & Financially Deliverable	Deliverable through Planning	SUMMARY	
to which the ts the needs	The extent to which the NZMM contributes to environmental or biodiversity net gain	The extent to which the NZMM is technologically deliverable within the time frame	The extent to which the NZMM is deliverable within commercial viability or financial budgets	The extent to which the NZMM can be delivered through the plan making or planning process	-3	Works strongly counter to the objective
					-2	Works moderately counter to the objective
					-1	Works a little counter to the objective
					0	On balance, neutral
					1	A little consistent with the objective
					2	Mostly consistent with the objective
					3	Strongly consistent with the objective
	2	2	-2	-2	A familiar place typology with potential benefits for the environmental, but with characteristics and a reiliance on technology that are as yet unproven and not yet societally ready, leading to concern about market appetite and planning	
	0	3	-2	2	Desirable and deliverable, but revenue funding needed to enable early provision	
	0	3	0	2	Desirable and deliverable, but requires funding priority and a determined approach to land provision and road space reallocation	
	0	2	-1	2	Desirable and deliverable, although in need of revenue funding needed to establish viability	
	0	0	-2	0	Focussed on the most carbon hungry trips, and technologically capable of being delivered, but the EV light concept is high risk in terms of societal and market acceptance or commercial model	
	1	-1	0	1	SAVs are not a big technological leap (unlike wider vehicle autonomy), but there could be concern about market acceptability and viability	
	1	-1	-2	-3	V2G is proven technology, but there are regulatory hurdles to be overcome. The concept of communal parking hubs is desirable from a carbon perspective, but untested. V2G should bring significant societal benefit, but whilst there may be a positive commercial case, the developer may be unwilling to embrace it until it is more widely tested.	
	0	-1	-3	-2	The Northern Gateway route is highly desirable from a carbon perspective. It is in the control of the Local Authority and Developer to deliver, but it will be necessary to reduce infrastructure costs elsewhere to enable funding. It could be hard to deliver through planning.	
	1	2	-2	-3	Communal parking and shuttles at Northern Gateway is desirable to support the switch to other modes, but likely to be controversial in planning terms, and hard for institutional funders to accept.	
	1	-1	0	-3	Whilst the concept of using the SRN for shared transport vehicles would appear to be relatively effective and non controversial, there are no plans to make provision for this. A culture change relating to how we use onr SRN would be needed.	
	2	-2	-3	0	Urban freight has not been the main focus of this work, but there would appear to be opportunities to make our urban freight systems more efficient. There are however technical, regulatory and commercial barriers that need to be addressed	

BRIDGING THE GAP: PRELIMI						
				Ultimate		
Alternative Future		**NZMM**		**Demand/ Carbon Reduction**	**Economically Sustainable Future**	**Meeting the Society**
			Lead responsibility for delivery	**The extent to which the NZMM could rapidly contribute to Demand/ Carbon Reduction**	**The extent to which the NZMM contributes to a thriving but sustainable economy**	**The extent NZMM mee of society**
UZC+	**Place Typology**	Urban densities with remote parking	Developers	3	3	-2
	Short trips	New local land uses	Developers	1	2	3
		Improved local connectivity	Developers	1	2	3
		Local Mobility Services	Developers and Local Authority	1	2	2
	Intermediate trips	Upgrading of QBCs to BRT routes along A56 and A58	Local/ Regional Authorities/ STB and Service Providers	2	1	2
		New rail and tram services to improve connectivity in suburban conurbation	Local Authorities and Service Providers	3	0	3
		Parking restraint on site - 0.3 spaces per dwelling in parking buildings	Residential Developer	3	0	1
		Segregated Northern Gateway route for active modes & local mobility services	Developers	3	3	2
		Parking areas and on site shuttle service at Northern Gateway	Employment Developer	3	0	2
		Integrated road user and transport services charging	Regional Authority/ STB	3	3	3
		Urban freight consolidation and distribution	Developers, Local Authorities and National Highways	2	2	2

Table 15: BTG Preliminary Performance Matrix

NARY PERFORMANCE MATRIX

Intermediate						
e Needs of	Environmental/ Biodiversity Net Gain	Technologically Deliverable	Commercially & Financially Deliverable	Deliverable through Planning	SUMMARY	
to which the ts the needs	The extent to which the NZMM contributes to environmental or biodiversity net gain	The extent to which the NZMM is technologically deliverable within the time frame	The extent to which the NZMM is deliverable within commercial viability or financial budgets	The extent to which the NZMM can be delivered through the plan making or planning process	-3	Works strongly counter to the objective
					-2	Works moderately counter to the objective
					-1	Works a little counter to the objective
					0	On balance, neutral
					1	A little consistent with the objective
					2	Mostly consistent with the objective
					3	Strongly consistent with the objective
	0	3	-1	-1	A familiar place typology for city dwellers, but retrofitting urban living in a sub-urban neighbourhood has its challenges for society, leading to concern about market appetite and planning	
	0	3	-2	2	Desirable and deliverable, but revenue funding needed to enable early provision	
	0	3	0	2	Desirable and deliverable, but requires funding priority and a determined approach to land provision and road space reallocation	
	0	2	-1	2	Desirable and deliverable, although in need of revenue funding needed to establish viability	
	1	1	-2	1	BRT would benefit from greater priority/ segregation and visibility, but would be an incremental improvement rather than creating an entirely new service. Likely to be commercially hard to deliver.	
	2	3	-3	2	New rail services are proven technology and should provide excellent returns in terms of carbon reduction and societal benefit. However, it comes at a heavy cost which is likely to be very hard to deliver through public sector budgets, and may make the economic case marginal.	
	1	3	1	-2	Residential parking buildings are deliverable and should have a positive economic and financial case. However, the developer may be reluctant to embrace the philosphy. it is also likely to be difficult from a planniing perspective	
	0	3	-1	-1	The Northern Gateway route is highly desirable from a carbon perspective, and in the control of the Local Authority and Developer to deliver. Reducing infrastructure costs elsewhere would be needed to enable funding, but planning hurdels are likely to be fewer than if provision was being made for an SAV route.	
	1	2	-2	-3	Communal parking and shuttles at Northern Gateway is desirable to support the switch to other modes, but likely to be controversial in planning terms, and hard for institutional funders to accept.	
	3	-1	-3	-3	Although now commonly accepted by the professional community as the route to better funding of transport services, this remains highly controversial, thus making the ability to provide funding and approvals extremely difficult	
	2	-2	-3	0	Urban freight has not been the main focus of this work, but there would appear to be opportunities to make our urban freight systems more efficient. There are however technical, regulatory and commercial barriers that need to be addressed	

7.19 The next stage of this hypothetical exercise would now be to develop an objectives-led vision for development and place which could create a framework for the development of appropriate plans and projects for implementation. This vision would be contextual to place, responding to DD+ and UZC+ place typologies appropriately. The key features might be:

- Appropriate local amenities and services provided in local community hubs, and improved connectivity to other local facilities that enable more community needs to be fulfilled locally, and accessed without a car.
- Mobility hubs/ services delivered as an integral part of the development centred around local community hubs, providing pay as you go mobility services to the front door where possible.
- Parking restraint and V2G technology appropriate to the place typology, either through the use of UZC+ parking buildings in high density areas, or through the use of V2C community parking hubs.
- Embrace community ownership models (or similar) that incentivises the use of local land use and mobility services over car use, supports revenue funding of local services, and helps to overcome reservations about 'trust'.
- Design principles to prioritise access for active modes, mobility services and public transport/ SAV's, with high quality streets and spaces that create an environment that people are happy to be in.
- A dedicated link to Northern Gateway Link providing segregated access to employment for active modes, local mobility services and BRT/ shared autonomous vehicles providing access from strategic routes and development at Elton Reservoir.
- Create opportunities to make more efficient use of the SRN for access to the local conurbation for both freight and passengers.

7.20 This vision seeks to optimise performance against the objectives by delivering effective demand and carbon reduction measures that can more easily be delivered quickly. In making best use of urban density where possible, avoiding the need to deliver major regional mass transit infrastructure, and focussing on enabling innovation in EV transition, public transport and mobility services, it seeks to maximise deliverability and potential for change, whilst also delivering co-benefits in economic, social and environmental terms.

7.21 However, there are many challenges and risks to the delivery of a vision like this. Without appropriate objectives to frame the vision, and guide its future delivery, the risk of reversion to business as usual will be significant. Societal Readiness Assessment should be a key element of this process to aid understanding of what is needed to meet the needs of society, as this will underpin how politicians, planning and transport authorities, and the market react to the need for more radical action.

7.22 Once the visioning stage has been completed, it is then necessary to move into the planning stage, (Figure 45). Here we are on surer ground, utilising modelling and appraisal skills to assess a range of scenarios to demonstrate alternative pathways towards the agreed objectives. This essential step allows developers, investors, local and transport authorities to better understand how planning permissions can be framed. Importantly, these will show how car based solutions fail to meet the Ultimate and Intermediate Objectives, and actually represent an outlier rather than the central case that has formed the basis of planning for many years, (Figure 46),

7.23 Beyond that, there will be a need to provide an accessible and affordable means of monitoring the progress of development against the objectives, agreeing changes in service or infrastructure provision in line with the plan, and to embed this in local governance structures. Regular opportunities to engage the local community in this process can help to increase trust and belonging, which in turn benefits the use of local facilities and mobility services. As innovations are brought forward, so these can be iteratively developed to ensure readiness for society and to maximise benefit for the community and its stakeholders. Figure 45 illustrates the important role of monitoring and managing the process of implementation to meet the shared objectives

Vision

Establish a shared, objectives-led vision through engagement and SoRA

Plan

Assess alternative scenarios capable of delivering objectives-led vision

Deliver

Phased approach to delivery through manage and monitor.

Figure 45: Places First:
Creating Communities Fit for the Future, 2019

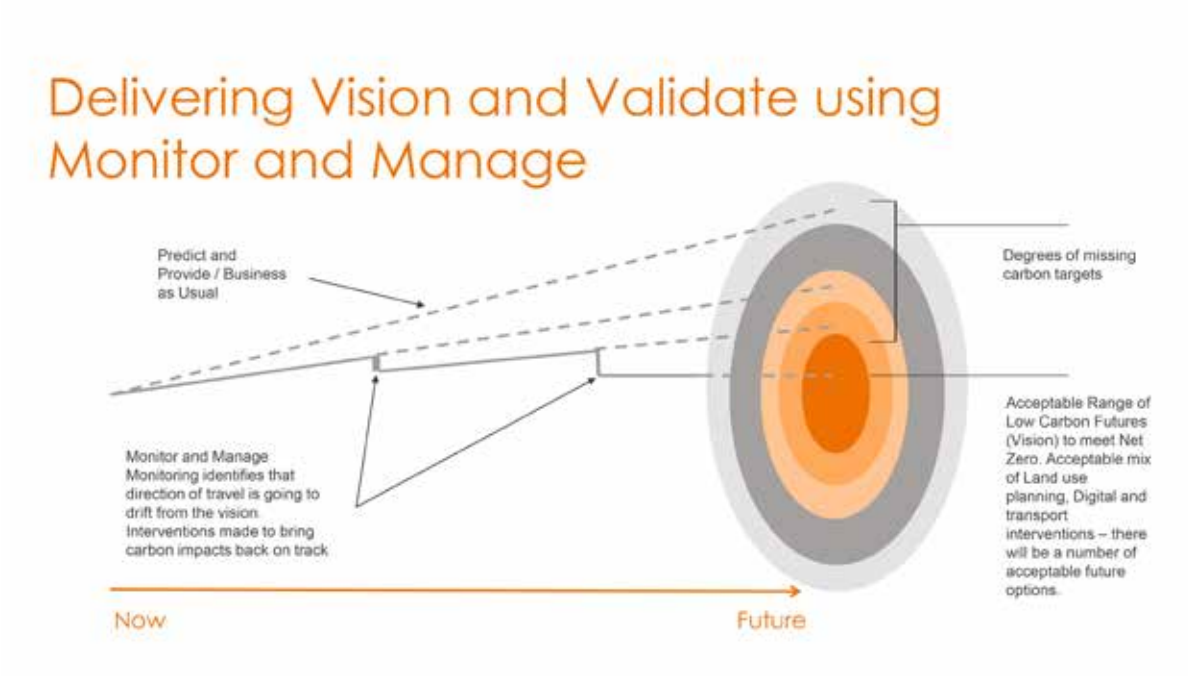
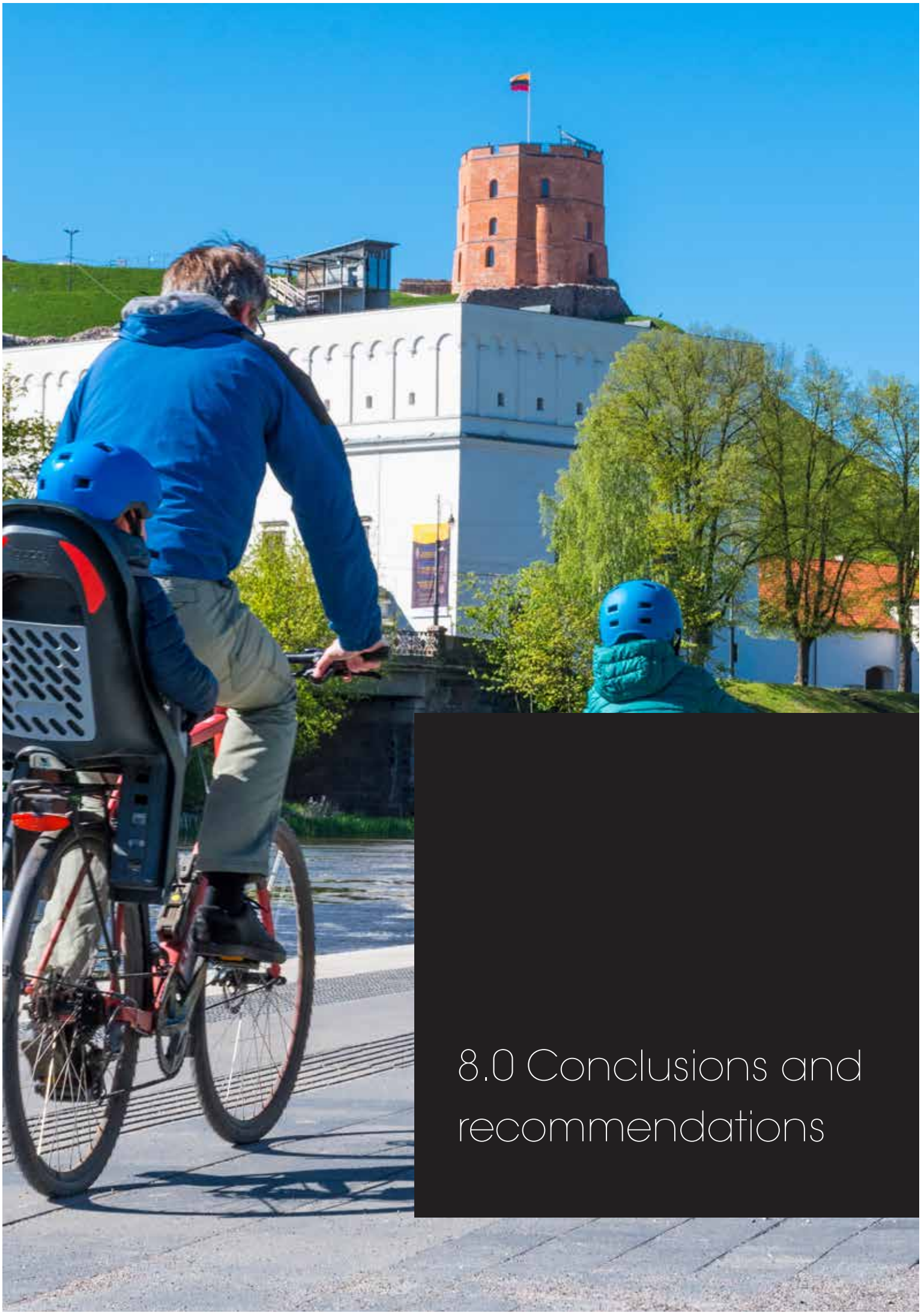


Figure 46: Delivering Vision and Validate using Monitor and Manage technique



8.0 Conclusions and recommendations

8.1 Key Conclusions

8.1.1 TfN's Future Travel Scenarios enable us to better understand which alternative pathways provide the best route to net zero, and to test what else needs to done to meet surface transport net zero objectives. Bridging the Gap concludes that 'Urban Zero Carbon' is the pathway that achieves the best carbon reduction outcomes, with 'Digitally Distributed' representing the best of the rest, (based on TfN's 2019/ 2020 futures). A reduction in travel by car, or equivalent, of at least 20%, (30% for DD), is required by 2030 to meet surface transport net zero, assuming the most favourable outcomes from current policies.

8.1.2 In considering a new development at Elton Reservoir in Bury, both UZC and DD would need to be 'supercharged' with net additional Net Zero Mobility Measures (NZMMs), if a net zero mobility future is to be created. Whilst it is important to promote greater movement by active modes, the key to carbon reduction is the reduction of intermediate trips (between 5 – 30km) which would represent over 60% of the travel distance related to the site.

8.1.3 A high-level vision and validate style assessment of alternative future scenarios has identified technically plausible land use and transport futures capable of meeting net zero mobility objectives. In all scenarios, car restraint policies would need to form part of a solution alongside the provision of convenient alternatives to the car.

8.1.4 In the DD+ future, this could be achieved using a combination of technology-led mobility services within a sub-urban environment, incorporating integrated community and mobility hubs and shared parking areas for EVs with Vehicle2Grid technology. In the UZC+ future, this could be achieved by focussed new urban living around mass transit hubs, streets focussed on active modes with constrained parking in remote parking buildings.

8.1.5 Neither of these alternative futures would provide a system of mobility that would be ready for adoption by society. Concerns about the DD+ world providing for the many and complex journey destinations and purposes required, and about the nature of urban living in a generally sub-urban environment would leave society anxious about its ability to thrive. Much work would need to be done to develop these visions into something capable of being embraced by society.

8.1.6 An iterative approach which treats community engagement and Societal Readiness Assessment as an integral part of the commercial, technical and operational assessment processes that would need to be adopted to ensure the development of a shared vision of the future that could guide a vision-led planning and design process, and lead to the carbon outcomes envisaged – a 'doughnut mobility vision'?

8.1.7 In assessing the practical implications of pursuing either the DD+ or UZC+ scenarios against a multi-criteria appraisal framework, it can be seen that some elements of each future are unlikely to be capable of implementation in the short timescale needed to meet net zero by virtue of the scale of cost, risk and complexity of projects required.

8.1.8 A hybrid vision begins to emerge which builds on existing plans to improve local transport systems, and focusses on promoting the quickest wins that have the greatest impact on intermediate trips, such as through the provision of new mobility services, and a development plan that uses UZC and DD features where most appropriate.

8.1.9 Critically, this requires a co-ordinated approach to planning and development across the local conurbation which prioritises investment in land use and transport interventions focussed on delivering net zero mobility priorities, and avoids unnecessary or counterproductive investment in providing greater capacity for car movement.

8.1.10 Place-based conversations between government, regional and local authorities, developers, investors and communities are urgently needed to lead this debate.

8.2 Other considerations

8.2.1 **Policy Considerations:**

1. The carbon gap is bigger than we thought, and the underpinning policy is changing faster than plans can be made. There needs to be a debate about this to decide what to do. Is it really feasible to reduce demand by 20% or 30%, and if so will this lead to the attainment of net zero? Only if everything else in the decarbonisation process is also being delivered to the maximum possible, including electricity grid transition, car manufacture and transport system investment. These cross-sector conversations need to be taking place more actively, especially locally.

2. There is much to do to move away from car dependent models of land use and transport planning. Continuing to invest in additional highway capacity creates additional capacity for car use and congestion. Change will only come with a co-ordinated move away from this towards the funding of mobility services and reallocation of road space towards other modes.

3. Local development can not make radical change unsupported. Local Authorities and developers respond to societal attitudes and political direction. In Wales, the Future Generations Act provides a national framework for the conversation about change, and both Wales and Scotland have implemented traffic reduction targets. Is something else needed in England to frame the conversation we need about road user charging, demand management and traffic reduction?

8.2.2 **Market Considerations**

1. There have long been developers and investors keen to deliver new models of development which respond more fully to net zero. How do developers and investors respond to the possibility of delivering quite radically different forms of development such as DD+ and UZC+? What do they see as the challenges and opportunities?

2. Change has been very slow. Previous work with University College London's Climate Action Unit resulted in a workshop with a wide group of developers, investors, local authorities and government departments. This identified the phenomenon of 'learned helplessness' as a causal factor*where even those who know they need to act feel they can't move ahead because there is no level playing field with those who don't. How do we break this vicious circle, both within the development planning world, and cross sector. Would SoRA provide a useful tool in helping to unveil some of the challenges and opportunities?

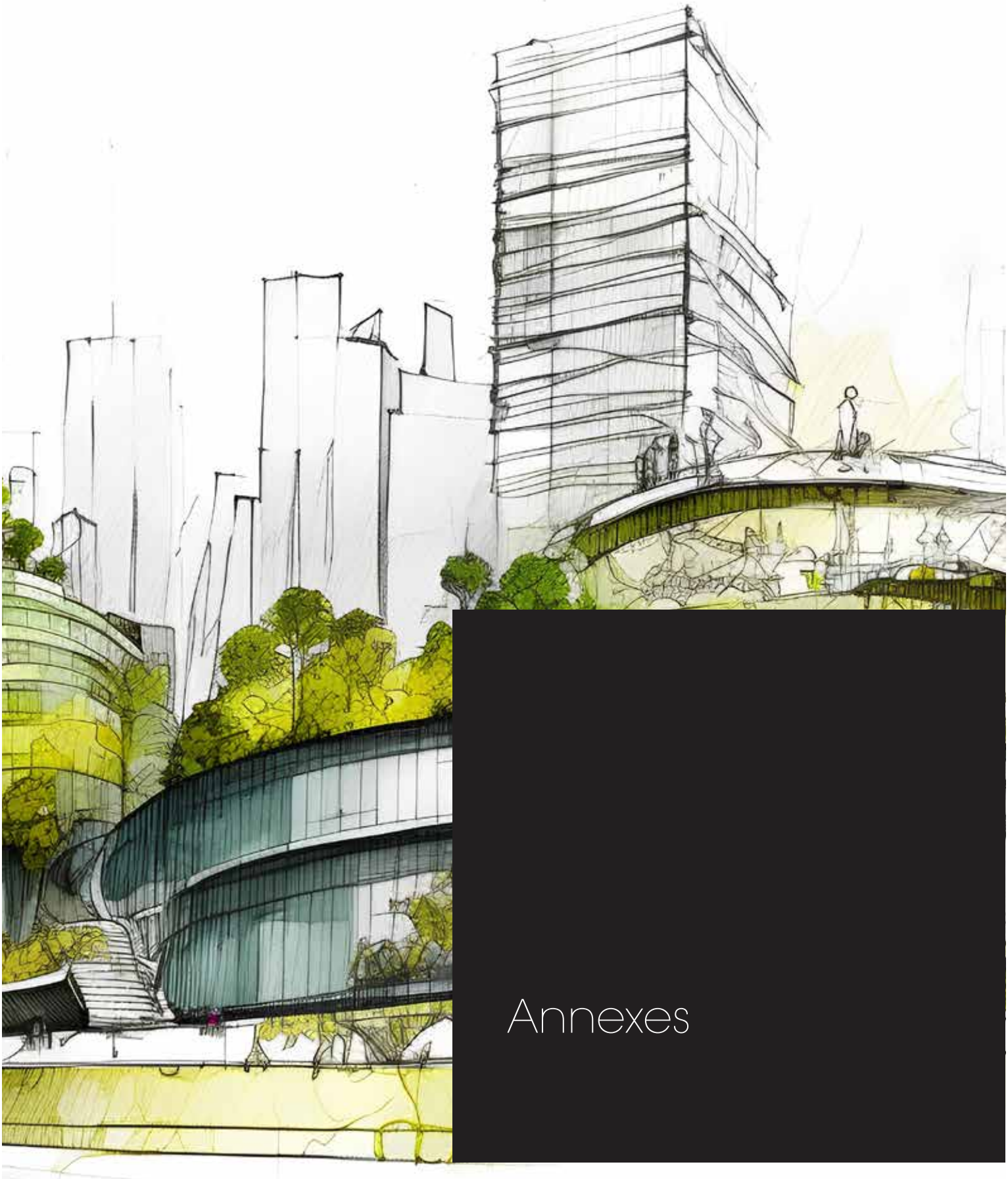
3. If development is to support the move towards provision of local amenities and mobility services as an integral part of its move towards net zero, there is a need to move from capital funding of infrastructure to revenue funding of services. This would need changes in planning policy and commercial delivery models.

8.2.3 **Professional Practice.**

4. There is a clear need to change land use and transport planning to reflect the need for people and place to support the transition to net zero. DD+ and UZC+ offer potential solutions, but context is very important. Responding to local circumstances is essential to ensure that investment is focussed on tackling high demand movements, quickly, as a first priority.

5. We are a long way off knowing how best to pursue land use and transport planning in a vision-led planning system, in particular the establishment of an objectives-led, shared vision that this study has focussed on. Some early prototypes of some of the tools and techniques we will need have been developed. Many others are doing the same – some very sophisticated, others not. There is a need for a conversation about how to quickly achieve greater consistency of approach in a way that is appropriate at all scales of planning. This is probably best led by the professional associations.

6. Demand for movement is generated by the need for society to fulfil its needs and desires, and the nature of that demand is influenced by planning, land use patterns and the nature of connectivity. Land Use and transport planners have long talked about the need to work across the disciplines - joined up thinking can help to change cultures and infrastructures - but how much effort has gone into working with sociologists or behavioural psychologists? Surely as most of the need for demand reduction implies a change of societal behaviour, this is needed more than ever? Is Societal Readiness Assessment a route to better vision-led planning….?



Annexes

Annexe One: Bridging the Gap carbon assessment

Annexe Two: DD+ Place Typology: Vehicle2Community summary

Annexe Three: Combining local intelligence with future travel scenarios for Bury zones

Annexe Four: Bridging the Gap transport demand profile analysis

Annexe Five: Reverse land use and connectivity optimisation

Annexe Six: Urban morphology and accessibility

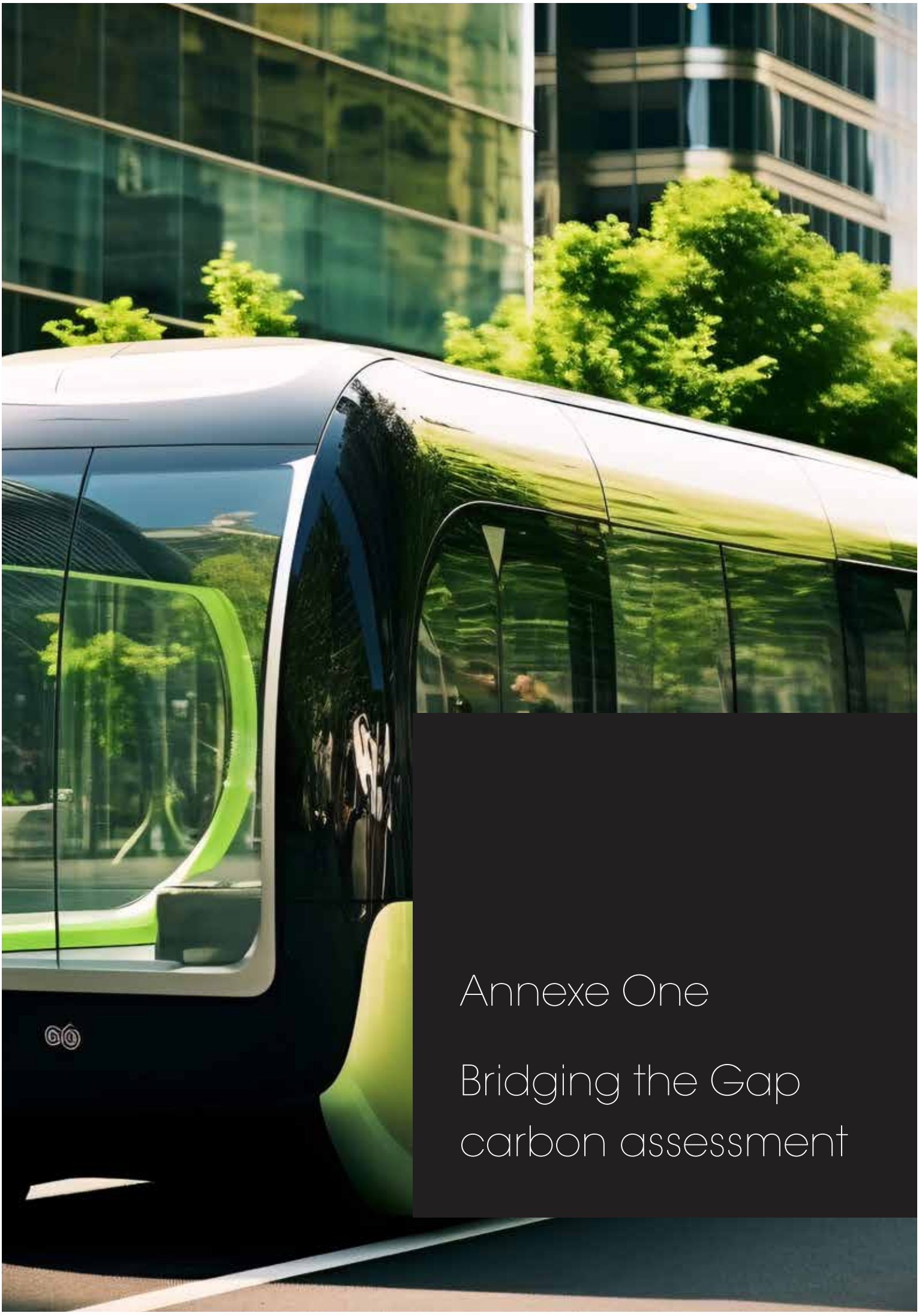
Annexe Seven: Better Places input to Bridging the Gap

Annexe Eight: Bury's future land use and transport scenarios, 2040.

Annexe Nine: Assessment of potential to deliver reduction in demand and carbon emissions for alternative futures.

Annexe Ten: Bridging the Gap Societal Readiness Assessment

Annexe Eleven: Bridging the Gap MCA criteria



Annexe One

Bridging the Gap carbon assessment

Bridging the Gap carbon assessment

Professor Greg Marsden, March 2023

Introduction

This note sets out the implications of different future travel demand and technology uptake scenarios compared with the proposed TfN carbon budget. The work is based on a spreadsheet model which uses as inputs:

- Billion vehicle miles travelled by car, lgv and hgv
- Proportion of those miles travelled in zero emission vehicles (tailpipe zero)
- Efficiency changes to existing fleet (as an average)

The work has been informed by TfN's NoCarb model which has provided demand profiles for the modes, split by fuel type (Bev, Phev, diesel, petrol, petrol hybrid and hydrogen (for HGVs). These were provided for the four TfN future scenarios:

- Just About Managing (JAM)
- Prioritised Places (PP)
- Digitally Distributed (DD)
- Urban Zero Carbon (UZC)

Model Differences and Model Calibration

NoCarb is a bottom up model which includes a level of detail which cannot be replicated in the CaSE model developed by Marsden. NoCarb, for example, looks at the split of registration types by area and the average speed on routes. This enables the deployment of COPERT speed emission curves to be used to estimate emissions.

NoCarb also includes a much greater variety of vehicle types than CaSE. CaSE looks at the proportion of miles that are run in fossil fuel mode and provides a fleet average emission factor for Car, LGV and HGV applied to all fossil fuel vehicle miles in a year. NoCarb includes Phevs and assumes that 50% of the mileage in Phevs is driven in electric.

CaSE was initially calibrated to the DfT's NRTF data and has a tolerance of 1.5% across NRTF scenarios. However, because NoCarb looked at the northern fleet and made different assumptions about the role of Phevs and petrol hybrid vehicles, the average fleet efficiency factors for the fossil fuel fleet needed recalibrating.

The process adopted was as follows:

1) Adjust the 2019 baseline emission factors so CaSE and NoCarb are equivalent in JAM

2) Examine the divergence for Car, LGV and HGV separately and make adjustments to the year on year average fossil fuel fleet efficiency

3) Assess the divergence again and readjust

The JAM calibration resulted in less ambitious fleet efficiency pathways for Cars, no efficiency improvements for diesel trucks. LGVs have less ambitious efficiency improvements to 2030 and slightly more ambitious improvements beyond 2030. The differences for cars and LGVs is most likely explained by the need to account for Phevs – more of the mileage is assigned to electric than in the DfT models and so the efficiency of the remaining fossil fuel element is relatively worse.

Whilst there is good agreement between NoCarb and national estimates of emissions of CO2 the calibration is not perfect and so it is difficult to say much more about the adjustments made.

The JAM calibration resulted in a CaSE modelled estimate of 326.1 MtC versus the NoCarb estimate of 327.4 MtC (a variance over the period 2019 to 2040 of -0.4%). The maximum within year variation of cumulative emissions was -0.9%. There is a slight underestimate of HGV emissions, particularly in the latter years of the model but this is the smallest fraction of emissions to 2035 and by the time the variance grows the overall contribution is small in the cumulative total.

Having calibrated the model for JAM the same efficiency factors were deployed for the other three scenarios with their unique travel demand and fleet technology scenarios. This resulted in the following outturns:

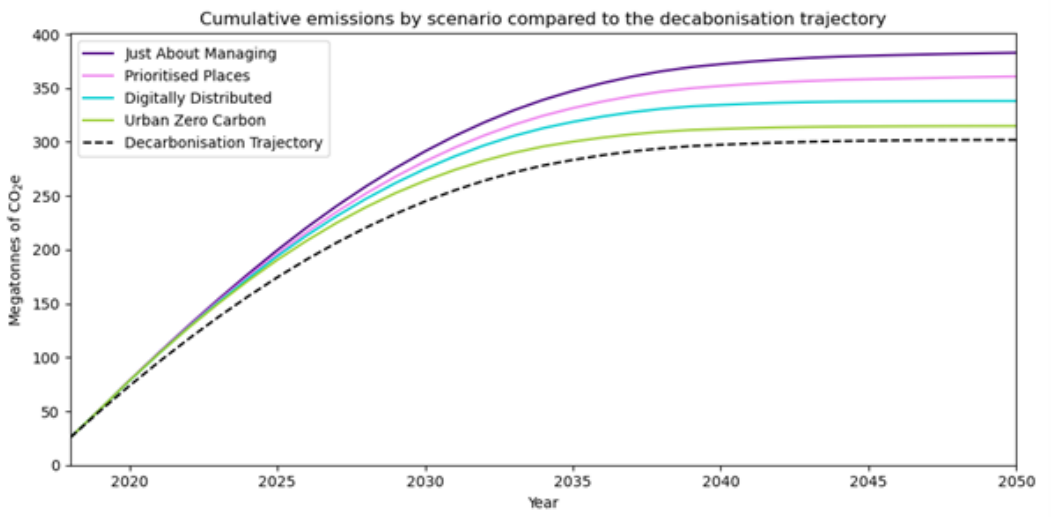
Scenario	CaSE (MtC)	NoCarb (MtC)	Variance (MtC)	% Variance
JAM (Calibration)	326.1	327.4	-1.3	-0.4%
PP	305.1	307.2	-2.1	-0.7%
DD	287.6	292.4	-3.8	-1.3%
UZC	268.6	270.1	-1.5	-0.6%

Table 1: Calibration and Validation Outturns

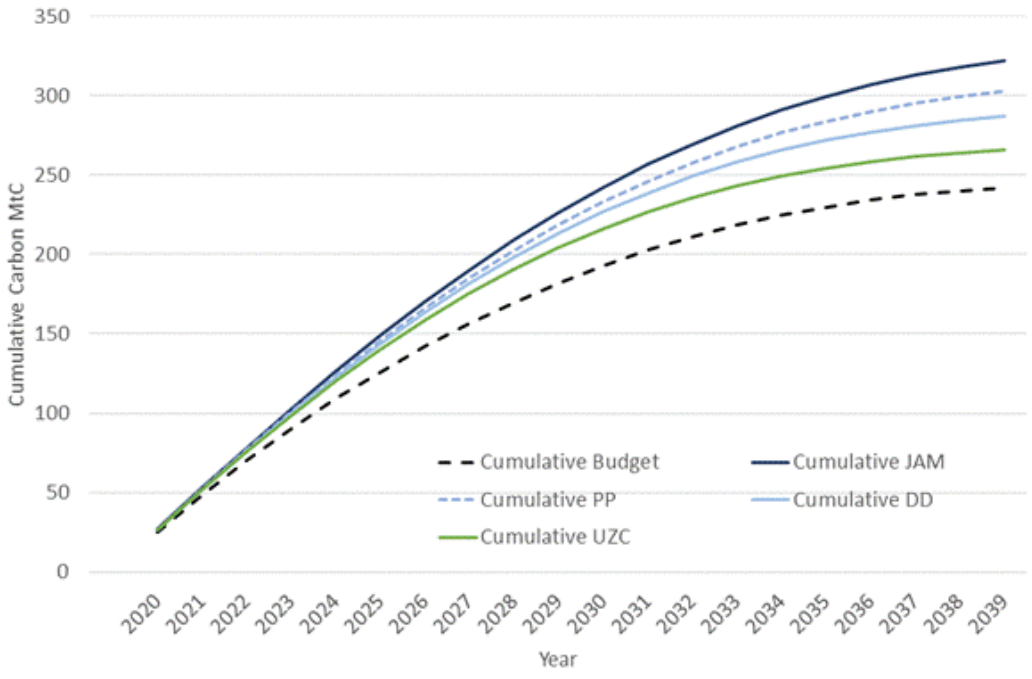
The CaSE model marginally underestimates the NoCarb outcomes. The differences vary somewhat by scenario (so a corrective factor is difficult to establish). As all of the variances are small (DD being the largest at -1.3%) over a 21 year period it is suggested that the CaSE model is sufficiently robust to provide a useful strategic representation of carbon outcomes across the North.

In interpreting future scenario variants run in CaSE it should be noted that this is a broad strategic tool and therefore should not be assumed to be equivalent to the outcomes that would be produced from NoCarb. Nor should the results be seen to be endorsed by TfN. However, for the Bridging the Gap project this provides a robust enough modelling basis to identify the gap to be bridged and how this could be achieved.

The total TfN budget applies to all surface transport emissions including bus, rail and 'other' and so there is a need to estimate what the size of the budget gap that car, lgv and hgv need to deliver on. The chart below from the NoCarb analysis gives an indication of the total budget.



The analysis which has been run for Bridging the Gap is over the period 2020-2040 (and so has a slightly different start point). This results in a scenario versus budget trajectory chart as set out below.



TfN Scenarios versus Carbon Budget 2020-2040

In the total carbon estimates from each of the scenarios here are the emissions from cars, LGVs and HGVs and two other categories of emissions – public transport and some associated emissions assigned to BEVs and Hydrogen by TfN. These are both small relative to the total emissions (between 20.6 and 22.2MtC compared to total emissions of 265.9 to 322.2MtC). It has therefore been assumed for the purpose of Bridging The Gap that these emissions cannot be further reduced and that any GAP to be bridged will need to be from the actions on the Car, LGV and HGV fleet.

Table 2: Size of Budget Gap to be Bridged

Scenario	PT and other	Budget	Budget Left for Car/LGV/ HGV	CaSE Car/ LGV/HGV	Gap to be Bridged MtC
JAM	22.0	242	220.0	301.2	81.2
PP	22.2	242	219.8	280.2	60.4
DD	20.6	242	221.4	262.8	41.4
UZC	21.6	242	220.4	243.8	23.4

Scenario Set 1: Go Scottish – Assume a 20% reduction in car traffic from 2019 levels by 2030 [and then flatline] – reduction linear

Scenario	Original (2020-40) MtC	GoScottish (2020-40) MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	272.1	30.1	81.2	51.1
PP	280.2	259.4	20.8	60.4	39.6
DD	262.8	243.4	19.4	41.4	22.4
UZC	243.8	227.5	16.3	23.4	7.1

This is close for UCZ but would still require significant additional traffic reduction for DD. DD may be possible to reach the TfN budget with reductions to LGV, HGV and some further car traffic reduction. It is hard to see PP and JAM meeting budgets. UCZ could meet the budget with either further car traffic reduction or LGV/HGV (or some combination).

Scenario Set 2: TfN Traffic with DfT Core Technology Assumptions

Scenario	Original (2020-40) MtC	TFNDfTCore (2020-40) MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	319.9	-18.7	81.2	99.9
PP	280.2	309.8	-29.6	60.4	89.6
DD	262.8	310.7	-47.9	41.4	89.3
UZC	243.8	309.5	-65.7	23.4	89.1

Note that all of the scenarios here perform significantly worse than the TfN scenarios. In particular the absence of any HGV decarbonisation other than through efficiency changes significantly impacts some scenarios.

Scenario Set 3: Go Scottish TfN Traffic with DfT Core Technology Assumptions

Scenario	Original (2020-40) MtC	Go_S_TFN DfTCoreTech (2020-40) MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	289.5	11.7	81.2	69.5
PP	280.2	286.8	-6.6	60.4	67.0
DD	262.8	286.0	-23.2	41.4	64.6
UZC	243.8	286.8	-43.0	23.4	66.4

There are no meaningful traffic reduction scenarios which would be compatible with the DfT core technology assumptions (Go Scottish Saved 20-30MtC but this is only a quarter to a third of the required saving)

Scenario Set 4: TfN Scenario Traffic with TDP Max Tech Assumptions

Scenario	Original (2020-40) MtC	TfNtraff TDPMaxtech (2020-40) MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	241.8	59.4	81.2	21.8
PP	280.2	234.9	45.1	60.4	15.3
DD	262.8	234.8	28.0	41.4	13.4
UZC	243.8	234.6	9.2	23.4	14.2

The DfT Max Tech Assumptions in the TDP are far more ambitious than JAM, PP and DD (compare columns 1 to 2) and slightly more ambitious than UCZ. One of the scenarios quite reach the TfN budget but all look within reach with significant additional traffic reductions early in the period (note reductions later in the period have very little effect due to the very high tech uptake).

Scenario Set 5: TfN Go Scottish with TDP Max Tech Assumptions

Scenario	Original (2020-40) MtC	TfN_ GoScottish TDPMaxtech (2020-40) MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	220.9	80.3	81.2	0.9
PP	280.2	219.1	61.1	60.4	-0.7
DD	262.8	219.0	43.8	41.4	-2.2
UZC	243.8	219.0	24.8	23.4	-1.4

We can say that all of the scenarios (within the degree of confidence we want to approximate to) reach the required budget with a 20% reduction in car traffic by 2030 and the DfT maxtech assumptions.

Scenario Set 6: Based off Scenario Set 1
Assume a 30% reduction in car traffic from 2019 levels by 2030 [and then flatline] for JAM, PP and DD – linear then flatline and a 10% reduction in LGV and HGV traffic – linear then flatline. Only LGV and HGV reduction assumed for UCZ

Scenario	Original (2020-40) MtC	Scenario 6 MtC	Actual Reduction MtC	Required Reduction MtC	Remaining Gap
JAM	301.2	257.9	43.3	81.2	37.9
PP	280.2	247.7	32.5	60.4	27.9
DD	262.8	233.2	29.6	41.4	11.8
UZC	243.8	229.2	24.6	23.4	-0.8

So – for UCZ a further 20% reduction in car traffic to 2030 and then flatlining, coupled with a 10% reduction in HGV and LGV traffic gets to the TfN carbon budget using TfN technology assumptions

DD is still 11.8 short despite a 30% reduction in car traffic by 2030 and 10% reduction in HGV and LGV. This would suggest to me that there are two potential scenarios of interest:

1) An extended ambition version of UCZ

2) A significantly extended ambition version of DD

Conclusions

There seem to me to be no remotely plausible options worth considering for PP and JAM. It is also important to note that the more ambitious the reductions are, the further away from the social future which the scenario was supposed to represent we end up. Basically, the maths of fitting to the carbon budget end up squeezing all of the futures to something fairly similar. It might be that DD and UCZ could still have a coherently distinct description.

Business as Usual is not carbon budget compliant with TfN's scenarios and nor are variants which pivot off this with different traffic levels.

More ambitious technology scenarios bring these scenarios into the realm of the achievable – but there is no sense that the technology scenarios represent anything reasonable (i.e. to make the traffic reductions credible you need to make the tech assumptions incredible).

Annexe Two:

DD+ Place Typology:

Vehicle2Community summary

DD+ Place Typology: Vehicle2Community

Jason Lewis; Director of Transport Planning

Concept

The core concept of Vehicle 2 Community is to capture the opportunity to make use of energy storage within idle EV batteries to assist with reducing demands on the power grid. Residual benefits arise from the concept, which will be described.

Bidirectional EV Charging

Vehicle 2 Grid is where EV batteries act as a bi-directional power source to feed back to the grid, reducing pressure on the grid. Vehicle to Home is where the EV provides battery storage and power back to the home. Vehicle 2 X is a later concept wording where EV batteries provide bi-directional battery storage power to a number of receiving destinations (otherwise termed as 'Vehicle 2 Everything').

EV batteries are progressively getting larger, with a typical capacity now being around 60kWh (up from around 40kWh around 5 years ago). Improvements in battery chemistry and technology is increasing capacity and longevity year on year. A 60kWh battery would be enough to serve a modern energy efficient three/four-bedroom home for up to 3 days during mid-winter.

All 'V2' concepts give the following benefits:

- Ability to redistribute cheap overnight electricity to a source at peak 'dirty' periods, reducing overall grid demand.
- Provide rapid (c. 6 seconds) grid balancing to enable more rapid role out of 'low inertia' renewable generators such wind and solar.
- Better provide smart charging to reduce grid frequency issues at peak times.
- The re-use of an existing idle EV battery which otherwise would net be doing any 'work' (also reducing criticism that EV batteries result in harm due to make up of significant rare earth minerals etc)

The first three bullet points result in significant value to grid operators for which operators would be willing to pay for, and this also results in indirect benefits in terms of CO2.

Site Parking

The Base Case

For Strategic Land and suburban development schemes parking has historically been provided 'on plot', on a driveway, and EV charging provided (as per Building Regs Part S5) at one charger per dwellings (not pe space). Such a layout requires conventional streets to service driveways, generating significant infrastructure imbedded carbon, urban heat island effects, surface water impacts etc. Further, on-plot parking is inflexible in that it is privately owned so if it goes unused the resource cannot be used by another party (hence waste).

The power implication of V2G/H on plot is that a) typically only one space is served, b) bi-directional power control is by the homeowner and c) the developer is likely to still need to provide 'certainty of supply' to the home and thus typically 3-4 kVA per dwelling allowance (for an electric only home). Flexibility is therefore very limited.

Vehicle 2 Community Case

V2C looks to remove parking from the plot and place it within a 'parking barn or court'. This results in numerous benefits including:

- Better parking use efficiency (the DCLG Residential Parking Report, 2007, stated typically 20-40% improved efficiency, depending on No. bedrooms, if unallocated);
- Ability to repurpose parking if it isn't used as anticipated;
- Complete control of bi-directional charge/ discharge, grid reaction etc;
- The opportunity to add solar to a car park canopy;
- Potential for a sizable grey water recycling tank below the car park, assisting Water Neutrality;
- Use of new communal refuse concepts (the Liverpool example);
- Integration with Mobility Hub, reducing ease of car access and promotion sustainable/flexible mobility.

The residual benefits to the urban street, which would no longer be required to provide direct vehicle access to the home or any on-street parking, include:

- Ability to reshape street design to include low carbon surfacing;
- Less neighbour conflict, better social integration;
- Ability to design in social space within the street, spaces for girls and other groups;
- Release of significant street area to provide larger trees (shading), SuDS, areas for biodiversity and BNG credit, more green space credit and creating a healthier enjoyable place.

Power

V2C looks to promote a single EV battery 'community' in each car parking area, thus creating a 'virtual power station' at every car park, with a direct link to the site primary sub station. This adds significant control over the V2C battery resource, both for import and export, for which payment can be received for providing a large grid flexibility/ demand management offer.

Discussions with iDNOs confirms that the 'primary sub station link model' allow them to potentially reduce per household power allowances don from c.4kVA towards 1 kVA, which would significantly benefit developers through reduced infrastructure and network reinforcement. Work is still ongoing and this is a matter where further investigation and testing with regulators is ongoing.

The payback for homeowners can be significant. Indra, who have ben running various rials with UK government, have fond that trialists can virtually eliminate their energy bill through V2G, and it is anticipated that V2C would do the same if not better that through canopy solar (which isn't normally possible with a home driveway parking space).

National Grid has been clear on their position that they see 'batteries on wheels' being the driver for the power system to reach net zero.

CO2

The benefits to CO2 come from the following sources:

1. Bidirectional charging gains
2. Solar canopies on parking courts/barns
3. Residual benefits from street design, vegetation/landscaping, water neutrality, SuDS etc.

Indra has calculated the gains from 1 and 2 above, using their UK government trial experience. Their estimation is that the solar and bidirectional CO2 savings would be in the order of **1.7 tonnes per annum per parking space**. Please note, this assumes an EV user who is well engaged with the process, hence this is considered at the upper end of the range. Further work is needed in order to gauge the potential CO2 savings and gains from items in 3.

Water potable water efficiency savings

There is also the potential for carbon savings to accrue from the implementation of water tanks underneath V2C barns, thus providing the potential for improved potable water efficiency. The assessment makes the following assumptions:

- Development is currently delivering a minimum of 100 litres potable water per day per person – Eddington, Cambridge is the only site we are aware of that has

reached 80 l/d/p and only because of the large storage tank under open space (e.g. the tank we are proposing to put under car parking areas

- The CO2 figure for potable water production of 150 kg CO2 per million litres as per the Annual Emissions Report, 2021, Water UK. This ignores the fact that some water companies have a green energy tariff, but that doesn't seem unreasonable for this exercise.

An assessment has been made of all scenarios in the calculation, but it is unlikely that JAM would be able to implement large tanks to the same degree as DD and UZC. You could compare values in columns C and D in the table below to show savings.

		Potable Water	Potable Water	CO2 kg /m litre	CO2 kg /m litre	kg CO2 Saving 120 vs 80 l/p/d	kg CO2 Saving per annum
	Population	100	80	150	150		
		litres pp pd	litres pp pd	100 litres pp pd	80 litres pp pd		
JAM	8400	840,000	672,000	126	101	25	9,198
DD	9600	960,000	768,000	144	115	29	10,512
UZC	14040	1,404,000	1,123,200	211	168	42	15,374

Table 1: Estimated CO2 savings from potable water production

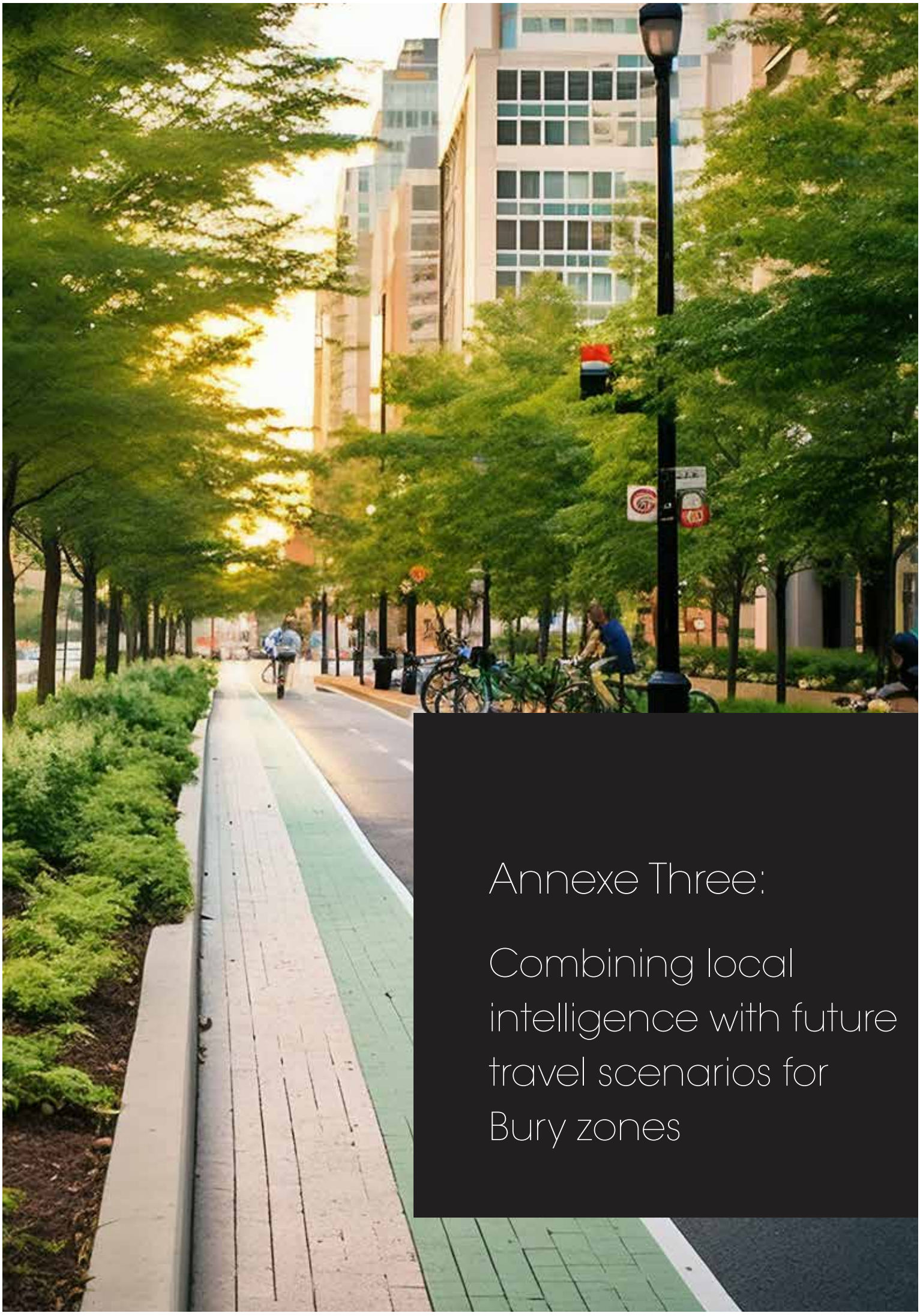
In essence, this illustrative assessment suggests that DD gets to a lower potable water CO2 level than JAM even though there are 1200 more residents on the site.

Additional gains could be estimated from V2C helping accelerate renewable generator implementation, again an area for further work. We are in discussions with Field Dynamics on this point.

Developer Benefits

Developer benefits are expected to include:

- Reduce overall parking quantum and space requiremen
- Potential to increase development density by reallocating drive and street spac
- Potential to meet emerging Water Neutrality requirement
- Reduced SuDS are
- Reduced infrastructur
- Reduced power (electricity) construction and reinforcement costs, sped up deliver
- Potential to hypothecate part of the energy payback to fund sustainable transport measures



Annexe Three:

Combining local intelligence with future travel scenarios for Bury zones

Combining local intelligence with future travel scenarios for Bury zones

Magda Smith, Senior Analyst, Transport for the North; November 2022.

1. Introduction

1.1 Overview of the project

This study proposes to undertake research into the planning and design of different place typologies, to test how these might change if net zero mobility was to be delivered, to assess the barriers to society and the market to delivering them, and to make suggestions about how better decision making could be facilitated. In doing this, it will be adopting a decide and provide approach to identifying how the vicious circle might be broken.

a. Establish demand profiles, together with the assumed transport systems and carbon outcomes for each Place Typology/ FTS combination – 2040/ 2050, and benchmarking against other urban areas.

b. What changes in demand would be likely to be needed to bridge the gap and meet net zero mobility objectives, (eg reduction in single occupancy car use and proportionate take up in other modes dependant on FTS)?

c. Bridging the Gap Workshop - defining potential interventions needed to bridge the gap between current plans and net zero mobility, including transport systems and services, and land use interventions.

d. Assessment of which transport and land use system scenarios best meet net zero mobility/ quality of life/ deliverability & value for money aims to inform the Societal Readiness Assessment.

e. Interim report and wider stakeholder engagement

f. The Societal Readiness Workshops – assessing the barriers people will experience in adapting to the proposed transport and land use interventions proposed for each FTS for each place typology

g. Defining net zero mobility place parameters – based on barriers identified and prepare urban design illustrations of how these places might be difference from today's masterplans, such as Transport System & Services, Land Use Mix, Planning Policy and Urban Design

h. Market Readiness Workshops – to consider what the barriers to delivery of net zero mobility places could be, and potential solutions

i. Final Report and wider stakeholder engagement.

1.2 Establishing demand profiles

The aim of this exercise is to provide demand profiles for the TfN's Future Travel Scenarios for different types of areas in Bury.

This part is undertaken using a combination of data from:

- TfGM – base matrices for rail and highways

- TfN – Future Travel Scenarios for rail and highways as % growth between 2018 and 2040/2050 from External Forecast System (EFS); additionally, outputs in terms of mode splits for future years for all modes for Bury are also provided from Northern Economy and Land Use Model (NELUM).

2. Methodology

Overview

TfGM base demand for the aggregated PT zones were then 'grown' using flat factors between 2018 and 2040 and 2018 and 2050 extracted from TfN's EFS model.

TfGM base demand for Bury

TfGM base matrices are available at quite a detailed zonal level for Bury compared to TfN's Future Travel Scenarios which are more aggregated in terms of a zonal distribution (district based).

TfGM has three zoning systems for:

- rail
- highways
- aggregated PT zoning system, nesting rail and highway zones (this zoning system was used for this analysis).

The demand data was presented as following:

- 3 time periods (AM, IP, PM)
- Origin Destination level
- 5 user classes (Commute, Employer's Business, Other, LGV, HGV) – only first three used to match TfN's matrices
- Highway demand is presented in passenger car units – TfGM base demand needed converting to persons to match TfN's matrices

TfN's Future Travel Scenarios in EFS

Documentation for this model is presented within Transport for the North's GitHub: GitHub - Transport-for-the-North/NorMITs-Demand

The processing included:

- Extracting demand for each scenario for highways and rail for years 2018, 2040 and 2050 to then work out flat factors between 2018 and 2040, and 2018 and 2050 to 'grow' the base (2018) TfGM demand.
- TfN's rail model is in 24 hrs format so this required aggregating TfGM's rail matrices across time periods.
- Aggregating results to TfGM aggregated PT zoning system.

TfN's Future Travel Scenarios in NELUM

Documentation for this process is presented here: Future Scenarios Technical Annex (transportforthenorth.com)

The processing included extracting demand, population and filled jobs for Bury and Rochdale districts and aggregating it to TfGM's PT zoning system.

3. Outputs

Please be aware that any of the provided results are based on the best available data at the time of production. The outputs provided for Future Travel Scenarios are based on a lot of assumptions and also carry limitations from models which can result in inaccuracies in some places.

2040 and 2050 demand should be interpreted by looking alongside the levers that are introduced for each of the scenarios across different years. This can be found in the graphic below, but is described in more detail in the technical annex here: Future Scenarios Technical Annex (transportforthenorth.com)

The following outputs were provided for the project:

- Rail matrices for each scenario are presented with a starting journey in Bury district per TfGM's aggregated zoning system: TfGM base matrices were 'grown' using factors calculated from Future Travel Scenarios in TfN's EFS

- Road matrices for each scenario are presented with a starting journey in Bury district per TfGM's aggregated zoning system: TfGM base matrices were 'grown' using factors calculated from Future Travel Scenarios in TfN's EFS

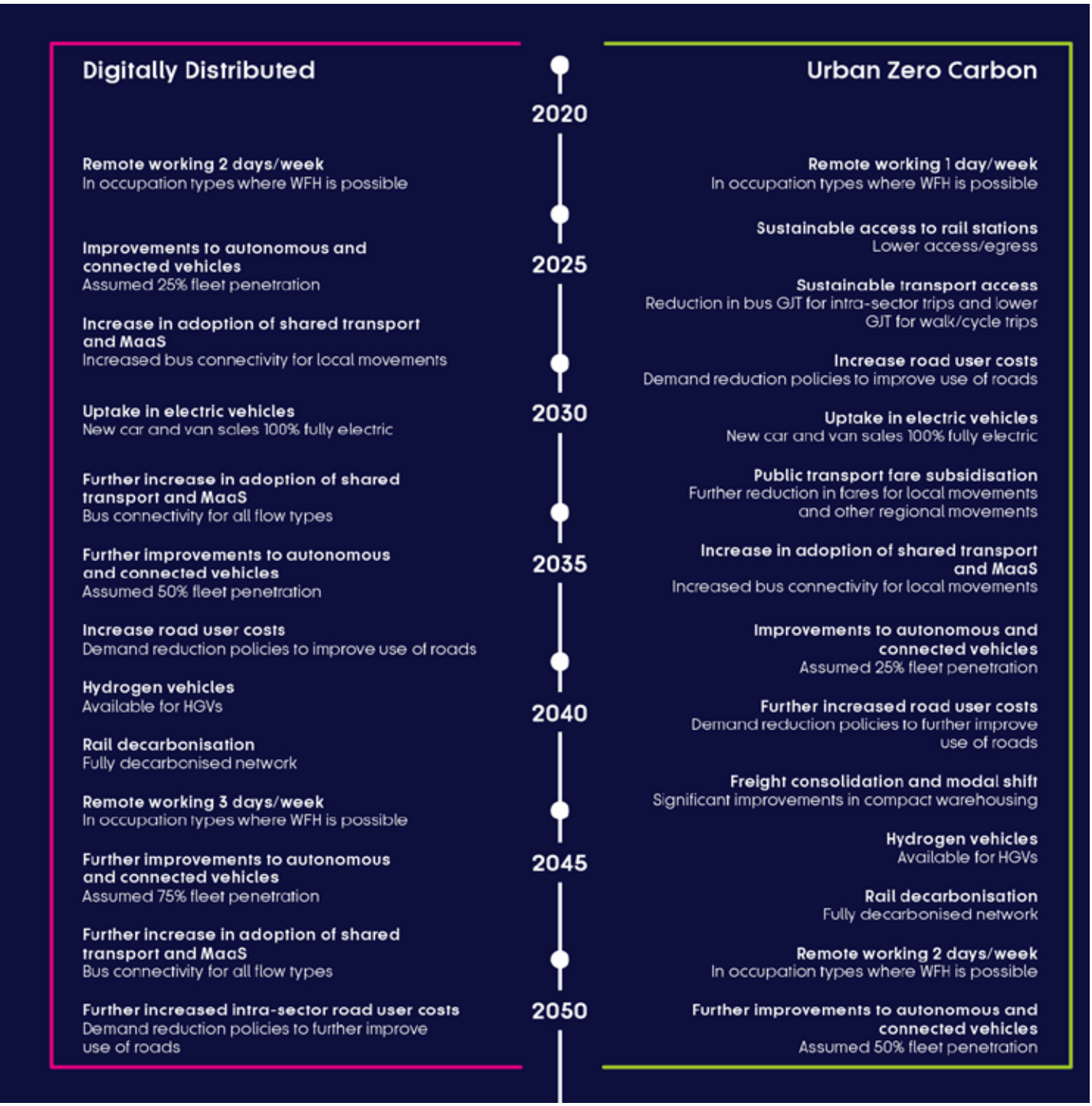
- Mode shares for each scenario from TfN's NELUM

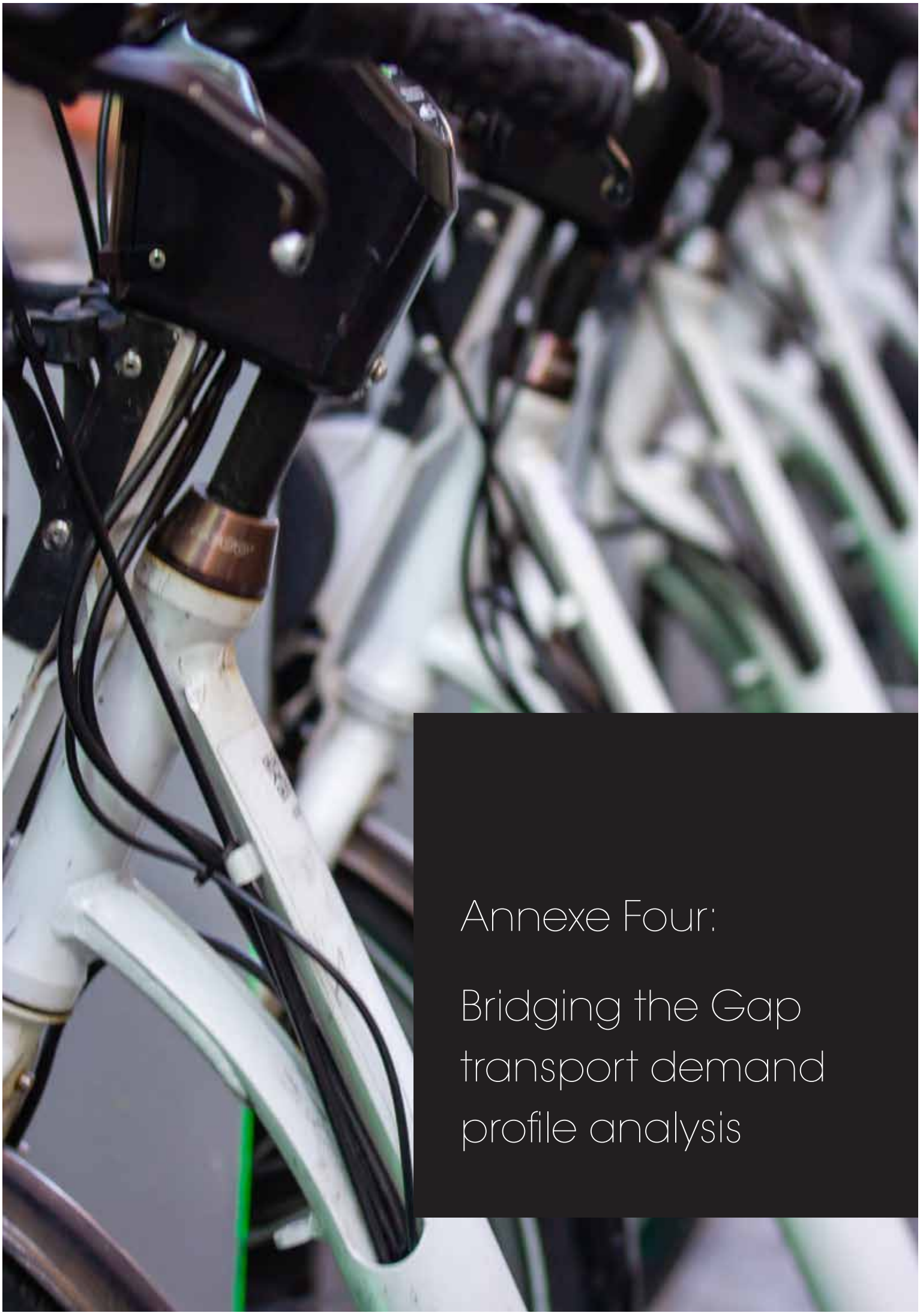
- Population and job growth for each scenario by district

Purpose	
1	Commute
2	Business
3	Other

Time periods	
1	AM
2	IP
3	PM

Figure 16: What changes our scenarios imply for key transport related developments, policies and measures


Digitally Distributed
2020
Remote working 2 days/week
In occupation types where WFH is possible
2025
Improvements to autonomous and connected vehicles
Assumed 25% fleet penetration
Increase in adoption of shared transport and MaaS
Increased bus connectivity for local movements
2030
Uptake in electric vehicles
New car and van sales 100% fully electric
Further increase in adoption of shared transport and MaaS
Bus connectivity for all flow types
2035
Further improvements to autonomous and connected vehicles
Assumed 50% fleet penetration
Increase road user costs
Demand reduction policies to improve use of roads
2040
Hydrogen vehicles
Available for HGVs
Rail decarbonisation
Fully decarbonised network
2045
Remote working 3 days/week
In occupation types where WFH is possible
Further improvements to autonomous and connected vehicles
Assumed 75% fleet penetration
2050
Further increase in adoption of shared transport and MaaS
Bus connectivity for all flow types
Further increased intra-sector road user costs
Demand reduction policies to further improve use of roads
Urban Zero Carbon
Remote working 1 day/week
In occupation types where WFH is possible
Sustainable access to rail stations
Lower access/egress
Sustainable transport access
Reduction in bus GJT for intra-sector trips and lower GJT for walk/cycle trips
Increase road user costs
Demand reduction policies to improve use of roads
Uptake in electric vehicles
New car and van sales 100% fully electric
Public transport fare subsidisation
Further reduction in fares for local movements and other regional movements
Increase in adoption of shared transport and MaaS
Increased bus connectivity for local movements
Improvements to autonomous and connected vehicles
Assumed 25% fleet penetration
Further increased road user costs
Demand reduction policies to further improve use of roads
Freight consolidation and modal shift
Significant improvements in compact warehousing
Hydrogen vehicles
Available for HGVs
Rail decarbonisation
Fully decarbonised network
Remote working 2 days/week
In occupation types where WFH is possible
Further improvements to autonomous and connected vehicles
Assumed 50% fleet penetration



Annexe Four:

Bridging the Gap transport demand profile analysis

Bridging the Gap: Transport Demand Profile Analysis

David Collis, Principal Consultant, Stantec.
May 2023.

Analysis of available transport data was undertaken to determine the likely demand profiles and trip distribution for the Elton Reservoir development.

Data Sources

Transport data was sourced from Transport for Greater Manchester (TfGM) and Transport for the North (TfN). This includes demand data from a Variable Demand Model (VDM) from TfGM covering the Bury and Rochdale districts. Carbon data was obtained from TfN's NoHAM model.

Data was provided for four Future Travel Scenarios (FTS) from both the VDM and NoHAM model. The future travel scenarios are:

• Just About Managing (JAM)

• Digitally Distributed (DD)

• Prioritised Places (PP)

• Urban Zero Carbon (UZC)

For the purposes of the demand analysis, the Just About Managing, Digitally Distributed, and Urban Zero Carbon scenarios were used.

VDM Data

The VDM model consists of 378 zones. Data was provided for origin zones in Bury and Rochdale rather than all zones. Bury consists of 18 zones and Rochdale consists of 24 zones.

Data was provided for 2018, 2040, and 2050. For this assessment, 2040 has been used as the future year.

Population and jobs for all 378 zones was provided for the base year of 2018.

The VDM data was provided for three time periods:

• AM: 08:00 – 09:00

• IP: 10:00 – 16:00 (Average hour)

• PM: 17:00 – 18:00

The data is split into three user classes:

• UC1: Commute

• UC2: Employer's Business

• UC3: Other

The VDM model includes two additional user classes (UC4: LGV and UC5:HGV) but data was not provided for these, so this demand has not been analysed.

Distance skims were obtained from the VDM model. This provides the distances for each zone by time period and user class. This was combined with the VDM demand data to calculate vehicle kilometres associated with each zone movement.

NoHAM Data

The NoHAM model consist of 1,072 highway zones. For this assessment data was provided for trips originating in only the Bury and Rochdale districts which accounts for 51 zones in total.

Data was provided for 2018, 2040, and 2050. For this assessment, 2040 has been used as the future year.

There are 3 vehicle types within the model: Car, LGV and HGV. For this assessment the car vehicle type was used as this will be the most reflective of the demand data from the VDM.

Carbon Calculations

The TfN NoHAM data was used to calculate CO2 emissions per kilometre. The carbon data was provided in two categories: grid and tailpipe. This allows for the carbon data to be calculated separately. This is important given that the tailpipe emissions are significantly lower in the future travel scenarios as the vehicle fleet shifts from fossil fuels to electric. The grid emissions reflect the proportion of the grid that is based on carbon emitting sources.

Data for the combined Bury and Rochdale districts was used to calculate the total vehicle kilometres and total CO2 emissions to calculate the average CO2 per kilometre for each scenario.

Trip Calculations

The Elton Reservoir site lies to the West of Bury and lies within VDM Zone 31. Given the minimal housing currently within the zone a nearby donor zone was used to determine the likely travel patterns for the Elton Reservoir site. Zone 25 was chosen as the donor zone for trip distribution.

Trips for the Elton Reservoir site have been calculated by comparing the population to the donor zone. The Elton Reservoir site was tested in three scenarios: Just About Managing (JAM), Digitally Distributed (DD), and Urban Zero Carbon (UZC).

To convert number of dwellings to population, analysis of the 2021 census was undertaken to determine the average number of residents per dwelling in the Bury Local Authority District. The analysis showed there are 2.4 residents per dwelling on average.

The number of dwellings and estimated population in each scenario are as follows

The donor zone has a population of 10,856 so factors for each scenario were calculated by comparing this value to the forecast Elton Reservoir population in each scenario. The trip distribution from the donor zone is retained.

Trips from the VDM model represent the peak hours. To calculate daily trips, the peak hour data was factored up based on analysis of National Travel Survey (NTS) data.

NTS table 0503 was used which is the "Trip purpose by trip start time" table. Factors for commute and business (VDM user classes 1 & 2 respectively) were based on NTS trip purposes of commuting and business respectively. Factors for other trips (VDM user class 3) was based on a weighted average of all other trip purposes from the NTS data. The factors were derived to uplift peak hour to peak period. The sum of the three time periods represents 07:00-19:00 so further factors were derived from the NTS data to factor the 12-hour trip totals to 24-hour.

Scenario	Dwellings	Population
Just About Managing	3,500	8,408
Digitally Distributed	4,000	9,609
Urban Zero Carbon	5,850	14,053

Table 1: estimated dwellings and population for each scenario

Time Period	Peak Hour	Peak Period	Commute	Business	Other
AM	08:00-09:00	07:00-10:00	2.51	2.13	1.70
IP	Average hour of 10:00-16:00	10:00-16:00	6	6	6
PM	17:00-18:00	16:00-19:00	2.23	2.80	2.69
12-hour to 24-hour	07:00-19:00	00:00-00:00	1.25	1.12	1.10

Table 2: Peak hour to peak period factors

Northern Gateway

A review of the VDM data showed that the Northern Gateway development was not included in the data. This is a large employment site of approximately 22,000 jobs and is likely to be operational before 2040. The Northern Gateway site lies within VDM Zone 36.

To account for Northern Gateway the employment trips for Zone 25 were re-distributed with more trips sent to Zone 36. This was done by calculating the current jobs in Zone 36 (1,523) trips from Zone 25 to Zone 36 were then factored up by 22,000 / 1,523 = 14.4. The increase of trips between these zones was then removed from trips from Zone 25 to all other destinations proportionally.

Travel Summary

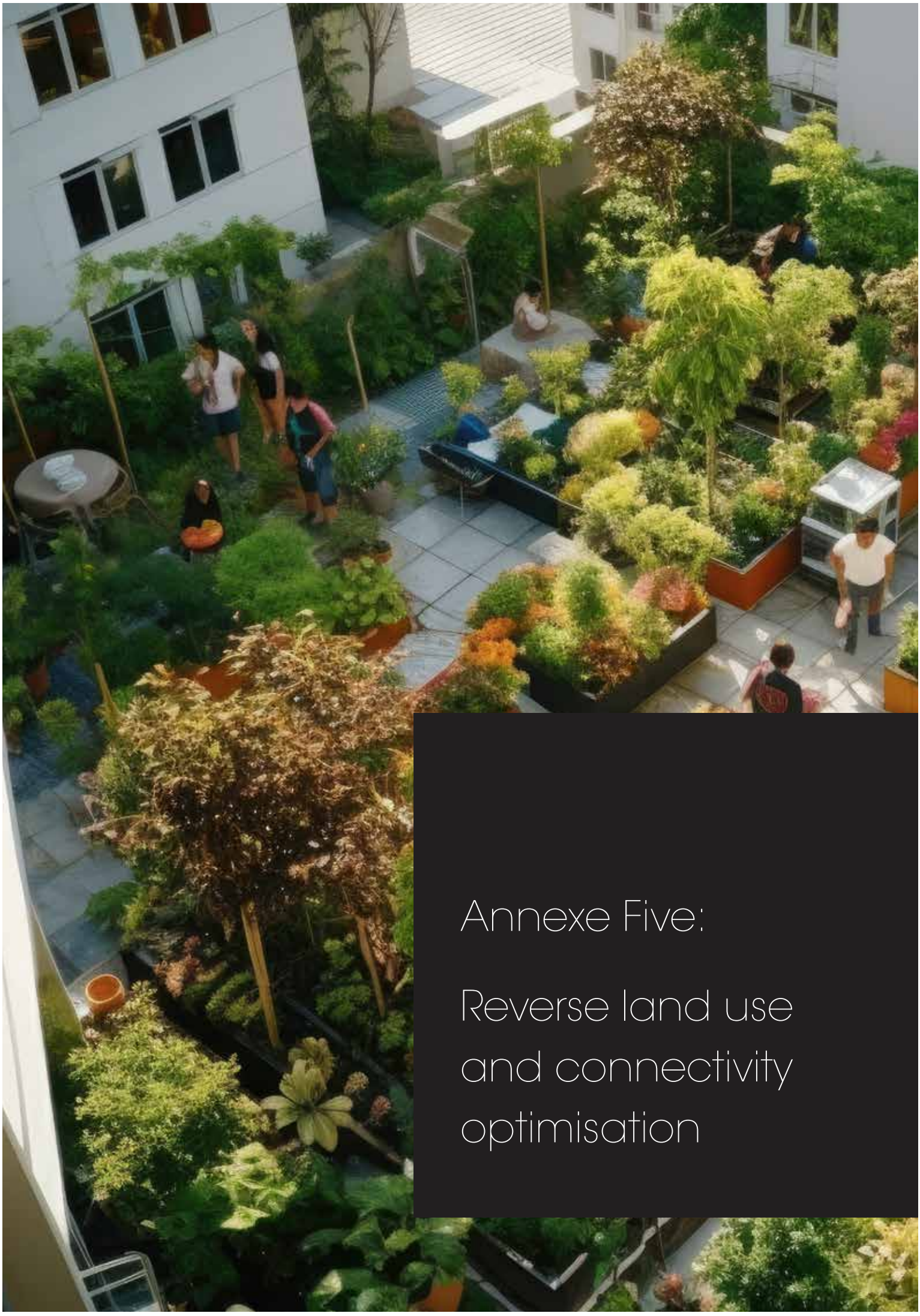
Elton Reservoir trips to the rest of the network have been summarised based on trip distance and destinations. Trips totals have been reported to Bury town centre and Manchester city centre. Both destinations offer a key opportunity for transport mode substitution. Summaries of trips to zones near the Strategic Road Network (SRN) have also been summarised as there is potential to offer public transport services on the SRN corridors to reduce car demand.

Northern Gateway is a large employment site and will therefore include a significant number of trips concentrated to all small area. As such there is also significant potential for mode shift so trips to this zone were summarised.

Trips between 5 and 40 km have been summarised as these trips form a large proportion of the total vehicle kilometres. While there are many trips shorter than 5km, these trips are short and are only a small part of the total vehicle kilometres (and therefore carbon). Trips between 5 and 40 kilometres cover the Greater Manchester area and settlements such as Warrington and Burnley. Trips above 40km (such as Leeds) are longer distance trips where local interventions will have less opportunity to reduce vehicle trips.

Car Trip Reduction

The trip generation and distribution summaries have allowed for an understanding of the transport needs of the Elton Reservoir site. This understanding can be used to determine where effective transport intervention can be delivered to reduce the total car vehicle kilometres.



Annexe Five:

Reverse land use and connectivity optimisation

Bridging the Gap: Reverse Land Use and Connectivity Optimisation

Steven Reid: Senior Associate and Transport Planning Digital Practice Lead, Stantec. May 2023

Before considering the delivery of a community at Elton Reservoir, it is first important to understand the current context of the site, in terms of both location and the connections it currently affords. It is essential to begin any land-use planning exercise focussing on the relative connectivity between 'people and place', as the way people live their lives is intrinsically linked to the connections or travel choices available to them.

The concept of 15 or 20 minute cities / neighbourhoods is now a key planning paradigm – a concept which emphasises local living, whereby residents can access most if not all of their everyday needs within a short walk or cycle from their residence. Core to the concept is four aspects (i) proximity, (ii) diversity, (iii) density and (iv) ubiquity. The rise in popularity of this concept can be linked to the response to the Covid19 pandemic, where residents were forced to spend more time locally, which in turn helped to strengthen the bond and affinity for many with their local neighbourhoods.

In working from home and spared the daily commute, more residents have enjoyed exploring their neighbourhoods – shopping, dining, exercising and socialising locally. The potential here is that there could be a shift away from normal planning practices with the decentralisation of some services towards local hubs and neighbourhoods. This concept has thus challenged authorities to consider transforming transport networks and land-use provisions to support more active travel connections in and between local communities. This concept could lend itself well to the site at Elton Reservoir, but how can we determine this?

Stantec has developed a connectivity-based appraisal framework, which combines bespoke digital tools and processes into the Sustainable Transport Audit & Appraisal Toolkit (STAAT). The toolkit provides the framework to assess transport networks at both the local and strategic level, enabling an agile data-driven and evidence-led methodology for identifying issues in connectivity by sustainable transport modes and their relationship with wider land-use planning.

The STAAT provides us with the ability to examine the relationship between specific land uses and connectivity, taking account of existing and potential future transport connections. This raises the possibility of being able to make an assessment of neighbourhood planning alternatives to help inform the size of the opportunity for trip substitution and modal shift through various land-use and transport-based interventions. Assessing both the local and strategic context, the framework developed a seven-step process with the outcomes being:

- An assessment of current provision and levels of connectivity by walking, cycling and public transport to key services and destinations within the Bury conurbation and beyond (Manchester for example)
- 15 and 20 minute neighbourhood assessment by mode
- Identify for all postcodes, services reachable within the 15 and 20 minute assessment
- Inverse the calculation to identify those services not reachable within these times (reverse land-use)
- Inform the discussion on what land-use services to provide on site, which would stimulate a 15 / 20 minute neighbourhood, both onsite and neighbouring communities
- Suggest the optimum location in which to situate these hubs on site to maximise accessibility for all residents (informed by Newcastle University – urban morphology)

The figure opposite illustrates the steps undertaken:

Having undertaken a "current" conditions run, the process highlighted several land-use and transport interventions that could be provided to reduce the number of perverse incentives for car ownership and use for some local journeys. Provisions were considered and arrived at collaboratively for each of the three scenarios; Just About Managing, Digitally Distributed and Urban Zero Carbon. Each of these provisions were integrated into each forecast scenario and the assessment repeated for each.

The outcomes of this appraisal was an understanding of potential "current" trips which could be substituted for more local, sustainable trips. This included an estimated saved kilometres, based on future residents of the site choosing to use services provided on site (identified through the land-use assessment) in addition to neighbouring communities making use of these facilities instead of travelling to services further away.

Therefore, by undertaking this reverse land-use assessment to understand what services communities are not connected to, provisions can be made on site to both facilitate the delivery of the number of homes identified, in addition to improving connectivity for neighbouring communities, both residential and commercial, thus not only contributing to reducing the number of trips made by private vehicles, but also helping to stimulate the local economy through access to life opportunities for residents and access to the labour market and customers for local businesses.

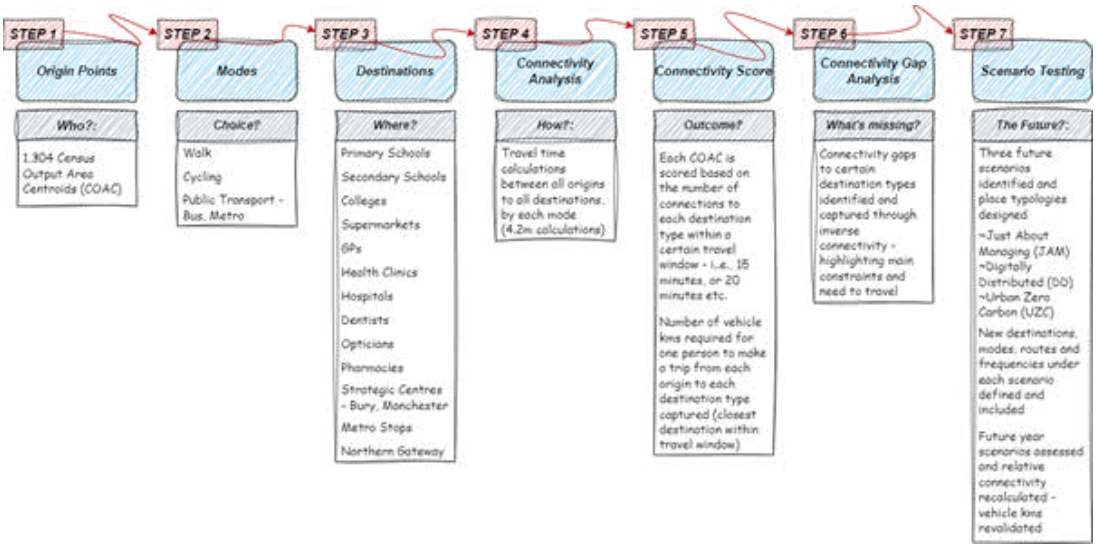
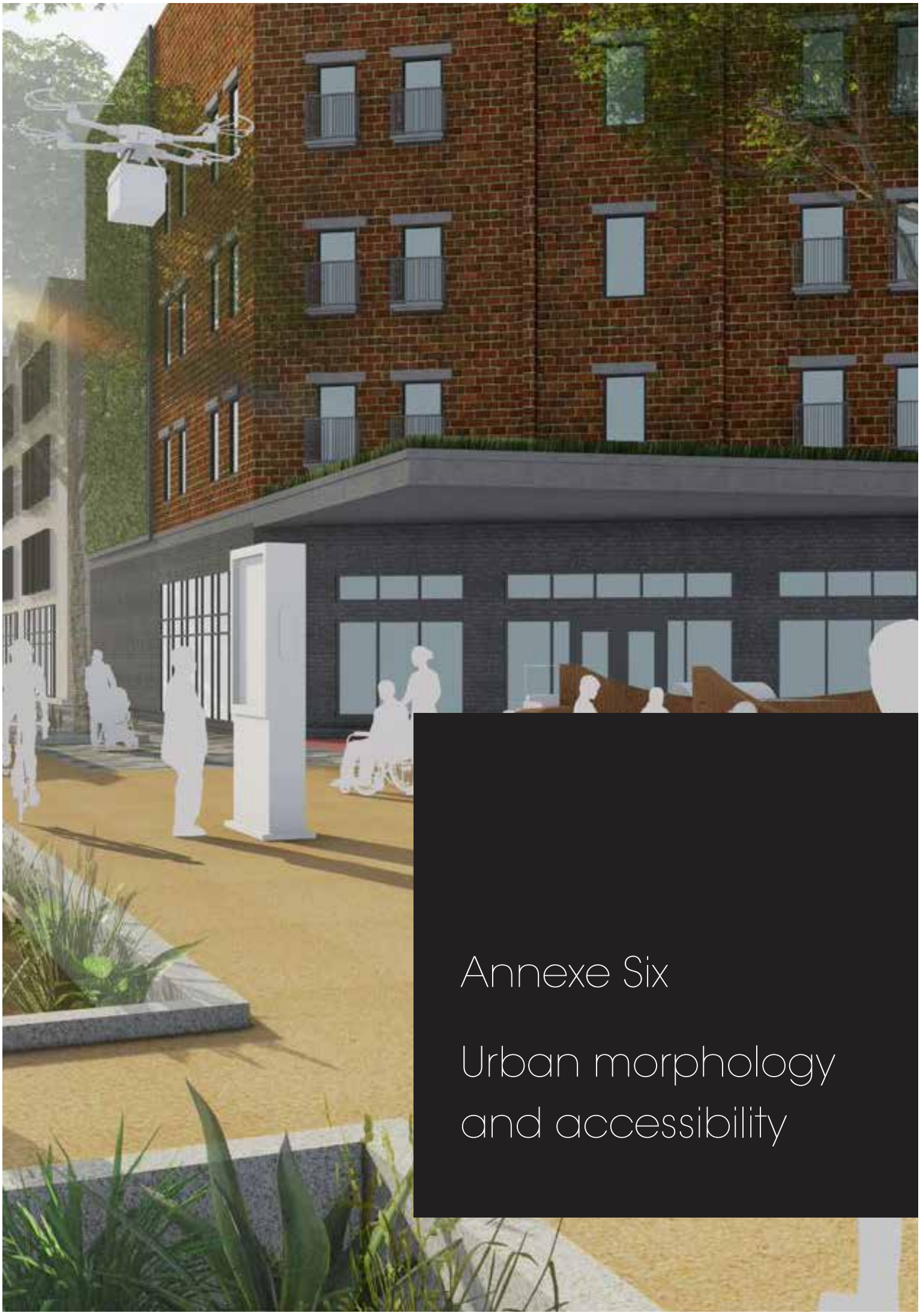


Figure 1: Connectivity Analysis Methodology



Annexe Six

Urban morphology and accessibility

Bridging the Gap Urban morphology and accessibility

Clara Pieret-Garcia, PhD Student,

EPSRC Centre for Doctoral Training in Geospatial Systems, SAgE Faculty, Newcastle University. September 2023

Newcastle University is currently advancing research in the field of activity based accessibility. This perspective on accessibility takes into account the activity and mobility patterns of different demographic groups i.e. preferred modes of transport, most commonly used urban amenities and incorporates them into accessibility metrics By integrating these factors into accessibility metrics, this methodology provides a broader and more comprehensive understanding of what constitutes an accessible city for different individuals. Recognising and accommodating these varying needs and pref erences is essential for guiding decisions in inclusive urban planning. Moreover, it contributes to the optimisation of land use and transportation systems, ensuring that they effectively serve the needs of all members of the community.

Furthermore, Newcastle University is actively engaged in evaluating the impact of urban morphology on accessibility. This research is underpinned by the recognition that different urban designs will be more suited for different transport modes. For instance, more compact ur ban forms favour active modes of transport such as walking or cycling, while more convoluted, sprawled models will foster car use. Gaining insights into how urban design shapes mobility choices is imperative for the strategic planning of sustainable urban development.

Figure 01. Compact versus sprawled urban forms.

Access to key amenities was assessed by developing an isochrone map. This analysis allowed us to evaluate the time it would take to reach basic services by different modes of transport and determine which areas present gaps in accessibility based on the cu rrent distribution of amenities. We performed this analysis for the entirety of the Bury conurbation.

Once this first step of the analysis was undertaken, we tested the potential increase in accessibility after the new amenities are built, considering th e master plan design. We observe important increases in access to basic amenities that not only benefit the planned new development area, but also its surroundings. This will likely result in a decrease in the use of the car as a mode of transport in favor of cleaner alternatives such as walking or cycling, due to the decrease in travel times to access basic amenities.

Accessibility levels were developed to support assessment of the preferred location for amenities, taking into account connectivity and se rvice provision. Whilst this was not used directly to inform master plan layouts for Elton Reservoir, (because that stage has not yet been reached), the work done confirmed proof of concept for an analytical approach to master plan design through the assessment of distance travelled and carbon emissions for alternative sccenarios.

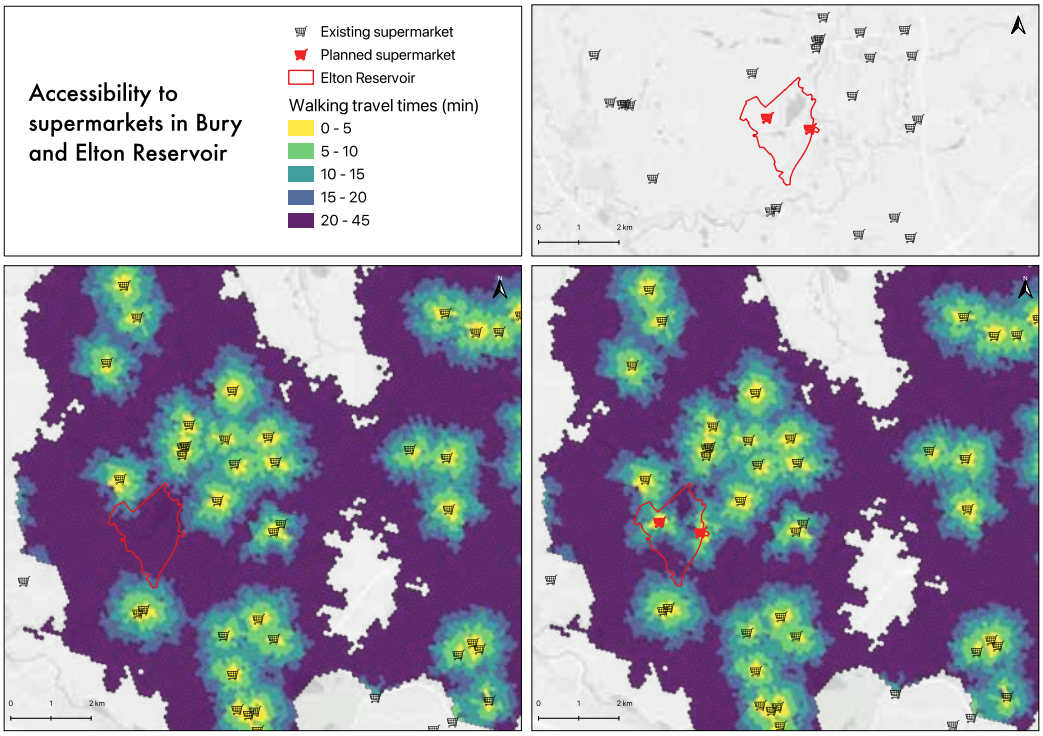
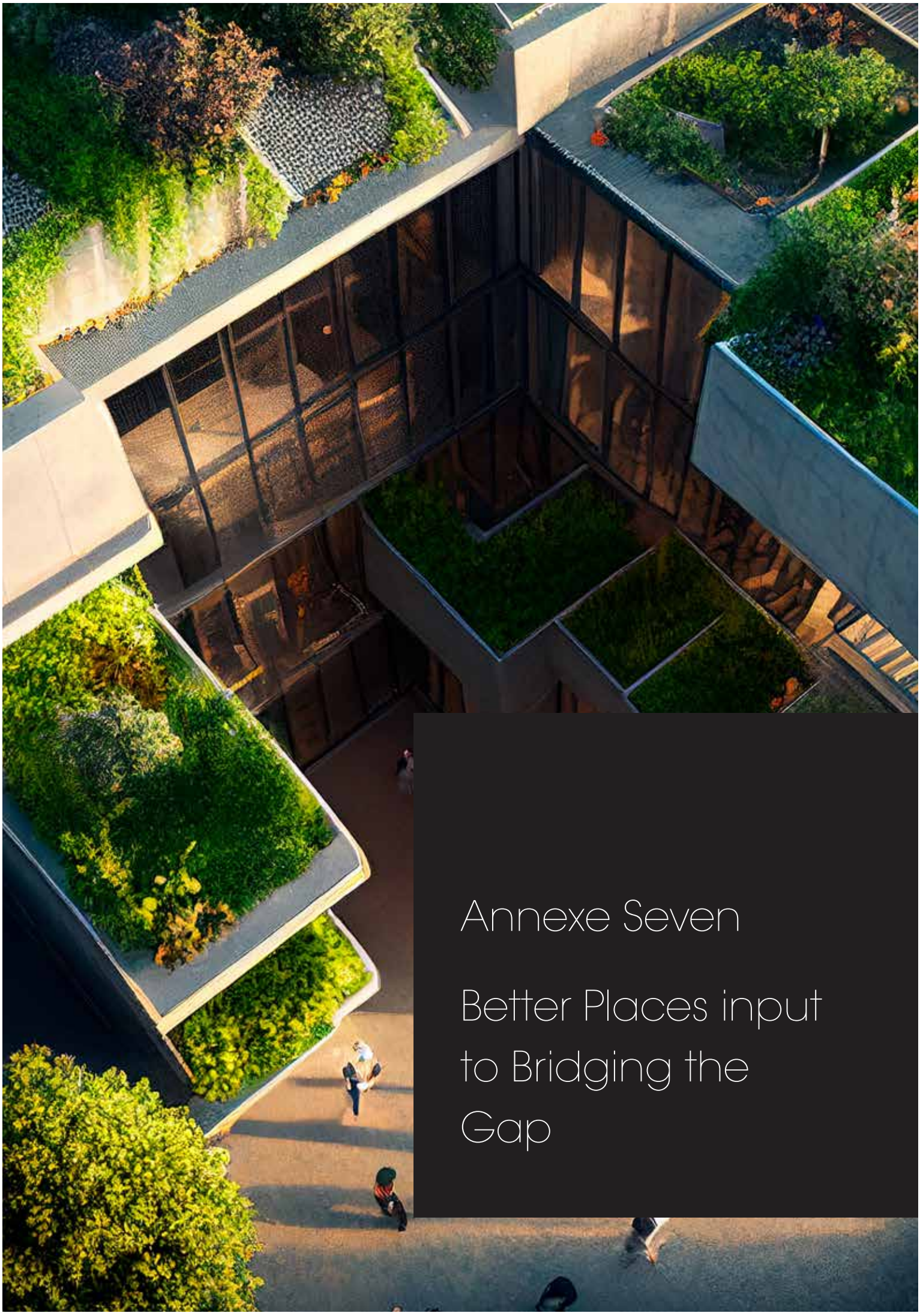


Figure 02: Assessment of Accessibility Levels for Bury, with and without new amenities



Annexe Seven

Better Places input to Bridging the Gap

Better Places Input to Bridging the Gap

Prudence Wales, Associate Health and Social Value Consultant, Stantec. September 2023

Stantec

Purpose and Approach

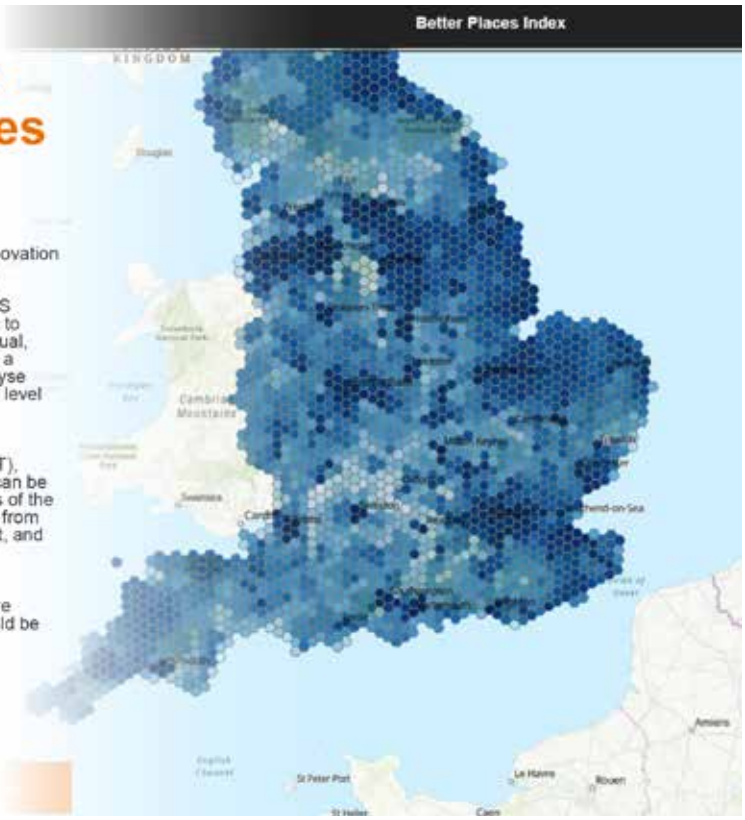
- The purpose of this briefing note is to provide recommendations on how social value considerations can be considered within the Bridging the Gap Place Typologies.
- Social value has many different meanings according to different stakeholders. In this report we have based our approach the UK Green Building Council's definition (2021):

'in the context of the built environment, social value is created when buildings, places and infrastructure support environmental, economic and social wellbeing, and in doing so improve the quality of life of people'

- According to social value best practice it is important to consider social value is specifically tied to its local context and who is affected by the project.
- For the project we have focused on datasets within the Better Places Toolkit (BPT) exploring social and community infrastructure that could be provided to support positive wellbeing outcomes within the place typologies.
- This is a data-led GIS picture to create a snapshot of the current social and community infrastructure provision in Bury and the surrounding area, to help understand what recommendations for future land use from a social value perspective.

What is the Better Places Toolkit

- Through Stantec's internal innovation programme led by our Global Innovation Office, we brought together our data analysts, GIS experts and social value team to build a tool that provides a visual, quick, and easy way to create a baseline of local context, analyse areas down to neighbourhood level and measure change.
- The Better Places Toolkit (BPT), alongside the policy context, can be used to identify characteristics of the local area which could benefit from social intervention, investment, and development.
- This allows us to identify where social value interventions would be most meaningful.



Deciding where to focus

The Better Places Toolkit covers six over-arching themes, 18 subthemes. Some of these sub-themes that that make up different requirements for places where 'individuals may feel their lives to be happy, active, sociable, interesting and meaningful'.

As the scope of this analysis is to provide some recommendations on what social and community infrastructure may be beneficial within identified areas within Bury and Rochdale, we have focused on those data sets which address these issues.

This process included:

- Looking at what underlining baseline data is relevant to recommendations regarding both social value and land-use
- Refining what data sets within the BPT drive these outcomes
- Providing focused recommendations on what additional elements could make a more socially valuable place

Creating a Baseline

Approach to the Baseline

The Better Places Toolkit is intended to allow for a rapid analysis of local characteristics, rather than provide a fully statistical baseline and is a snapshot of an existing area.

For this project we have chosen to primarily rely on the Indices of Multiple Deprivation Data (last updated in 2019) to understand the overall socio-economic baseline within the local area and have focused on those domains which have explicit links to planning and land-use. We have then used data-sets within the BPT to explore these topics further.

It is important to note here that we have not included information in our baseline regarding other demographics such as gender, ethnicity, languages spoken and disability. These are all important and have significant impacts on the way people use transport. We have made recommendations about including this in the future project recommendations section.

An example of demographic baseline information that would need to be considered within a social value baseline is population changes regarding age. Both Bury and Rochdale have seen an ageing population (65+) between the 2011 and 2021 Census. However, the have also had a higher-than-average increase in children under 15. These trends may impact recommendations regarding community and social infrastructure.

Bury

An ageing population between 2011 – 2021:

- 19.8% rise in residents aged 65 + (20.1% England average)
- 1% rise in residents aged 15-64 years (3.6% England average)
- 5.2%rise in children under 15 (5% England average

Rochdale

- An ageing population between 2011 – 2021:
  - 19.7% rise in residents aged 65 + 20.1% England average)
  - 1.5% rise in people aged 15 – 64 (3.6% England average)
  - 9.6% rise in children under 15 (5% England average

Indices of Multiple Deprivation (IMD)

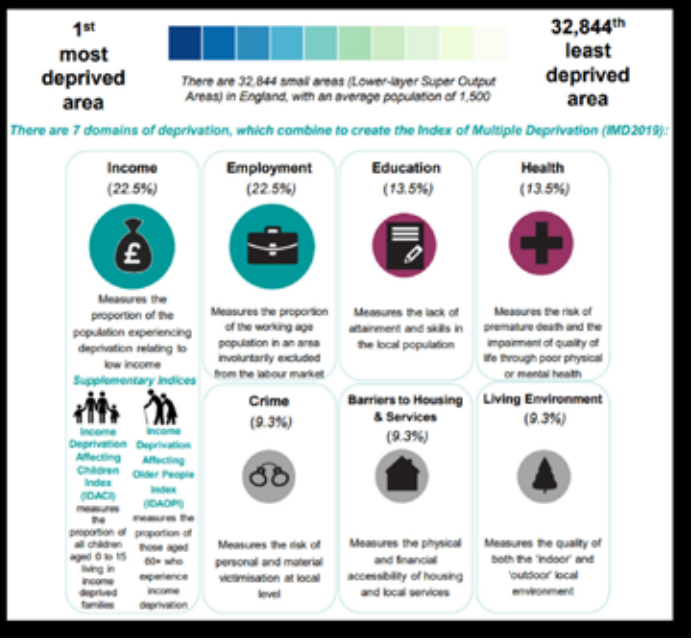
As mentioned, for this project we chose to use the BPT to map IMD data as the starting point of our baseline to give an overview of likely issues before diving into key themes. Below is an overview of what IMD explores.

Each small area (LSOA) in England receives a ranking from most to least deprived area for each domain

The domains are combined to create an overall IMD ranking for the LSOA

Relative rankings allow areas to be compared to each other

The latest data can be found for 2019



Baseline: Overall Indices of Multiple Deprivation

The two site areas rank amongst the least deprived LSOAs in the country. Elton Housing site boundary (site 1) is in the 10% least deprived neighbourhoods and Northern Gateway site boundary (site 2) comprises neighbourhoods in the 50% least deprived areas. Both sites sit between two more deprived areas, which is important when considering the integration of existing communities and how new facilities are made accessible and inclusive.

Both Site 1 and Site 2 are mostly undeveloped areas, it is important to look outside these boundaries to understand existing communities.

Map 1: IMD Data Overall Indices of Multiple Deprivation

12 LSOA's out of the 120 (10%) making up the Local Authority of Bury rank within the top 10% most deprived deciles within England, overall Bury has 52.6% of LSOA's within the top 5 most deprived deciles. All 12 of these LSOA's are shown in this map and are relatively close to the northeast and southeast of Site 1.

Within the Local Authority of Rochdale, there are 40 LSOA's out of the 134 (29.9%) LSOA's making up the Local Authority, within the 10% most deprived decile, with 76.9% of LSOA's within the top 5 most deprived deciles. Some of these highly deprived sites are shown to the north and south of Site 2 with the remaining located within Rochdale town centre.

The following slides explore these trends in more detail.

Access to community and cultural assets

Baseline: IMD Domain Barriers to Housing and Services

Data from the IMD Barriers to Housing and Services fall into two sub-domains:

- 'geographical barriers', which relate to the physical proximity of local services
- 'wider barriers' which includes issues relating to access to housing such as affordability and homelessness.

The local services included are road distance to post offices, primary schools, supermarkets, and GP surgeries.

The wider barriers include household overcrowding, homelessness and housing affordability.

Map 2: IMD Barriers to Housing and Services

Similarly, to the overall IMD rank, barriers to accessing to housing and services also low within Site 1 and Site 2, due to the lack of residential development.

There are pockets of higher deprivation towards the northeast of Bury town centre (Bury 008E). However, the higher levels of IMD deprivation within this area do not seem to be primarily driven by this domain. The only LSOA in the top 10% most deprived that is overlapping with the site in fact falls within the 50% most deprived for housing and services.

In the centre of Bury, there are pockets of higher levels of housing and services deprivation. Interestingly, only one LSOA within Bury ranks in the top 10% most deprived LSOA's for barriers to housing and services (Bury 022A) immediately south of site 2. This mapping does not explore what is driving this deprivation, but there are potential severance issues to consider for this area.

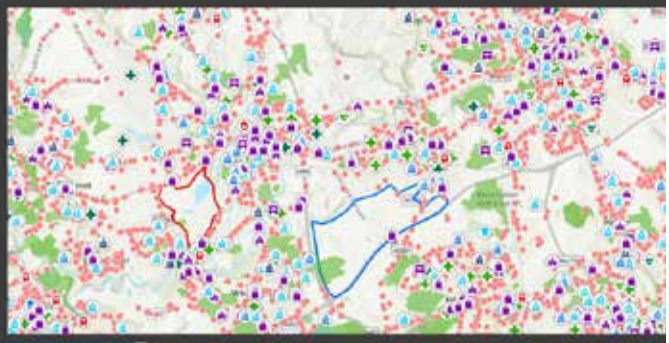
Better Places: Social Infrastructure & Cultural Density

To explore the IMD baseline data further we have mapped a range of local facilities and infrastructure and explored the BPT Cultural density ranking.

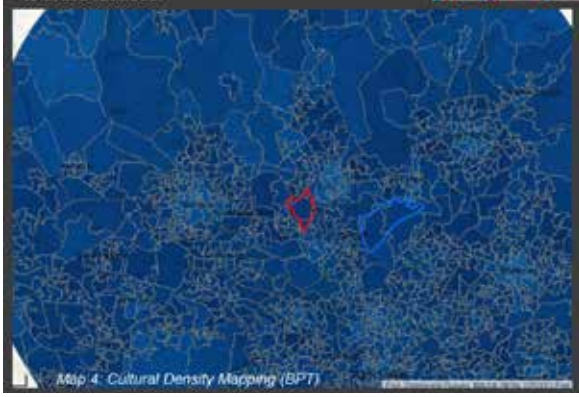
This mapping includes:

- GP surgeries
- Sports and Leisure Centers
- Education
- Art Gallery's
- Libraries

We have also included existing bus routes (the pink circles) to show potential patterns of access to these facilities.



Map 3: Local Facilities and Infrastructure Mapping



Map 4: Cultural Density Mapping (BPT)

There is limited local facilities and infrastructure and directly within Site 1 and Site 2. However, there is an existing primary school within the Site 1 boundary and facilities immediately outside the redline boundary within Radcliffe.

Site 2 is more limited in terms of immediate facilities, with infrastructure such as GP's, supermarkets and education being location within Middleton.

The BPT cultural facilities rank reflects this overall pattern with lighter LSOA's around urban centers have greater density of cultural facilities.

Measures to integrate new and existing community identity would need to be prioritised. As well as developing an understanding of how these facilities are currently used and accessed to understand if there is a perceived deficiency in the local area.

Enabling Healthier Lifestyles

Baseline: IMD Domain Health Deprivation and Disability

The IMD Health Deprivation and Disability domain includes data regarding premature deaths, illness and disability ratios, morbidity indicators and data on mood and anxiety disorders.

Fundamentally, it measures the risk of premature death and impairment of quality of life through poor physical or mental health.

Within Bury as a whole 65.8% of LSOA's are within the top 50% of most deprived areas in this domain, and in Rochdale 85% of LSOA's are more deprived than average.

This indicates that levels of poor health and disability are lower in these areas as a whole relative to the national average.

Map 5: IMD Health Deprivation and Disability

One overlapping LSOA with Site 1 (Bury 009B) is within the top 10% relative most deprived LSOA's within England, the other immediate LSOA'S to Site 1 (Bury 014C and Bury 015D) and Site 2 (Bury 017A and Rochdale 20F) fall outside top 20% most deprived LSOA's for barriers to health services.

Place-based design should encourage healthy principles, that embed long-term health outcomes. Through understanding the implications of the above data, and how wider determinants of health through the built environment (such as access to green spaces discussed below) can impact this domain a stronger case can be made for design interventions that prioritise health.

Better Places: Active Travel, Public Transport and Green Space

Public Rights of Way the Cycle Network and public transport

Map 6: PRoWs, Cycle Paths, Public Transport & IMD 2019

Currently, accessing local town centres from Site 1 and 2 would prove difficult through walking and cycling, and public transport.

We can see the cycle paths present within Bury. One does pass through the edge of Site 1, but Site 2 is not situated near any existing cycle networks.

This data is then overlayed with the Indices of Multiple Deprivation, showing that the two sites sit between areas of high levels of deprivation. Linking up areas with updated travel infrastructure could benefit communities within these areas to access more opportunities.

Proximity to Green Space

Green space is highlighted in the right-hand map in green. The dark blue areas are areas with limited access to green space, the lighter the blue the more access there is to green space.

From the map, we can see that in fact the centre of Bury has better access to green space than some more 'rural areas'. It is unclear at this stage whether these green spaces are useable spaces or not and this could be affected by severance and route access.

Map 7: Proximity to Green Space (BPT)

Better Places: Healthy Assets and Hazards

The maps to the left and below draw on data from the Access to Healthy Assets and Hazards data set (2022), which ranks LSOA's on a variety of characteristics based on proximity to health determinants.

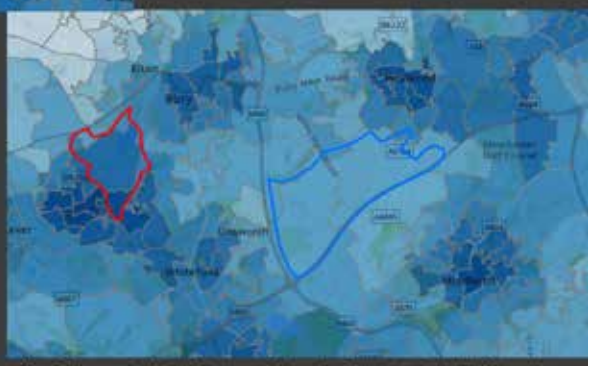
Access to healthy Assets map on the left, shows, by LSOA's distances to dentists, hospitals, blue space, green space, GPs and leisure facilities. The lighter LSOA's have better access.

Map 8 : Access to Healthy Assets and Hazards – Proximity to Healthy Assets (BPT)

Access to healthy hazards maps distances to hazards including fast food retail, gambling, pubs and tobacco.

As an overview, the areas with higher access to healthy assets and health hazards seem broadly similar, however, there are some differences around the extent of access to each domain. This is perhaps not surprising given patterns of previous development.

Consideration of preventative measures, designing out noise and air pollution hazards, prioritising elements such as active frontage and walkable streets and conditioning engagement with health professionals are examples of how to embed social value.



Map 9 : Access to Healthy Assets and Hazards - Proximity to Healthy Hazards (BPT)

Economic and Income Resiliency

Baseline: IMD Domain Employment Deprivation and Income Deprivation

Map 9 : IMD data Employment Deprivation

The IMD domain regarding employment deprivation, primarily maps data regarding receipt of unemployment benefits.

Employment deprivation is most prevalent in the outer areas of the Bury town centre and south of Site 1 in Radcliffe, as well as towards Heywood and Middleton. This is reflective of wider trends, where more urban areas have higher rates of unemployment.

25% of LSOA's within Bury are within the top 20% most deprived areas within England for employment deprivation, in Rochdale this stands at 43.3% and is mostly clustered in the town centre and Heywood. The west of the borough tends to perform better in this domain, with 3 LSOA's being in the top 10% least deprived areas.

The Income Deprivation domain is based on a variety of indicators concerning households who receive a range of means-tested benefits.

Similarly, to employment deprivation, there are 25% of LSOA's within Bury within the top 20% most deprived – with 15% in the 2nd decile. These are centre around Bury town centre and Radcliffe, with pockets in Whitefield.

39.6% of LSOA's within Rochdale are within the top 20% most deprived LSOA's within Rochdale with similar patterns to employment deprivation.

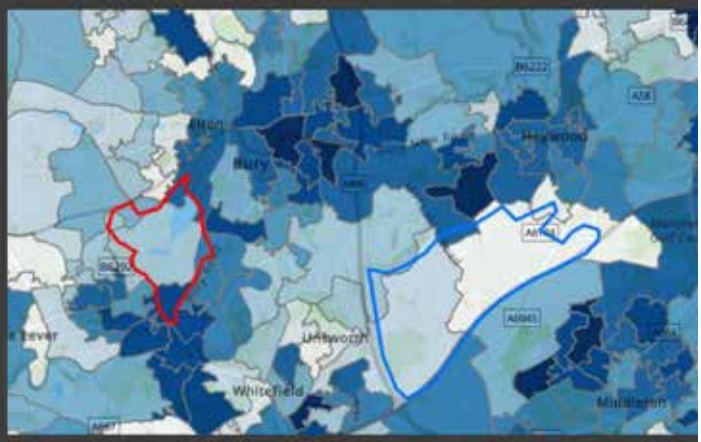
Map 10 : IMD data Income Deprivation

Fuel Poverty

The fuel poverty data
Fuel Poverty is an indicator based on household income, household energy requirements and fuel prices, and this data set is from the Priority Places Index (2022).

Fuel poverty here can be seen to cluster around familiar areas towards the south of Site 1 into Radcliffe and towards Whitefield, areas of bury town centre, Middletown and Heywood.

This reflects other deprivation data outlined in the employment and income IMD baseline and may be a factor when considering how to enable capability for existing communities to respond different scenarios and typologies regarding both communication and engagement approaches and supportive interventions.



Map 11 : Fuel Poverty

Better Places: Affordability and Opportunity

The equity of a just transition to Net Zero is an oft controversial topic.

The BPT provides information regarding affordability, which is key area of low resiliency within the tool for both Bury and Rochdale, and this measure contains data regarding both income after housing costs, housing affordability ratios and income deprivation.

There are clear discrepancies around the site, reflected in the IMD data described elsewhere, regarding access to economically sustainable housing. With some areas, including site 1's LSOA performing much higher.

Map 12 : Opportunity BPT

Map 12 : Affordability BPT

Opportunity within the BPT model refers to the economic and educational status and attainment within an area.

Opportunities for local communities to access these educational and employment opportunities is crucial to the resiliency of an area, and is dependent on many interlinking factors, including the wider regional economy.

This is a key cross over with the myriad of issues associated with mobility poverty and transport related social exclusion, where recent studies have demonstrated that lack of access to affordable, efficient and safe transport have profound impacts on people's life chances.

Therefore, this map should be looked at to help guide suggestions on areas that may benefit from targeted transport interventions.

Key Recommendations

The information in this presentation is a data snapshot regarding the existing community. There is recognition that the elements spoken about can interact and reinforce each other. Altering wellbeing outcomes is dependent on multiple complex factors, many of which would be outside the remit of changing the planning system and land-use.

However, based on the information mapped using the Better Places Tool the following initial recommendations can be made regarding potential land-use and interventions:

Social and Community Infrastructure

- Outlining clear requirements within area SPD's for **public access green space**, which respond to different density projections
- Providing a **range of recreation spaces**, responding to future need and attracting different age groups (e.g. sensory play/open fields/ low impact fitness stations/ therapeutic gardens)
- **Co-location of services** regarding multi-use health and wellbeing services (such as elderly care centres, occupational health and wellbeing services, community health hubs) and social infrastructure (such as cafes, libraries, youth centres)
- Need for dedicated social spaces integrating new and existing communities – this could include dedicated sports facilities, arts & culture such as cinemas/theatres/workshops.

Healthy Lifestyles

- Design codes which prioritise **well-designed accessible streetscapes** for pedestrian's and cyclists, including: tactile sidewalks/ clear signage/ curb ramps/kerb cuts/ accessible parking/ accessible street furniture / integrated with green spaces and shade.
- **Nature-based solutions** prioritised (for example community gardens, SuDs, green roofs/walls, urban forests, raingardens/bioswales ecological corridors/ biodiversity requirements)
- **Integrated new active travel schemes** with existing used routes e.g. active travel trails
- **Conditioning of planning engagement requirements** such as health professional engagement

Economic Resiliency

- **Affordable spaces built-in**, including use of covenants and management structures (for employment incl. adaptable unit sizes, housing policy and dedicated community social use)
- **Co-location of services** around hubs to reduce need for chain-journeys, particularly health and education services as mentioned above
- Opportunities for **higher education expansion and specialist skills centres (e.g. light industrial workshops)**
- **Targeted transport interventions:** using geo-spatial data to guide decisions on targeted areas where support such as subsidies, training or implementing specific service timetables.

Future Project Recommendations

The below recommendations are included to consider how the Better Places approach could be used in similar projects and integrated with the other assessments within Bridging the Gap:

Better Places through the Project Lifecycle:

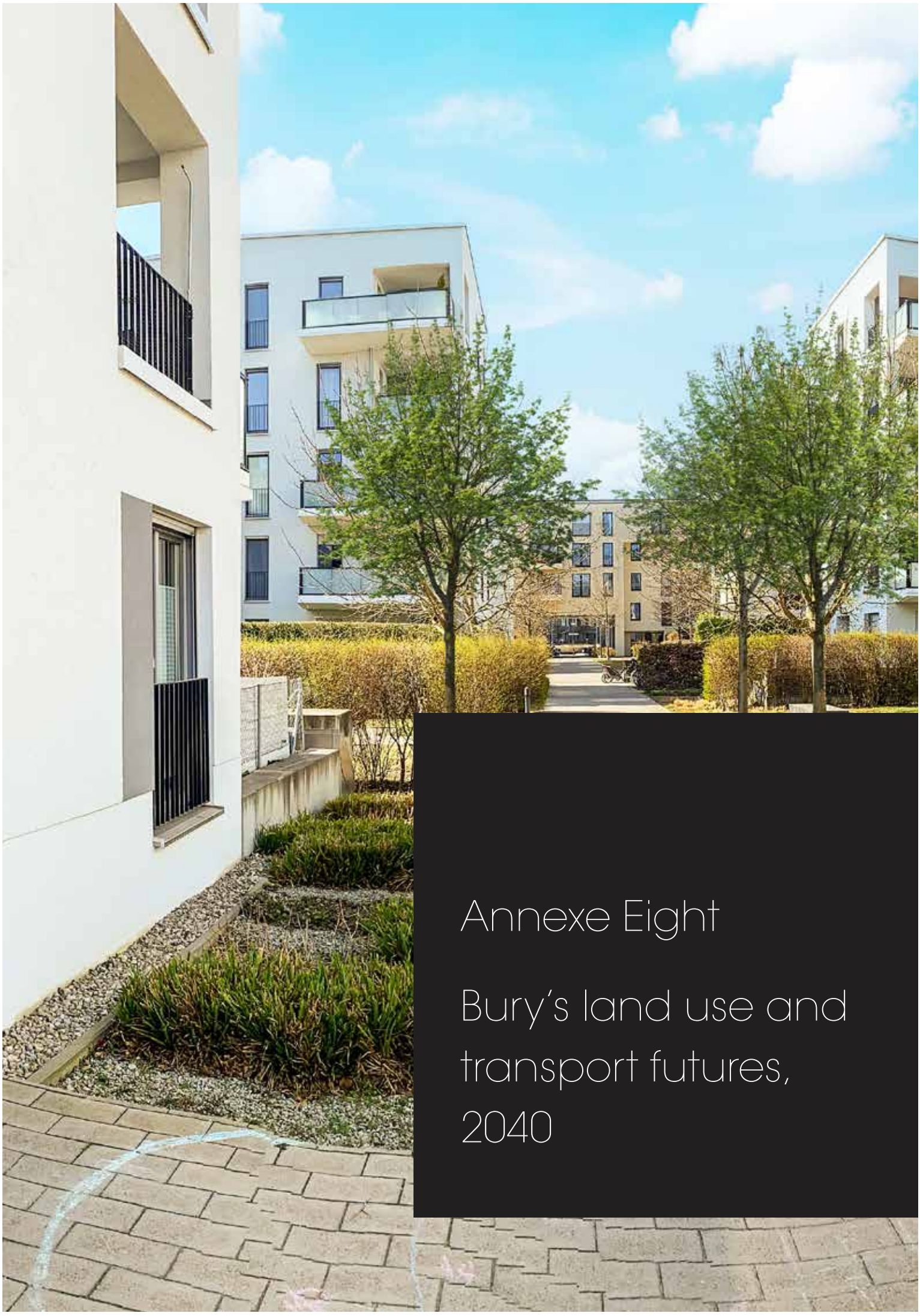
Project Inception
BPT is designed to give a snapshot of social value resiliency in a local area and can help inform initial conversations regarding potential project principles
- It can be used to align multiple technical teams in thinking through wider social, economic and environmental considerations

Project Development
- It can be used to engage public sector and community stakeholders; including through sense-checking the national data sets with on the ground knowledge and integration with smaller scale data.
- Information collecting through BPT should be used in conjunction with information such as travel time and connectivity data to show accessibility from multiple angles and how this interacts with wider determinants of social, economic and environmental exclusion

Project Monitoring
- The active data (qualitative data from engagement) can be integrated within the tool to sense check baselines and assumptions, and also understand changes in behaviour and monitor impacts.

Approach to baseline
This assessment baseline is a light touch approach using the Indices of Multiple Deprivation. However, it is recommended that a full baseline be undertaken at project inception for similar future projects including the consideration of demographics and Protected Characteristics. This information is intrinsic in shaping engagement, interventions and understanding potential recommendations.

Engagement
The baseline uses national datasets offers a birds eye view of an area, the granularity needed to understand local needs, wants and interactions with existing provision is achieved through both passive data (the analysis provided) and active data (how people feel about their communities on the ground) to create a rounded picture. Therefore, integrating with societal readiness engagement is a must moving forward.



Annexe Eight

Bury's land use and transport futures, 2040

Bury's land use and transport futures

Keith Mitchell, Director, Transport and Place, Stantec. May 2023

Baseline 2040

We have taken the baseline as assuming the successful delivery of the Bury Local Transport Strategy and GM Transport Strategy. This would approximate to Just About Managing up to 2040.

An increasing number of extreme weather events and migration increases talk about the need to do something about climate change, but nothing ever really seems to happen in terms of changes in daily life. People remain unwilling to change their behaviours.

Economic growth has continued at a moderate rate. There are still geographical and social inequalities, and the economy is more fragile and open to disruption.

There is still a housing shortage and much new housing remains sub-urban in nature, with provision of 2 cars at or close to home.

Those who can, work 2 days a week at home, and most travel to work by car – unless rail provides a convenient alternative.

Car ownership remains high and the private car is still the most dominant form of transport. Most cars are now EVs, but ICE vehicles are still in use. Autonomous vehicles are beginning to take off, but regulation hasn't kept up with technology and the mixed transport environment is challenging.

Highway networks are becoming increasingly congested, and this is affecting public transport as well as car journeys as investment fails to provide the necessary priority for buses or shared mobility services.

Public transport is working well in urban areas, and are beginning to be replaced by other shared mobility services such as automonous shuttles, but lack of subsidies means that sub-urban and rural services are struggling.

People are walking and cycling a bit more than they used to, mainly because of the rising health agenda and investment is better facilities.

Freight remains very largely road based through a system of national and regional distribution centres, with each urban area having a number of private sector driven local distribution hubs from which local deliveries are made.

Baseline Travel Scenario

Locally, the Baseline is assumed to include:

- A new central interchange which will transform the quality of provision, provide for substantially improved interchange between tram, bus, cycling and walking. NB the interchange will make provision for the Bury to Rochdale tram-train proposal, but it is not assumed that this will be delivered.
- A new tram stop at Elton Reservoir, together with a programme of tram stop improvements and associated provision of mobility hubs.
- Quality Bus Corridors and whole route bus priority strategies along

o A58 Bury to Rochdale

o A58 Bury to Bolton

o A56 Bury to Manchester

o A56 Bury to Ramsbottom

- Provision of Mobility Services including mobility hubs, bike hire, bike, e-bike, car/ EV share and EV taxis., and genuinely connected networks for walking and wheeling, well connected to local amenities, with cycle parking, storage and wayfinding.

- Provision of additional EV charging facilities. The level of investment and increased capacity is not specified, and it is assumed that this will fall significantly short of demand, assuming the rate of transition to EV assumed in TfN's Future Travel Scenario
- Township plans aimed at improving local facilities and connectivity, together with the provision of local amenities elsewhere needed to support 15 minute neighbourhoods, including new recreation spaces, with prioritised investment in walking and cycling
- Street space reallocation from car to active and public transport, provision of shared street spaces, and implementation of low traffic neighbourhoods and 20 mph zones within the existing urban area
- At the GM level, the Clean Air Zone was implemented in May 2022, but other forms of demand management are not assumed to be included in the baseline.

What is not included in the Baseline Travel Scenario?

Baseline Land Use Future: The baseline land use future for strategic land development is assumed to reflect current principles of design for residential and employment development, including

- Residential densities of around 35 dwellings per hectare
- Residential parking of 2 spaces per dwelling, with more for larger dwellings
- Employment plot ratios of 30 – 40%
- Employment parking ratios of between 1:20 sqm GFA for office and 1:100 sqm GFA for warehousing
- Streets designed primarily for cars, but with well designed facilities for walking and cycling
- Local Centres provided as market demand allows, providing retail, GP surgery and pharmacy, 2 Primary Schools and a Secondary School in Radcliffe.

Substitute	**Switch**
• Provision of Work-hubs and co-working spaces. • Requirements for new development to deliver a significantly greater range of local amenities. • Support for home working through provision of superfast broadband. • Implementation of digital public services and learning opportunities .	• Incentivisation of EV charging. • Grants to trade in petrol of diesel vehicles*. • Provision for hydrogen fuel cell vehicles*. • Conversion of vehicle fleets to EV*. • Encouragement of EV fleets through licensing or corporate leasing.
Shift	**Freight**
• Provision of Demand Responsive Transit systems or automated vehicle shuttles. • Provision of controlled parking zones or other parking restraint measures. • Workplace parking or other road user charging strategies*. • Development of a Sustainable Urban Management Plan.	• Trial consolidation hubs for freight. • Provision of rail cargo hubs • Provision of logistics infrastructure. • Development of micro-consolidation centres. • Provision of flexible pick up and drop off points.

Table 1: measures not included in the baseline (equivalent to Just About Managing)

* Probably/ possibly out of scope for the purpose of developing new scenarios and place typologies

Digitally Distributed: 2040 Context

We have assumed that all the Baseline transport measures have been implemented, but other measures and trends are influencing the way we live and travel. This scenario is led by technology and a willingness to embrace mobility as a service.

Climate change is being addressed through government policy making and market behaviour. This is driving digital and technological change which is impacting people's lives.

Digital and technological advance accelerate, transforming how we work, travel and live and we move towards a distributed, service based economy. Economic growth is as predicted, and the more distributed life-style means that smaller conurbations benefit from increased economic activity as well as the larger ones. Those that can pay are able to benefit from being able to travel individually.

The development of housing has continued at pace, but this has been widely distributed around larger and smaller towns. Densities have increased a little, and parking is now constrained to a maximum of 1 space per dwelling for those who still want to own their own car. Car storage is peripheral whilst mobility services are designed to be more accessible.

As people increasingly work from home, travel becomes less city-centric. The total number of trips being made falls, but trips get longer as journeys become more distributed. For those that can't work from home, their jobs are increasingly located at out of town business parks and industrial estates which can be accessed using a more distributed transport system.

Car ownership remains high, and EV take up is strong. Autonomous vehicles are reasonably widespread now.

Optimised road pricing and higher levels of online activity has reduced some trips but some peak hour highway congestion remains.

Public transport use is relatively low, but new shared mobility services are now being implemented which are enabling travel for those who can't pay for individual travel.

Changing work patterns are increasing available leisure time. This is leading to a limited in increase the amount of walking, cycling and micro-mobility for short, local journeys

Freight and distribution centres have been established at many locations around the urban area and highway network, and these are served by efficient autonomous vehicles and innovative delivery options.

Digitally Distributed +: Bury's Transport Future:

- All the baseline proposals are assumed to have been implemented.
- Large scale investment in EV charging and provision of renewable energy sources to deliver full transition to EVs by 2050 (so well on the way by 2040) and significant levels of autonomy.
- A range of pay as you go mobility services have been implemented, including:

o Active and micro-mobility services

o A fleet of EV light vehicles is introduced, providing a mobility service for movement around the local conurbation (5 – 40kms)

o Car clubs develop into EV car and van services, either self drive or autonomous

o Public transport services are provided as a range of shared autonomous mobility services.

- Interchange is provided on Northern Gateway close to the SRN to provide interchange between local mobility services and shared autonomous, 'Motorway Flyer' passenger services along the SRN.
- Road-space optimisation is required to provide for increased use of local mobility services, including active/ micro mobility services and EV light. Priority lanes and segregated routes are provided for the shared mobility systems to high volume destinations.
- Road User Charging has (finally) been introduced, but this remains disconnected from other mobility services.
- Parking for private cars is constrained, and mobility services are promoted.
- Interchange for freight is provided between strategic freight and local shared mobility services, which make use of overnight capacity to deliver to a supporting network of freight hubs across the conurbation.

Digitally Distributed +: Residential Land Use Future

• Medium density development/ sub-urban development with densities around 50 – 55 dwellings per hectare.

• Provision is made for super-fast broadband to support home working and work hubs and other local businesses.

• Autonomous shared mobility services/ shuttles provide frequent and regular services around new development, with:

o Direct access to the new tram stop near Elton Reservoir and segregated/ priority provision between Elton Reservoir and Northern Gateway (for employment and access to SRN mobility services).

o Access to the secondary schools and college to the South of the town centre and the new secondary schools provision in Radcliffe.

• 5 Local mobility hubs provide for EV charging, mobility hubs, freight hubs, etc. The mobility hubs would provide:

o a centre for active and micro-mobility services.

o a centre for local EV mobility services which can be called autonomously to your front door, making this option more convenient than owning your own car.

o a stop on the autonomous shuttle network

o a freight pick up and drop off facility, and autonomous robots which deliver to your front door for a charge

• Two local centres providing a focus for community amenities, including work-hubs and other land uses identified as gaps in local provision, such as local retail, GP clinics and primary schools.

• Parking provision limited to 1 space per dwelling, located in shared V2C parking areas around the development, within 5 minutes walking distance. These V2C hubs provide a means of using EV batteries to manage energy demand at peak times thus reducing the scale of energy provision for development.

• Additional parking provision can be purchased for an annual charge which will be located at the perimeter for non EV vehicles. These charges are used to address the price difference between public and private EV charging facilities.

• Plot design provides covered facilities for personal cycle/ e-bike/ e-scooter storage close to the front door

• Street design is focussed on provision for local mobility services and active modes on residential streets, and an optimised highway distributor network for autonomous shuttles, EVs and EV light vehicles providing access to V2C mobility hubs.

Digitally Distributed +: Employment Land Use Future

• Provision is made for super-fast broadband to support technology forward businesses, e-learning linked with academic institutions, and e-working practices.

• Provision is made for collaboration, well-being, health and education facilities on site enabling innovation and efficient working practices.

• Autonomous shuttles provide frequent and regular services around new development, providing access from remote car parks and EV charging hubs, and segregated/ priority provision between Northern Gateway and Elton Reservoir.

• Passenger interchange facilities are provided between local mobility services, local autonomous shuttles and SRN shared autonomous passenger services

• Freight handling facilities are provided, enabling local deliveries to be taken from HGV platoons on the SRN via overnight capacity on mobility services to local freight hubs.

• Parking adjacent to buildings is available only for EVs which are parked in charging hubs.

• Provision is also made for EV light vehicles, micro-mobility services, active modes.

• Street design provides priority for active modes, micro-mobility and shared mobility services.

Urban Zero Carbon: 2040 Context

We have assumed that all the Baseline transport measures have been implemented, but other measures and trends are influencing the way we live and travel. This scenario is led by strong government action, urban placemaking and densification.

Climate change has become a key political issue which drives strong policy making in favour of climate action by Government which a instils willingness to change personal travel behaviour.

Economic growth has been boosted by investment in green business and climate change/ adaptation solutions. Cities and larger towns have benefited and have become attractive places to live, but more rural and coastal towns have struggled.

New housing has responded to the urbanisation agenda and where possible is being delivered close to public transport hubs and at higher densities with very limited car parking.

Working patterns have become blended between work from home or in work hubs using active modes or local micro-mobility services, and travelling to work using public transport.

Car ownership is low. Most of the fleet are now EVs and the energy system has decarbonised so that both tailpipe and system are on their way to being zero carbon. However, these are mostly provided through mobility services, some of which are autonomous.

Road use is subject to a road pricing system which is used to manage demand, and ensure capacity is available for other, shared and active transport modes.

Public transport services provide the spine of the local transport networks in urban areas, but public transport are less available outside the major conurbations, where shared mobility services fill the gap in a well regulated transport environment.

Walking, cycling and local micro-mobility have boomed as urban placemaking and densification have made this an attractive option within major conurbations

Reduced consumption begins to see a fall in the demand for virtual retail. Freight distribution has moved to a system of urban consolidation centres with smaller, zero carbon vehicles bringing goods into the urban area.

Urban Zero Carbon +: Bury's Transport Future

• All the baseline proposals are assumed to have been implemented.

• Large scale investment in EV charging and provision of renewable energy sources to deliver full transition to EVs by 2050 (so well on the way by 2040).

• Travel by car is largely accessed through mobility services rather than as private vehicles.

• Mass transit systems, (ie rail, metro and BRT/ shared mobility) are the focus of movement around the conurbation.

o The Bury to Rochdale tram train is constructed with access from Bury Town Centre Interchange and Metrolink from the Manchester direction. This provides access to the wider rail network from Rochdale

o The Metrolink extension via Northern Gateway and Middleton to Oldham is constructed, providing access from Bury, Elton Reservoir and Manchester to the major employment area and access to the wider rail network at Oldham.

o BRT provision is extended beyond the A56 and A58 routes to the SRN enabling shared mobility services to use the motorway network for access to the wider conurbation

o Shared autonomous mobility services replace local bus/ DRT services providing local accessibility.

• Provision is made for interchange between mass transit, active modes and micro-mobility services wherever possible. Growth in the use of active modes for access around the local area and for access to mass transit systems is high.

• Provision for active modes/ micro-mobility services is made between Elton Reservoir, Northern Gateway the secondary schools and college south of the town centre and the secondary school and other facilities at Radcliffe.

• Road space reallocation and demand management through road pricing has been implemented to ensure sufficient capacity for local transit and active modes.

• Parking in existing and new development is highly constrained, and access to public transport/ shared mobility services are encouraged. Parking charges are used to address the price difference between public and private EV charging facilities.

• Local freight services are provided overnight using overnight BRT capacity for local freight distribution to local freight hubs.

Urban Zero Carbon +: Residential Land Use Future

• High density development with densities around 90 – 120 dwellings per hectare, located as close as possible to public transport hubs.

• Provision is made for super-fast broadband to support home working and work hubs and other local businesses.

• Greater provision for public open space, community facilities and local food production, supporting wellbeing. (NB review against Better Places outcomes)

• Connectivity is focussed around active and micro-mobility access to mass transit, i.e. via the new tram stop close to Elton Reservoir and Radcliffe with onward access to the town centre interchange and Manchester City Centre.

• Provision is made for safe movement of active transport and micro-mobility modes. These provide safe, convenient, frequent and regular services around new development, and:

o Direct access to the new tram stop near Elton Reservoir and segregated/ priority provision between Elton Reservoir and Northern Gateway.

o Access to the secondary schools and college to the South of the town centre and the new secondary schools provision in Radcliffe.

• Development hubs focussed around Elton and Radcliffe Tram Stops provide for local mobility hubs, freight hubs, etc. These would provide:

o a centre for active mode and local micro-mobility services

o access to local shared mobility services

o a freight pick up and drop off facility

o a focus for community amenities, including work-hubs and other land uses identified as gaps in local provision, such as local retail, GP clinics and primary schools.

• Parking provision limited to 0.3 spaces per dwelling for private EVs, in buildings adjacent to the development areas. Access avoids use of streets in the centre of development.

• Limited, additional parking provision can be purchased at a remote location for an annual charge. Non EV vehicles are only permitted in these locations. These provide access to EV car and shared mobility services.

• Plot design provides covered/ integrated facilities for personal cycle/ e-bike/ e-scooter storage close to the front door of shared buildings

• Street design is focussed on provision active modes and micro-mobility services on residential streets. Shared mobility shuttles and EVs don't have access to the centre of development, but are accessed at parking buildings with access to the highway.

Urban Zero Carbon +: Employment Land Use Future

• Provision is made for super-fast broadband to support technology forward businesses, e-learning linked with academic institutions, and e-working practices.

• Provision is made for live-work, collaboration, well-being, health and education facilities on site enabling innovation and efficient working practices.

• Access by mass transit is provided via the Metrolink extension to Oldham, and BRT services extended from the A56 and A58 routes. These provide frequent and regular services to the employment development, with autonomous shuttles providing access from transport hubs.

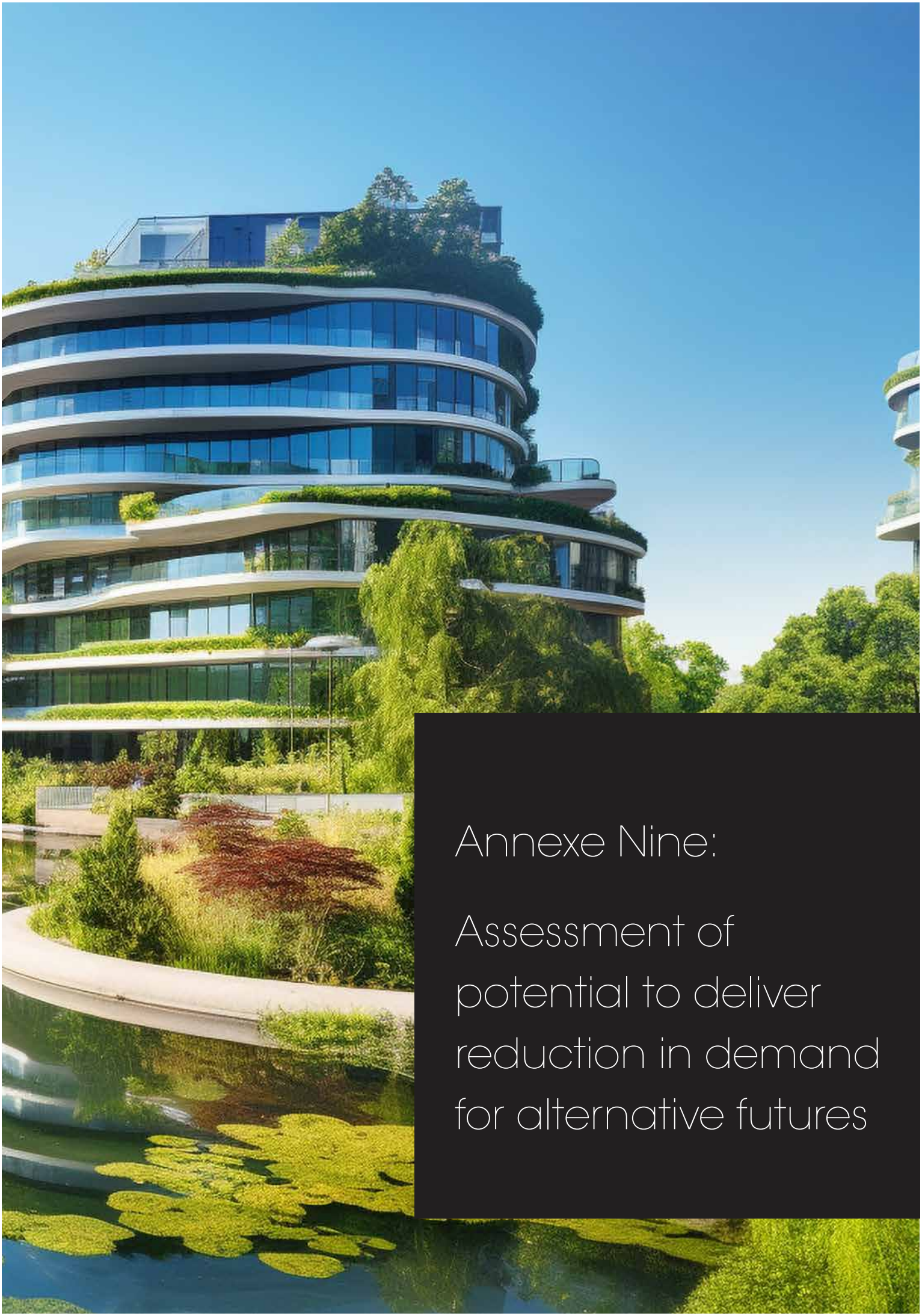
• Passenger interchange facilities are provided between metrolink, shared mobility services, EV parking and autonomous shuttles providing an integrated system that provides access between the local conurbation and the wider SRN.

• Freight handling facilities are provided, enabling local deliveries to be taken from HGV platoons on the SRN via overnight capacity on metrolink/ mobility services to local freight hubs.

• Parking is not available adjacent to employment buildings, but is provided, at a charge, in parking buildings on the periphery of the development areas, where charging is provided.

• Parking is provided at the buildings for active modes and local micro-mobility services.

• Street design provides priority for active modes, micro-mobility and shared mobility services.



Annexe Nine:

Assessment of potential to deliver reduction in demand for alternative futures

Assessment of potential to deliver reduction in demand for alternative futures

Short Trips: Stephen Reid, Senior Associate and Transport Planning Digital Practice Lead

Intermediate Trips: David Collis, Principle Consultant, Stantec, September 2023

Short Trips: demand reduction through land use and connectivity

1.0 The land use and connectivity analysis undertaken to inform the development of alternative land use and transport futures created a data set that could be used to inform the assessment of the potential reduction in demand arising from:

- Trip substitution: longer distance trips to existing land uses (eg health facilities) that would be shorter in the alternative future because of new land use provision, and
- Modal shift: a change of modes arising from new destinations being closer in the alternative future, thus being more attractive to non-car modes.

The expectation is that trip substitution has greater potential for demand reduction because the savings of travel distance by car are likely to be greater per trip.

2.0 A methodology has been developed to translate the connectivity analysis into an estimate of the potential for demand reduction, in vehicle kilometres. For the purposes of this study, the assessment has been informed by statistics from the National Travel Survey, although in practice more local data should ideally be used.

3.0 Other caveats include:

- The car-based journey time elements used in this analysis uses posted speed limits, as the software TRACC (https://basemap.co.uk/tracc) has limitations on car-based travel data. Therefore, the car journey times assume uncongested networks. This is unlikely to be the case, so the numbers presented in the modal shift calculation may underestimate the impact of new land use and connectivity provision.
- A car penalty of 10 minutes has been used in all calculations to represent the lack of on plot parking provision in DD and UZC. It assumes that there would be a minimum walking distance of 5 minutes to a communal parking location which is applied as a 10 minute interchange penalty.
- The journeys used in the calculation do not take into account prescribed journeys – i.e., allocated to a specific GP, Dentist etc. This assumes that choice is fully unconstrained. This is a complex area and varies by land use.
- No allowance has been made for road-based constraint mechanisms in the calculation such as road space reallocation or road user charging.
- There are limitations on the level of detail of public transport based interventions that are capable of being modelled, so some non-car mode alternatives may not be accounted for.
- The methodology assesses existing journeys and development journeys (from the new housing) separately.
- Census output centroids have been used as the origins and 2021 population data has been added to this. Only people over the age of 19 have been included in the calculations due to the five-year banding reporting of the census demographic data.
- The final vehicle kilometre numbers are representative of one way travel, and adjusted at the end of the process.

4.0 Existing Trips

4.1 Trip Substitution for all journeys under 5km: For this calculation, the assessment focused on which existing journeys could be substituted for more local journeys based on the land-use provision on the site. This has only included all journeys less than 5km.

- Distances to the closest of each of the 13 destination types were compared between the base and the future scenarios, (i.e. GP, Clinic, Hospital, Pharmacy, Dentist, Opticians, Transport hubs (metro stops), Supermarket, Primary Schools, Secondary Schools, College, Northern Gateway and Strategic Centres (Bury, Manchester, etc.)). Schools were excluded from this calculation due to a level of school transport provision.
- The analysis highlighted several benefits for local communities based on the new services on the site, as these services would become the closest destination per type for many of them (Radcliffe for example).
- Using table NTSQ01003b from the NTS, the number of trips made per year by mode and purpose was extracted.
- This data was then reduced to focus solely on the car based trip information. A new rate was developed by taking the car driver rate, and then adding 50% of the car passenger rate to this figure. This assumes that 50% of all passenger journeys were made for the same purpose as the driver, thus we should account for the 50% which may be a result of getting a lift from a friend / family member to an appointment etc.
- Using this information, the population for each zone was multiplied by the trip rate by car by purpose by distance saved from substituting existing journeys to shorter journeys.
- This provided a total one-way 86,873 veh kms saved for journeys under 5km.

4.2 Modal Shift for all journeys under 5km: This calculation follows many of the same steps as above, but with a few additional factors.

- Travel times between each origin and destination were analysed between the base, DD and UZC scenarios. Where journeys which were previously quicker by car in the base, were now quicker by PT / Walk / Cycle, these were extracted.
- Based on the destination type, the car trip rate as calculated above was assigned in addition to the population, before a total vehicle km for that OD journey was calculated, for example population*car trip rate*distance.
- Using table NTS0308a (modes by distance travelled), the percentage of journeys under 5km made by car driver and passenger were extracted. Again, a car mode share rate was calculated based on the same method as above (100% car driver + 50% car passenger).
- This provides a factor for how many of these kms would be undertaken by car - (population*car trip rate*distance)*car mode share
- Finally, a dampening factor was created to reduce the number of trips that would be assumed would shift modes. Not everyone would necessarily switch to PT / Walk / Cycle. This reduction factor was created by calculating the proportional change in number of connections per origin which are now quicker by PT / Walk / Cycle than car. For example, one zone can now reach 4 out of 13 destination types quicker by PT than driving. Therefore, a factor of 4/13 was created. This was done for each origin – thus providing individual decay factors.
- Applying this final factor then produces the final total one way veh km saved – ((population*car trip rate*distance)*car mode share)*reduction factor
- This provides a total one-way 49,395 veh kms saved for journeys under 5km.

4.3 These numbers were assessed on the basis of the Digitally Distributed scenario. In the Urban Zero Carbon scenario, the additional public transport infrastructure is not likely to offer much more by way of time savings than the DD scenario because more of the time savings are beyond the 5km range, and in any event are likely to be counter-balanced by the proposed development of the SAV network. Also, the impact of the greater constraint of UZC on car traffic cannot even be estimated at this strategic level without a more sophisticated modelling approach.

4.4 So in total (two-way) across both substitution and modal shift, there could be a saving of 272,536 veh kms for journeys under 5km – without including future housing-based trips.

5.0 Development Trips: For the new development, the following assessment has been made:

5.1 Trip Substitution for development journeys under 5km

- From the information on population and dwellings provided by the team working on the masterplan elements – the population was split between the five zones in the connectivity model.
- 24% of the population in both scenarios was removed to signify those 19 and under (to align with the calculations undertaken above and informed by census 2021)
- This provides an adult population of 7,296 in DD and 10,670 in UZC.
- Using the dwellings data, number of spaces per dwelling and the population, a person car trip ratio was calculated (to be used at a later stage in the calculation).
- In similar vein to the existing trips, the distance to the closest of each destination type was estimated for the five development zones in a base scenario (provision of dwellings and no other land use) and in each of the DD and UZC scenarios (provision of dwellings and other land uses).
- Using the population for each zone and the same trip rate information as used previously, (informed by NTS), the number of vehicle kms that would be saved if you deliver the full plan was calculated, assuming that all journeys under 5km are made by car.
- This provides a one-way veh km saving of 306,818 in the DD scenario and 340,103 in the UZC scenario – this is like for like with the work undertaken previously for existing trips.

5.2 A further scenario was then considered to make allowance for the effect of parking constraint proposed in the DD and UZC futures. This would reduce car availability in each of the futures, and act as a factor to further increase vehicle km savings. This was achieved by using the person car trip ratio mentioned in 5.1 above. This would imply that a further 0.55 trips per dwelling would be saved in the DD by only having one space available and 0.71 per dwelling in a scenario where only 0.3 spaces available

5.3 Applying these factors means that in the DD scenario, 475,568 veh kms could be saved by delivering dwellings + land-uses + parking constraint and 581,576 in the UZC scenario with dwellings + land-uses + parking constraint. As per the calculations for existing trips, this assessment works on the basis of one-way trips, and assumes that all existing journeys are made by car.

5.4 Modal Shift for development journeys under 5km

- No assessment has been made of the potential for modal shift between a baseline, (for example JAM), and the alternative futures (DD and UZC).
- However, from the analysis it appears that PT / Walk / Cycle is quicker for 65% of all journeys from the site to all services within 5km than car, assuming the 10 minute interchange penalty is applied for the two alternative futures
- For those trips that are not quicker, the margins are small so larger gains would be anticipated if a more sophisticated analysis were undertaken.
- On average the main difference between a car vs PT / Walk / Cycle trip is 1.2 minutes (including the 10 minute car interchange penalty), There is therefore greater potential to achieve modal shift if other elements were taken into account, congested networks, access cost, fares, access, demand etc

5.5 Conclusions: Whilst this approach is a high-level approximation of potential reductions in travel demand by car for trips less than 5km, the assumptions made have ensured a balanced approach has been adopted. In summary, the conclusions of this analysis are shown in Table 9.1

6.0 Schools

6.1 Education trips are conceptually very difficult to assess because there are so many factors that determine choice of school, mode choice, linked journeys etc. However, they are numerous, and in the case of secondary schools close to the town centre, they are 2.5km away from Elton Reservoir creating travel distance reduction opportunities either through substation or modal shift.

6.2 Some consideration has therefore been given to estimating the potential for impact of better schools and connectivity provision, including safe routes for mobility services and active modes, for DD+ and UZC+ respectively. The following methodology was applied:

- The census data for those previously excluded (under 19s) was extracted and split between primary and secondary school age groups.
- From the NTS, trips to/from school for both primary school and secondary school has a car mode share of 40% for primary and 29% for secondary.
- The number of schooldays was estimated to be 195.
- Following the same methodology as before, the number of pupils in each age group was multiplied by the trip rate, and dampened by the mode share to produce annual car journeys to both primary and secondary schools.
- The resulting number of annual car journeys was then multiplied by the value for saved kilometres from the land-use change analysis to provide the demand savings by car.

6.3 There are clearly many assumptions being made here, and in particular travel distance reductions relating to trips from existing and new housing to existing schools which are assumed in this assessment to be vkm savings arising from trip substitution (changing school) rather than modal shift (going to the existing school using an alternative mode). Nevertheless, this assessment provides a helpful estimate of the potential for vkm savings arising from short trips, which is summarised in Table 9.3 above used in the next step of our work.

Trips < 5km	All Trips Annual 1-way vkm	Development Trips Annual 1-way vkm	Total Demand Reduction Annual 1-way vkm
Digitally Distributed			
Trip Substitution	86,873	475,568	562,441
Modal Shift	49,395	-	49,395
Total	136,268	475,568	611,836
Urban Zero Carbon			
Trip Substitution	86,873	581,576	668,449
Modal Shift	49,395	-	49,395
Total	136,268	581,576	717,884

Table 9.1

Existing Housing		Annual 1-way vkm
	Secondary Schools	267,204
	Primary Schools	98,961
	Total	268,070
DD+ New Housing	Secondary Schools	376,125
	Primary Schools	98,961
	Total	475,087
	Total with restraint	736,384
UZC+ New Housing	Secondary Schools	411,401
	Primary Schools	99,558
	Total	510,958
	Total with restraint	873,739

Table 9.2

Short Trips (one way vkms)	DD+		UZC+	
	Annual	Daily	Annual	
Trip substitution	562,441	1541	668,449	1831
Modal Shift	49,395	135	49,395	135
Schools	736,384	2,017	873,379	2,393
Sub Total Short Trip Reduction	1,348,220	3,694	1,591,223	4,360
One Way / 1000 dwellings/ annum	337,055	923	274,348	752

Table 9.3

Intermediate Trips: demand reduction through local transport interventions

1.0 A different approach has been adopted to the assessment of demand reduction arising from Increased attractiveness of alternative modes for intermediate trips. In summary, the NZMMs developed for each of the alternative land use and transport futures have been used to provide a framework for a set of simple scenarios. The alternative scenario's tested are set out below:

1.1 Digitally Distributed +

- A relative deterioration of access to private cars arising from car restraint measures on site, limiting parking spaces to V2G communal areas. Additional vehicle use requires use of pay as you go mobility systems which provide access to a range of different vehicles to meet the need.
- A relative improvement in accessibility to pay as you go local mobility services, assuming provision of e-bikes, EV lights and SAVs offering convenient access to destinations between 5 and 40km from the front door.
- Introduction of a price advantage for zero carbon mobility services via pay as you go technology, although this assumption is already contained within the TfN Future Travel Scenario and is not therefore net additional.
- A reduced travel time to Northern Gateway assuming:

o A new priority route for local mobility and SAV services to employment

o Remote parking for car users with interchange to on-site shuttle service to each building at Northern Gateway.

o Interchange to SRN SAV services.

1.2 Urban Zero Carbon +

- A relative deterioration of access to private cars arising from significant parking restraint. 0.3 spaces per dwelling are provided in parking buildings on the edge of the development areas.
- A relative improvement of public transport travel time to local towns and other key destinations when compared with car use, assuming Improvements to rail and tram services including to Rochdale, Rossendale, Bolton, Middleton, and Oldham.
- Introduction of a price advantage through integrated charging for road and other transport use, although this assumption is already contained within the TfN Future Travel Scenario and is not therefore net additional.
- A relative improvement in public transport travel time to Northern Gateway, assuming:

o Provision of the Metrolink Extension to Oldham

o Remote parking for car users with interchange to on-site shuttle service.

o Reallocation of road space on routes to NG in favour of active modes

2.0 A simple spreadsheet has been developed to allow alternative scenarios to be considered, taking into account each of these NZMM interventions.

- The impact of changes to local land use and connectivity on short trips through trip substitution and modal shift has been subtracted from the total travel distance for both DD and UZC.
- The effects of parking restraint and improvements in accessibility to alternatives to the car affect all trips. This measure could add around a 10 minute delay to using a car. Using this as a proxy for the change in balance of convenience between modes, traditional Logit modelling and elasticities would suggest that this would result in only a 5-10% increase in trips by other modes. This has been applied differently between the DD+ and UZC+ scenarios:

o For DD+ 5% reduction in vkm has been applied to all intermediate trips to represent the impact of relatively reduced accessibility to a car. This reflects the non-directional nature of the interventions and consequent challenge this present to presenting attractive alternative travel choices for all destinations

o For UZC+, 10% reduction in vkm has been applied to all journeys apart from those with affected by a specific mass transit NZMM. This reflects the more directional effects of the urban transit solution, and the greater extent of demand management acting as an incentive to use alternative modes.

- **For DD+, separate measures are assumed to have been implemented:**

o Dedicated transport proposals to Northern Gateway, in combination with land use and interchange proposals providing access to buildings on site and the SRN.

o Extensive pay as you go mobility services providing an alternative choice to the car for intermediate trips. It has been assumed that these trips are undertaken in small EVs which have 50% of the carbon impact of an EV, and therefore only 50% of the saving has been applied.

- **For UZC+, separate measures are assumed to have been implemented:**

o Dedicated tram access to Northern Gateway via the Middleton/ Oldham Metrolink extension, and via segregated active mode connections, in combination with land use and interchange proposals providing access to buildings on site and the SRN.

o New rail and tram proposals that provide good connectivity with local towns, including Manchester City Centre Rochdale, Rossendale, Oldham, Middleton and elsewhere, accessible from a new tram stop at Elton Reservoir and at Radcliffe.

3.0 As illustrated in Table 9.4 overleaf, the total trip length from intermediate trips that would need to be 'saved' is higher for DD than UZC. Even though the number of dwellings is higher for UZC, the lower percentage saving needed for UZC makes an important difference. Savings from measures targeted at short trips amount to only around 5%, thus reinforcing the point that the intermediate trips are likely to be the key target for trip distance savings, and of those, the largest group is 5 – 10km.

4.0 For DD+, the required trip distance saving from Elton Reservoir is 40,945 vkm per day. Short trip distance savings reduce this by 11% to 36,518 vkm. This saving would need to be delivered mainly by transport and land use measures targeted at 5 – 40km trip lengths (39,452 vkm) through local mobility services, and through specific measures targeted at attracting trip to Northern Gateway (28,536 vkm) and the SRN (20,781 vkm) to alternative modes. A total saving of 41% would be required from these trips, a very significant challenge.

5.0 For UZC+, the required trip distance saving from Elton Reservoir is 37,936 vkm per day. Short trip distance savings reduce this by 5% to 32,842 vkm. This saving would need to be delivered mainly be transport and land use measures targetted at mode shift to rail and tram for destinations including local towns (34,366vkm), Manchester City Centre (815 vkm), Northern Gateway (39,168 vkm) and beyond via the SRN (29,930 vkm). A total saving of 47% would be required from these trips, also a very significant challenge.

Daily One Way Assessment - Elton Reservoir vehicle km		
	DD (1 space)	UZC (0.3 spaces)
1 way veh km - Daily	**136,482**	**189,682**
% reduction required	30%	20%
Vkm reduction required (a)	**40,945**	**37,936**
Short Trips		
Trip substitution	1540.5	1831.5
Modal Shift	135	135
Schools	2017	2393
Sub Total Local Journeys (b)	3692.5	4359.5
Reduction in total veh KM (%)	9%	11%
Remaining demand reduction from intermediate trips	**37,252**	**33,577**
UZC+ Intermediate Trips - 1 way total vehicle KM (5k -40k)		
All Intermediate Trips from Elton Reservoir (Vehicle KM)		132,745
Northern Gateway - Vehicle KM		39,168
SRN - VKM to zones with close proximity to the SRN		29,930
Manchester City Centre		815
New Railway between Rossendale / Rochdale & Metrolink to Oldham - veh km equivalent		34,366
Sub Total Intermediate Vkm		**69,913**
Mode Share adjustment in Vkm - 10% or remaining car trips		62,832
Vkm required to meet vkm reduction (a-b)		33,577
Vkm reduction required as a percentage of potential		48%
DD+ Intermediate Trips - 1 way total vehicle KM (5k -40k)		
All Intermediate Trips from Elton Reservoir (Vehicle KM)	93,441	
Mode Shift adjustment in Vkm - 5% of all trips	4,672	
Remaining Intermediate Trips	**88,769**	
Northern Gateway - Vehicle KM	28,536	
SRN - VKM to zones with close proximity to the SRN	20,781	
other 5- 40km total vehicle kilometers	39,452	
Sub Total Intermediate Vkm	**88,769**	
Vkm requried to meet vkm reduction (a-b)	37,252	
Vkm reduction required as a percentage of potential	42%	

Table 9.4

6.0 To better understand the challenge of demand reduction for each of the DD+ and UZC+ futures, alternative scenarios have been considered. Table 9.5 illustrates this assessment. As can be inferred from this analysis, even the radical transport and land use interventions considered in each of the land use and transport futures would struggle to deliver the vary significant changes indicated in the scenarios. Where this might be possible is where there is significant control over both the origin and destination parking provision, and the capacity provided for car travel through charging or road space reallocation. It does, however, rely on these measures being acceptable to society, policy makers and crucially – the market.

7.0 In DD+ scenario 1, even if the Northern Gateway scheme could deliver 80% of trips from Elton Reservoir by modes other than the car, 20% of trips to zones close to the SRN and 30% of other intermediate trips would need to be undertaken using the local mobility and SAV services, rather than by using a car. As the proportion of Northern Gateway trips by car increases, so that need to capture intermediate trips elsewhere onto local mobility services increases, until DD+ scenario 3 has around 50% by non car modes for Northern Gateway, and other intermediate trips, and 40% of trips using the SRN.

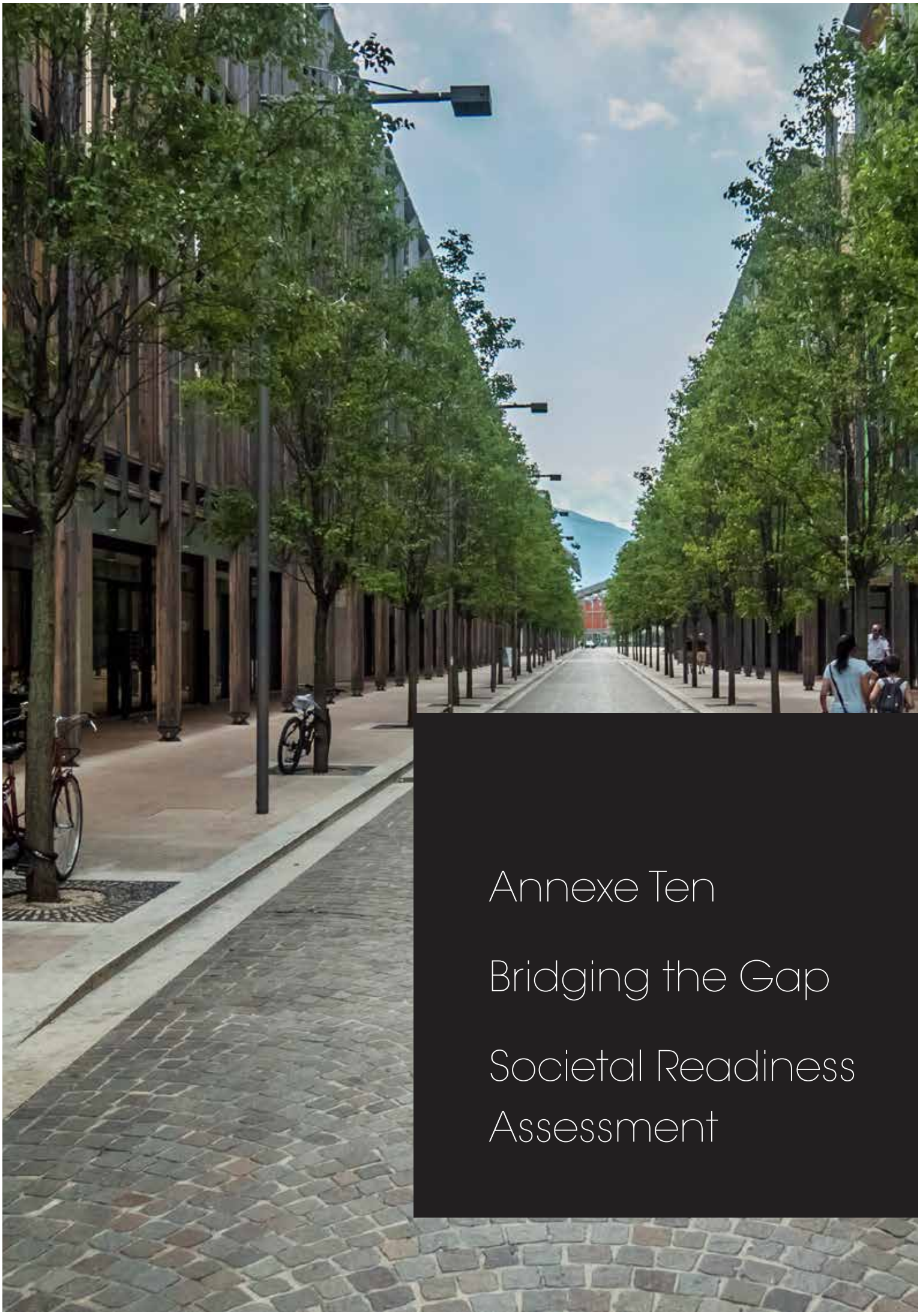
Assessment of alternative demand reduction scenarios						
Daily One-way Assessment	**UZC+ Scenario 1 %**	**veh km**	**UZC+ Scenario 2 %**	**veh km**	**UZC+ Scenario 3 %**	**veh km**
Northern Gateway Schemes	61%	23,892	53%	20,759	40%	15,667
Interchange to the SRN routes	5%	1,497	10%	2,993 1	5%	4,490
Manchester City Centre	5%	41	10%	82	20%	163
New Rail/ Tram to local towns	5%	1,718	10%	3,437	20%	6,873
Mode Share Adjustment	10%	6,283	10%	6,283	10%	6,283
Total demand reduction implied	Total	33,431	Total	33,553	Total	33,476
	DD+ Scenario 1 %	**veh km**	**DD+ Scenario 2 %**	**veh km**	**DD+ Scenario 3 %**	**veh km**
Mode Share Adjustment	5%	4,672		4,672		4,672
Northern Gateway Scheme	80%	22,829	65%	18,548	51%	14,553
Connections to SRN SAV Routes	20%	4,156	30%	6,234	40%	8,312
5 – 40km Mobility Services	30%	5,918	40%	7,890	51%	10,060
Total demand reduction implied	Total	37,575	Total	37,345	Total	37,598

Table 9.5

8.0 In the UZC+ scenarios a similar trend can be seen. If the Northern Gateway schemes can attract over 60% of trips to tram and active travel, the required contribution of other interventions would be relatively low, but if only 40% is attracted to the Northern Gateway alternatives as suggested by UZC+ scenario 3, upto 20% of other intermediate trips would need to be attracted to rail, and 15% using shared transport on the SRN. Given the dispersed nature of these trips, this would appear to be difficult to deliver by public transport alternatives.

9.0 None of this assessment is a forecast of what would happen given the delivery of measures associated with the DD+ and UZC+ futures. It does however begin to inform the 'what would need to be true' question, if these futures are to deliver the demand reduction needed to meet net zero requirements. It also points to some important initial conclusions:

- From the Elton Reservoir perspective, making provision for alternative modes to and from Northern Gateway is the most important consideration from a demand and carbon reduction perspective.
- The ability to exercise restraint on parking at both the Elton Reservoir and Northern Gateway ends of the trip, together with reallocation of road space in favour of the alternatives would appear to be a critical to success. Without this, there would be little prospect of delivering the necessary switch to the alternatives.
- Particularly in the DD+ scenario, the SRN plays an important role in accommodating intermediate trips. There is a real need for the SRN to begin to provide capacity for shared transport, SAV's in the world of DD+, particularly given the potential role of Northern Gateway as an interchange.
- UZC+ does, on the face of it, appear a more likely route to the necessary demand reduction, (from a transport planning perspective, not necessarily in terms of cost, risk etc), requiring less of the heavy lifting being needed from other, more disperse parts of the transport network.
- The delivery of rail and tram projects in UZC+, and a network of local mobility and SAV services in DD+ provide an important role, but these could not be achieved without a consistent local and regional approach to policy and planning.



Annexe Ten

Bridging the Gap

Societal Readiness Assessment

Societal Readiness Assessment.

Author: Monika Buscher, Professor of Sociology
and Director, Centre for Mobilities Research,
Lancaster University

Annexe 10.I: Workshop Programme

Bury 2040 – Mobility Futures Agenda & Outcomes

4:15-5:00 Our mobile week 2023 & 2040 Visions
5:00-5:30 Stantec - Bury 2040 Scenarios

5:30-5:40 Comfort Break

5:40-6:30 Societal Readiness Assessment

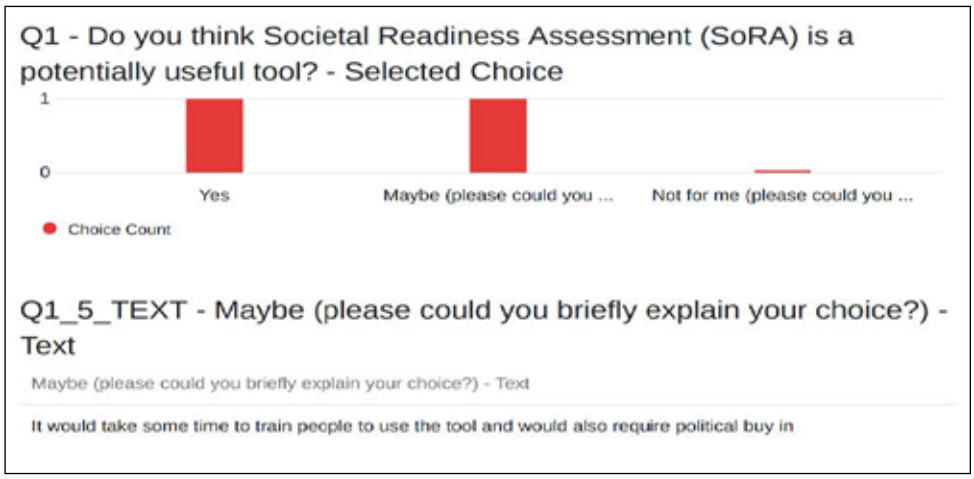
6:35-6:45 Rapporteurs' reports

6:45-7:00 Next Steps & Close

7:00 Dinner

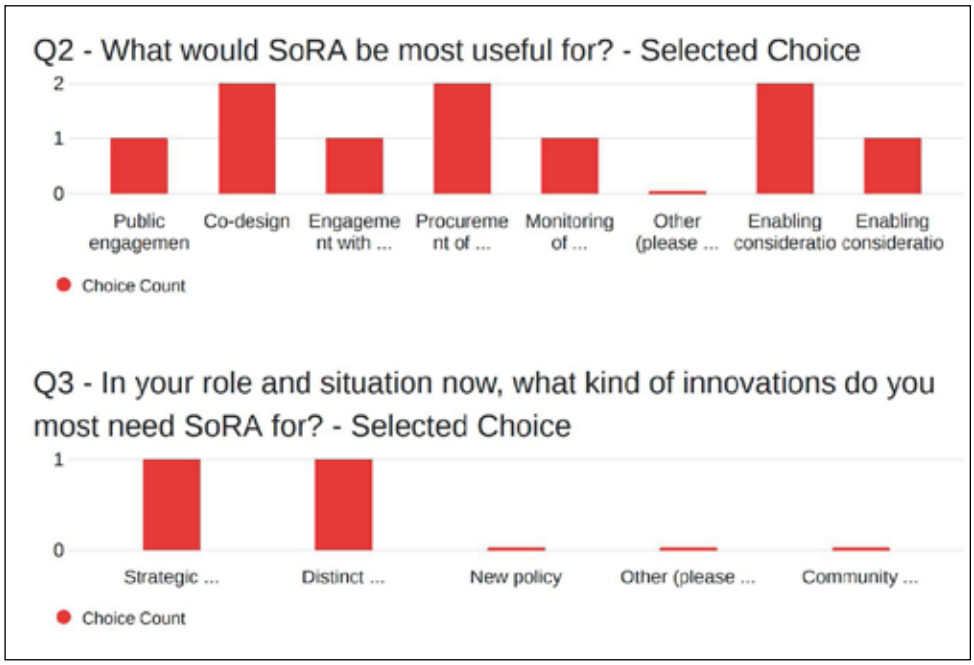
- ✓ Formative SoRA evaluation of two mobility futures
- ✓ Creative knowledge exchange about place-based decarbonising mobility through place-based innovation.
- ✓ Discuss ways of improving scenarios.
- ✓ Develop plans for future collaborations.

Annexe 10.2: Bridging the Gap - SoRA Pilot evaluation questionnaire



Q1_5_TEXT - Maybe (please could you briefly explain your choice?) - Text

Maybe (please could you briefly explain your choice?) - Text
It would take some time to train people to use the tool and would also require political buy in



Q4 - SoRA is designed to facilitate constructive, creative dissent, especially in situations where controversial choices need to be made about our mobility futures. Is this useful for you? Please could you explain why/why not?

SoRA is designed to facilitate constructive, creative dissent, especially in situations where controversial choices need to be made about our mobility futures. Is this useful for you? Please could you explain why/why not?
This is useful, as long there is a skilled person to manage those conversations

Q5 - How could SoRA be improved?

How could SoRA be improved?
If would simplify it if possible.

ANNEXE 10.3: Reflections on SoRA Process

1.0 After the workshop, workshop participants were sent an evaluation questionnaire, (Appendix III). The two responses received suggest that the process is useful for a range of purposes, but needs to fit better into local authority processes.

2.0 Email feedback was also received from another attendee:

Many thanks to you and the team for the workshop on Tuesday - it was very thought provoking and great to share ideas and thoughts - It would be great to remain involved in your research.

Interestingly I had a meeting the following day with TfGM re shared mobility and they were discussing the idea of mobility hubs and the best way to introduce them and how it might work. In our workshop group on Tuesday, we had suggested that the quick wins like mobility hubs could be maybe a starting point in introducing the concept of "shared mobility" and making active travel more accessible. I mentioned at the TfGM meeting re Societal Readiness as something we would need to consider in our introduction of proposals such as these.

3.0 Acknowledging that this was a pilot 'taster' workshop, initial 'hotwash' reflections by the SoRA and design team highlighted a range of opportunities for improvement of the SoRA process (from Notes circulated):

What worked in the workshop

- Quick wins: mobility hubs and bike libraries were mentioned in both groups
- Explaining the structure of the workshop at the start
- Short non-technical presentation to situate the discussion
- Having visual tangible objects to engage attendees
- Having refreshments

SoRA-specific opportunities & challenges

- It is difficult to do a SoRA on a whole scenario, as one might score different parts of the vision very differently e.g. think e-scooters are very societally-ready but have a low opinion of autonomous delivery robots, for example.
- Someone suggested a SoRA on SoRA - the wording of the SoRA scale and assessment could do with being simplified as it's too difficult to easily understand. We are already doing this.
- Someone talked about 'Maturity Levels', and questioned if these would have any relevance to what we are trying to do. This was well spotted - SoRA and SRL are indeed intended to complement and challenge Technology Readiness Assessment and Levels, which are 'a method for estimating the maturity of technologies during the acquisition phase of a program'. Our argument is that TRA/ TRL is too technology focused.
- The maps were quite difficult for people to engage with.
- The concept of 'societal readiness' is easily misunderstood - Lots of discussion about 'how to get people ready'. Some of the group were very keen on imposing measures that would encourage behaviour change e.g. removing bus stops to increase walking. Others suggested that a 'sharing economy' mindset just had to be learnt, everyone would be likely to love it if only they were forced to do it, and it would be good for all. Little recognition of the systemic lock-ins that railroad behaviour. The fact that SoRA actually turns the table to ask how ready innovations are for people who are locked into systems needs more introduction and guidance.
- People found it very hard to score using the scale definitions also because the scenarios were hypothetical and involved too many unknowns - some people chose to fill in the blanks by creating an imaginary story about 'how consultations took place', etc., but others found it harder to speculate.
- Brief discussion took place about whether or not it would have been helpful to have more detail in the scenarios. Someone said they felt SoRA would work "quite well" for existing innovations but that it was hard to use in relation to a made-up world. It might be helpful in future sessions to give people an example or a demo of how they might think through a scenario. It felt like a lot for people to take on board and process in a short space of time

• Conversations about policy led to conversations about place-specific politics, and future scenarios were couched within thoughts about Manchester being 'very Labour' and Bury being more politically precarious (which influenced the interpretation of the scenarios). SoRA could enable a more constructive, less helpless way of dealing with these challenges.

Potential workshop improvements

- Have a sign outside building e.g. 'Workshop here'
- Really enforce the purpose of the workshop at the start (and lightly throughout?)
- Re-phrase SRL scale to be more accessible (local resident had difficulty understanding what each level meant)-
- Some confusion on what all the objects on the table were – keep workshop materials clear and don't have too many (can be overwhelming) People didn't really use the little figures, and it was quite hard to get people to engage in storytelling.
- Enforce stronger time-management if attendees are taking too much of the floor off-topic
- The roles of team members were unclear (enabling, listening, engaging in dialogue with participants v presenting and educating 'them')

4.0 With more time to think, we would add a few more thoughts to these reflections:

4.1 **Delivering benefit from SoRA -** SoRA aims to unlock benefits - has this been initiated? Table 1 opposite sets out some of the issues.

4.2 **Avoid a 'public deficit' approach -** Common sense ideas about societal readiness naturally assume that society has to make itself more ready to accept the 'solutions' that experts propose are ready to fix the problem. Our version of SoRA actually turns the table to ask how ready innovations are for people who are locked into systems. This is a provocative approach that capitalises on the constraints and contradictions that people discover when they try to enact or bring about behaviour change. But more time is needed to enable participants to embark on this line of reasoning in their own way. SoRA should be discovered, not imposed.

4.3 **Facilitate an iterative and inclusive approach -** SoRA is intended to infrastructure creative, constructive dissent and collaborative design over the whole course of the innovation process, from ideation to implementation and evaluation, adaptation. The full range of stakeholders should be involved to foster inclusion, local, global and intergenerational justice. This includes geographically and temporally distant stakeholders - difficult in a pilot and in a public atmosphere of concern.

4.4 **Limits of Imagination -** All participants' imagination is limited by what they know - while Bury residents know much about the practicalities of their everyday lives, they know less about the potential of discrete and systemic innovations, similarly, while the Stantec team and Bury Council Officers know much about decarbonising transport innovations, they know less about the lived practices of residents. Actually no-one can know how systemic futures will form, and SoRA could be an instrument to shape them responsibly. It implies that knowledge exchange has to be an integral part of the process, without taking an educational approach where experts tell people what to think or give them 'the science'. Exchange has to be dialogical.

4.5 **Limits of Concern -** many participants rated the DD scenario quite highly, assuming that the technologies will work and disregarding dangers of surveillance capitalism. This may have been a feature of the kinds of participants, but it also suggests that media discourse about 'solutions' is promoting a partial picture. Knowledge exchange and collaborative learning is required, avoiding a public deficit approach.

4.6 **Beyond Comparison -** SoRA is a mobile method that can be applied in different contexts at different times but that doesn't mean the findings (e.g. SRL scores and comments made by workshop participants) are transposable. As an example, it may be the case that a Societal Readiness Assessment in Town A scores an e-scooter scheme quite highly. This does not mean that the e-scooter scheme 'has' high SRL across different contexts. SoRA emphasises the need for place-based engagement and assessment. Town B, with a different infrastructure, different demographic, different terrain, etc. may assign a low score the same e-scooter scheme. SRL are an invitation for ongoing formative evaluation, creative design and appropriation.

Stretch the imagination, widen the envelope of creative thinking, inspire socio-technical innovation	We made a start. The pilot has helped to shape how we might go about SoRA for a complex visioning process in future stages.
Heighten the ambition of procurers, designers, investors, developers, etc. to make innovations societally ready in the four dimensions of SoRA (carbon reduction, social justice, social good, fit for a decarbonised future)	Mostly through increasing awareness of complexity, not so much in terms of inspiring changes in the process or ways of addressing difficulties. Future stages of this work aim to do this.
Productive engagement with a full range of stakeholders throughout the lifespan of the project, embracing dissent.	In terms of the pilot BtG project we failed on that count. Societal Readiness was not explicitly considered in the early development of the scenarios – with the focus being on developing scenarios that delivered against carbon objectives. Could the SoRA process begin earlier?
	However, seeing BtG in a wider frame and as a pilot in itself, it is clear that stakeholder involvement in scenario development and establishing the vision that leads future development could be an important step in delivering change.
Embed climate and intergenerational justice. Enhance dignity and health, liberty and enfranchisement, social inclusion.	The pilot has identified how these issues can be considered as part of a planning process, and importantly how dissent can be successfully managed.

Table 1: SoRA Benefits

Annexe 10.4: Workshop Shared Notes

Mobility Futures Workshop 18/04/23

1.0 Current situation: key points made by attendees

1.1 Experience of existing situation

- Bury bus service is awful. Suggested more frequent buses
- No safe cycling routes (unlit, canals, trails)
- First consideration about cycling somewhere is 'where can I safely park my bike'. Currently no protecton for bike storage
- 1 contributor (mother of 3) currently has to use a car because of multiple school drop offs, kids' football training, and work location
- Another contributor gets the tram to work when cycling would be quicker but the bike share scheme does not carry on from Manchester to Bury

1.2 Current policy issues

- Publicity can have a negative effect on schemes and ideas. The voice of a few who are loud outweigh the quieter majority who are for the schemes
- Suggested the use of bike libraries, travel hubs with car share, no dedicated car parking
- Put bike lanes on Bury New Road (taking space away from cars)
- Suggested policy change – all new A and B roads should have a cycle lane
- New houses should be built with car share scheme, everyone should not have a car parking space
- Bury bike is a good scheme and should be replicated
- Ring road encircles town centre, this needs to change

2.0 2040 vision

- Improved local neighbourhoods
- Increased cycling infrastructure and action e.g. secure bike parking at tram stations, local shops (making infrastructure more accessible for cyclists and pedestrians)
- Tram prices more accessible (to match current bus ticket prices e.g £2)
- Transport hubs
- Active travel
- Pedestrianised spaces
- Cycling and walking to be the first means of travel
- Stability/ consistency in ticket prices (currently on phone it's cheaper than buying in person)
- Car clubs
- Current bus stops are very close together, maybe every other stop could be removed and turned into a mobility hub
- People have access to a car but don't own one (so if needed they hire an electric car)

3.0 Introduction to Future Mobility Scenarios

- Attendees seemed to find the discussion about radical alternative futures difficult to engage with, and there were few questions about how each of these might work in practice
- It was easier to generate discussion about particular elements of each strategy, for example the implementation and operation of mobility hubs
- It would have been helpful to have been able to use persona's (or other technique) to describe some typical daily travel needs as a way of demonstrating how each of the scenarios might work in a practical situation.

3.1 Urban Zero Future Scenario

Discussion

- There are many complex contradictions - someone whose main mode of transport is a bicycle suggested a good future would entail all newly developed houses having EV charging points. An interesting discussion ensued as someone else countered by saying that it would be better to run an existing car into the ground because of the carbon expenditure associated with batteries, etc.. Also, someone who championed a sharing culture would be reticent about keeping their (expensive) bikes in a shared storage facility.

- The funding issue means anything near this will take extremely long (if at all), (ie investment to extend the public transport network to create wider accessibility around the conurbation/ region)

- In this world, access to a car was seen as important for those journeys that couldn't be catered for by rail/ BRT/ shuttles.

- Questions raised about car availability ie peripheral/ charged parking favours those who can afford to pay for it? This future suits those who are more affluent?

- Electric vehicles could pose a problem for the visually impaired as they are silent (guide dogs struggle to hear them as well)

- The practicality of using pay as you go mobility services for a range of different journey purposes, some linked, some not, was questioned. Attendees found it hard to see how their daily travel needs could be satisfied without their preferred personal transport mode close at hand.

- A key challenge was about how road space would be allocated. This exhibited itself as a discussion about the poor conditions for cycling and the poor level of bus services. How would this all be allocated in the future to ensure safe/ attractive cycling conditions?

- Questions raised on who owns and builds the housing, and the nature of the housing (ie suitable for families/ inter-generational living etc?)

- People will move out to suburban areas if you urbanise the area in this way, especially those with young children who want more (private?) space

- Maybe it would naturally become a place for the elderly only?

- 15 min neighbourhood was abandoned in Heaton Park because of wide community opposition – is this a barrier to land use change as part of the solution?

- If everything one needed was in the area, people may become insular as they don't need to travel elsewhere for anything

Possible Interventions

- The idea of extending the concept of bike libraries was discussed, converting the mobility hubs terminology into something more familiar (mobility library!), a place where you can hire a bike, e-bike, or access car share/ car hire etc?

- 'Trust' was raised as a key issue for an extension of the shared economy (ie car share schemes, shared mobility services etc. Could these work on a shared ownership model (akin to the Garden Cities Trust models). (Local resident suggested it would need to be backed by local stakeholders/ambassadors, not a private external firm)

- Shared ownership is good, enhances social goodness. However, currently some feel a poor sense of community, and would not be comfortable doing a car share with a stranger right now.

- Some liked the idea of shared ownership of things you would not be able to afford on your own e.g nice car

- It would require a massive communications strategy and mindset change to reduce antisocial behaviour for the sharing economy to work

- Community greens in Prestwich currently work as cooperatives, funded by residents. Perhaps management of mobility hubs could be run through the cooperative

Comments

- There was little discussion about access to and the use of the upgraded public transport system – perhaps because that was relatively easy to imagine?

- The challenge seemed to be more about the relevance of urban living to a location like Bury, and the effect of greater restraint on car parking/ ownership, and how access to a car (or other modes) would work for those occasions when you need it.

Societal Readiness Level

- Between 2/3 with no intervention, and a maximum of 5 with the interventions discussed during the workshop.

3.2 Digitally Distributed Future Scenario

Discussion

- Mobility hubs could be quick wins

- This would mean moving away from individual ownership, could be potential for a shared ownership structure.

- Pay as you go nature of hubs will exclude some people. Digital nature is not inclusive to young children, elderly and those without access to required technologies.

Possible Interventions

- Overall, the mobility systems would need to be cheaper and more accessible to all

- Are there any other notes of suggested interventions?

Comment

- Some of the UZC discussion about mobility hubs/ libraries/ shared ownership seems even more relevant to the DD scenario?

- Discussion during the last session suggested that there was a challenge in understanding the practicality of how a pay as you go mobility service would be able to cater for the wide range of day to day needs, or what measures could be used to improve the readiness of this scenario?

- Surprisingly little talk about AI, data sovereignty, etc. – why?

Societal Readiness Level

Between 3/4 with no intervention and a maximum of 6 with the interventions discussed during the workshop.

Annexe 10.5: BtG Scenarios - Societal Readiness Levels & Reflections

1.0 Despite the difficulties of a short pilot workshop and the challenge of explaining both BtG and SoRA, the workshop was very useful. The participants' feedback confirms the need for an iterative process of societal readiness assessment, which is what SoRA is for. At the end of the workshop, participants scored the two scenarios as ranging between SRL 2 (as described) and SRL 6 (with adjustments discussed) (Figure 1).

2.0 Given the short time to present and discuss the scenarios, time for the assessment was shorter than planned and there was no opportunity to discuss explanations and improvements in any detail. However, feedback from the design team indicates that the scenarios 'were rightly judged to be miles short of being societally ready'. This was not a surprise to the team, as each of the scenarios were deliberately seeking to deliver the radical change needed to meet net zero mobility objectives, with the inevitable consequence that more development would be needed to align them more closely with societal needs.

3.0 The other simplistic observation of the design team was that the DD scenario appears at first sight to provide for the existing travel needs of society more closely, replacing personal transport options with

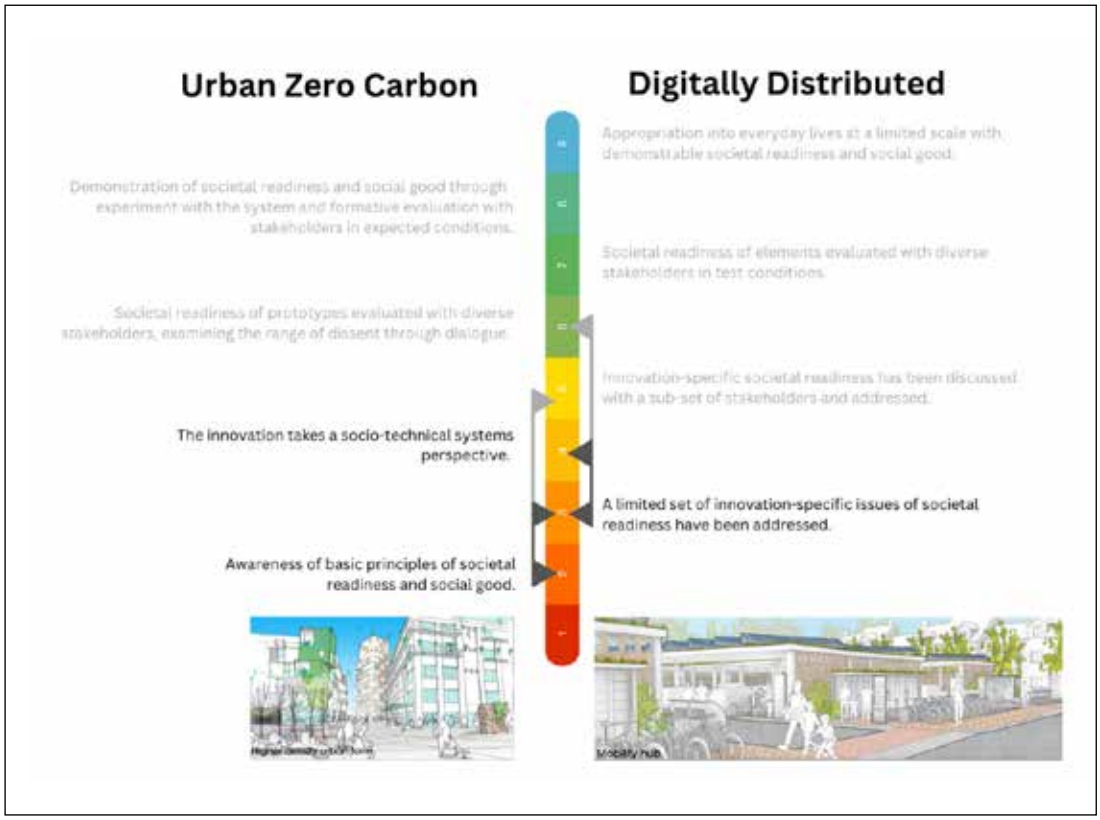


Figure 1 Participants' SRL scores for UZC and DD scenarios

technology driven solutions which allow lifestyles and working patterns to be less affected than by the UZC scenario, which would require a shift towards a more urban and mass transit focussed way of life. There was less focus on how the DD technology solutions might affect social justice or deliver social good, or the systemic changes that would be required to deliver it, so perhaps this felt more familiar than the UZC world.

4.0 To explore reasons and opportunities for improvement, we have used the prototype SoRA Societal Readiness Levels Gauge to score the scenarios from our perspective as social science consultants and participants in the workshop. This can only be based on what we know and is therefore limited by that, but neverthess allows greater rigour to be applied to the task of responding to a set of 'indicator' questions to inform the assessment.

5.0 Diverging from the workshop participants' assessment, the SoRA team has scored the UZC scenario higher than the DD scenario. Table 2 presents our Summary SoRA Assessment and below it, we explain briefly how and why we have scored JAM, DD and UCZ on each question. This also leads into an outline for a plan of work, which is described in Section 5.

Societal Readiness	JAM	DD	UZC
Carbon Reduction	Levels of awareness of the carbon reduction challenge implied by 2015 Paris Agreement are low. Decarbonisation aims are balanced against other objectives, and commitment to regulation and delivery is low. Actionability on targets is low.	Both scenarios There is a medium level of awareness commitment and actionability, with room for improvement on all three counts. Decarbonisation has been prioritised over other objectives in the design of the futures, but the innovations proposed are at low levels of development or actionability	
Social Justice	All three scenarios: Levels of awareness, commitment, and actionability on social justice are low. Stakeholder engagement comes late, the range of stakeholders considered is limited, and there are no clear mechanisms of accountability for how concerns are addressed.		
Social Good	All three scenarios: There is some awareness of co-benefits, unanticipated consequences, ethical or wider societal implications, but low levels of commitment to defined processes of exploring these aspects and low actionability in relation to them.		
Fit with a decarbonised future	Levels of awareness of potential future changes in social practices are low, there is a low level of commitment to system change and low levels of actionability on the challenge of systemic change.	There are low levels of awareness of future social practices, medium levels of commitment and actionability to address the emissions gap.	There are medium levels of awareness, commitment, and actionability in terms of systemic change.
Societal Readiness Level	2	3	4

Table 2: SoRA Summary Assessment

5.0 Below, we detail some of the reasoning behind these summary assessments.

5.1 Carbon Reduction - Maximising carbon reduction through reducing the use of carbon intensive materials & enabling low-carbon practices.

To serve society well, solutions must address the urgency and scale of the challenge posed by climate change mitigation and adaptation. As such, there should be high levels of awareness, commitment and actionability in terms of the carbon reductions the innovation enables. The SoRA Questionnaire's indicator questions probe these dimensions, and there are clear differences between the three different scenarios.

Q1 - How well informed is the design about carbon budgets to meet the 2015 Paris climate targets?

Both the DD and UCZ scenarios are well informed and have brought in specific expertise to calculate the required carbon emission reductions to meet climate targets. What is currently lacking is transparent explication of reference to carbon budgets.

Q2 – To what extent is decarbonisation a key priority for the innovation compared to other priorities?

Both DD and UZC have prioritised decarbonisation objectives over other objectives, whilst JAM balances decarbonising goals against other priorities. JAM assumes low levels of policy and regulation to drive change, whilst in DD and UZC, the market and government respectively drive technological and lifestyle change. UZC contemplates greater commitment to demand management

Questions			Answers	JAM	DD	UZC
1	How well informed is the design about carbon budgets to meet the 2015 Paris climate targets?	Awareness	Q1-3 High (e.g. There is comprehensive and transparent reference to carbon budgets)			
			Q1-2 Medium (e.g. The design is either well informed or the design team recognise the need to bring in expertise)		2	2
			Q1-1 Low/I can't tell (e.g. There is no specific attention to targets, but the design recognises the broad challenge)	1		
2	To what extent is decarbonisation a key priority for the innovation compared to other priorities?	Commitment	Q2-3 High (e.g. Carbon reduction is the key priority under which all others are subsumed.)			
			Q2-2 Medium (e.g. Carbon reduction is balanced against other priorities)		2	2
			Q2-1 Low/I can't tell (e.g. It's not really focusing on decarbonisation)	1		
3	How significantly could the innovation contribute to reaching the carbon reductions required to meet the 2015 Paris Agreement targets?	Actionability	Q3-3 High (e.g. Experimental implementations demonstrate that carbon reduction would be significant)			
			Q3-2 Medium (e.g. Carbon reduction is at a medium level or not reliably demonstrated)		2	2
			Q3-1 Low/I can't tell (e.g. The degree of carbon reduction is low or unclear)	1		

Table 3: Indicator Questions and scores – carbon reduction

whilst DD incentives change through service provision.

Q3 – How significantly could the innovation contribute to reaching the carbon reductions required to meet the 2015 Paris Agreement targets?

It is difficult to gauge how carbon reduction aims will be translated into real world changes in mobility practices in the JAM scenario. What is more, given that JAM allows much of the current mobility system design to continue, adequate carbon savings seem less likely. DD and UCZ are more ambitious, but currently limited by a lack of clarity over the degree to which developers and citizens can appropriate and realise the plans.

5.2 Social Justice - Embedding consideration of equity, inclusion, and fairness, engaging a wide range of stakeholder views in the innovation's design and development

Social justice is not a provision to be granted on the basis of exclusive analytical capacity, but an effect of democratic and participatory processes. In all three scenarios, there is recognition of the need to work with stakeholders, but efforts to engage are thus far limited. Arguably, UZC represents a future in which government is more engaged with society, whereas DD sees the market leading the way. One may be more prone to a 'public deficit approach' (eg demand management) whilst the other advertently or inadvertently excluding less affluent or informed sectors of society from the decarbonisation transition, (service provision).

Questions			Answers	JAM	DD	UZC
4	To what extent are all types of stakeholders who might be affected (positively or negatively) considered?	Awareness	Q4-3 High (e.g. There are defined processes to identify a wide range of stakeholders)			
			Q4-2 Medium (e.g. The importance of working with stakeholders is recognised, but capacity to include all is limited.)			
			Q4-1 Low/I can't tell (e.g. A small selection of key stakeholders is considered.)	1	1	1
5	What level of active engagement with stakeholders has there been?	Commitment	Q5-3 High (e.g.There is a co-design process and a degree of stakeholder ownership of the implementation)			
			Q5-2 Medium (e.g. Stakeholder participation is an integral part of the design)			
			Q5-1 Low/I can't tell (e.g. Stakeholders are not considered explicitly).	1	1	1
6	To what extent does the design concretely address the needs and opinions of all stakeholders?	Actionability	Q6-3 High (e.g. The needs of diverse stakeholders have clearly been addressed)			
			Q6-2 Medium (e.g. There is clear but limited effort to address the needs of marginalised stakeholders)			
			Q6-1 Low/I can't tell (e.g. The needs of stakeholders can be addressed through the implementation, policy and/or business models)	1	1	1

Table 4: Indicator Questions and scores – social justice

Q4 – To what extent are all types of stakeholders who might be affected (positively or negatively) considered?

In the JAM scenario it is not clear how stakeholders are identified. In the DD and UCZ scenarios, stakeholders have been identified and understood by means of data modelling. Data is commonly understood as objective and therefore 'fair' and 'inclusive', but data can never offer a complete view and is always produced from a situated and value-laden perspective. It is important to engage those negatively or positively impacted in interpreting data and to ask what data matters to them, including ethnic minorities, LGBTQIA populations, neurodiverse communities, people living with chronic illness, young people, older people. Stakeholder mapping would reveal diversity and pose interesting challenges that can raise the ambition of the design. A few examples will illustrate this:

- The workshop highlighted that the DD and UZC scenarios attend primarily to those who are expected users of the provisions described. What about excluded 'non-user' stakeholders? And what are the ramifications for people who would not use but encounter or share space with some of the innovations described in the scenarios? In the DD group, for example, discussions gave rise to suggestions that the pay as you go nature of mobility services, "which you operate from a mobile device", is not necessarily an "attractive alternative" because young children, elderly and those without access to required technologies would be excluded. Furthermore, beyond not having the means to do so, there are many reasons why people may not wish to make digital payments e.g. data protection, security, and privacy (World Economic Forum, 2019).

- Of course it is impossible to consider all types of stakeholders – from housing developers to those mining the Lithium for EV batteries - but casting the web wide will reveal important constraints and opportunities. For example, global climate justice debates have an impact on local climate budgets and this should be explored, and consideration of accountable and transparent ethical supply chains and ethical finance will bring powerful stakeholders, some of whom are operating in the shadows, into view and explicitly address their positive or negative impact.

Our desk research amplifies some of the observations on local climate justice voiced in the workshop, showing that:

- Safety is important and has many aspects: "the train station isn't very nice, I'd be scared, it needs to be so you can feel safe and I wouldn't … it's quite isolated and there is a lot of kids out all hours and I would think they'd congregate round there so I think it would need to feel safer for me to use that facility' (Crisp et al., 2018). Safety concerns vary by gender in that 'women aged 16 to 34 years felt the most unsafe of any age and sex group using public transport alone after dark' (ONS Survey, 2022), and intersect with other aspects of diversity: '40% of LGBT+ people … were afraid of accessing [public] transport because of fear of how they might be treated' (Community Rail Lancashire, 2018)

- 'Often less affluent, ethnic minorities are more likely to be key workers—within the NHS, transport sector, care industry, as well as gig economy' and BAME communities must be at the heart of collaborative street design (Sustrans, 2020)

- 40% of blind and partially sighted people were 'unable to make all the journeys that they want or need to make' (Sight Loss Council, 2018) and shared road schemes can pose dangers to blind people (BBC, 2018). Overall, disabled people 'felt less safe in all settings than non-disabled people' (ONS Survey, 2022). Health issues can affect travel choices: 'At the moment, health issues are stopping me working, but until then I've always worked and enjoy working … I'd look for something in walking distance so I don't have to take the bus when it's busy. I've always been a bit nervous about transport and things' or 'Transport has to be near to where the firm is, I can't get off the bus and walk 20 minutes cos there is a few [jobs] like that, that are nowhere near the bus stop, not with arthritis, many moons ago maybe but not now.' (Crisp et al., 2018)

- Accessibility requires clear signs and time-tables, easy-read information, trained customer-facing staff, and accessible toilets, priority seating and ramps, for example to support people with learning disabilities (Mencap, n.d.). Older people are less likely to have access to internet 'on the move', less likely to use a smartphone, or travel related apps (Transport for London, 2019).

- Reliability matters: Research conducted by the National Autistic Society found that 75% of autistic people said that unexpected changes, like delays, diversions and cancellations, made them feel socially isolated and 52% of autistic people said that a fear of experiencing unexpected changes has stopped them from going on a bus or train (National Autistic Society, 2020)
- Family commitments affect travel choices: 'I can't go far out cos of her being in nursery and the amount of money it would cost and the travelling time, I'm just not able to do it, but if I got a local job, I've been looking at cleaning or retail or just something that would fit in with the hours that she'd be at nursery and stuff. (Crisp et al., 2018)
- The cost of travel is a critical factor: 'The sorts of jobs I am going to get will wipe out in bus fares … by the time I've paid for travel expenses to get there, work in a part-time job on a part-time wage, it wouldn't be worth my while travelling that far' (Crisp et al., 2018)

Q5 - What level of active engagement with stakeholders has there been?

Stakeholders have so far not been engaged in the design of any of the future scenarios. Engagement appropriate to the context (see Figure 9) should occur iteratively from ideation to implementation.

Figure 9 Arnstein's 'ladder of participation' The hierarchy does not necessarily imply that higher levels are better in all contexts. However, lower levels limit the degree of genuine participation and ownership. (Arnstein, 1969)

In the DD and UZC scenarios, a small number of carefully selected 'interested and informed' stakeholders were invited in the pilot workshop to participate in formative evaluation after the formulation of the scenarios. Ideally, the development of scenarios would detail how, when, and where stakeholders will be involved throughout the ideation, design, implementation and running of innovative schemes, so that these mechanisms could also be evaluated in terms of societal readiness.

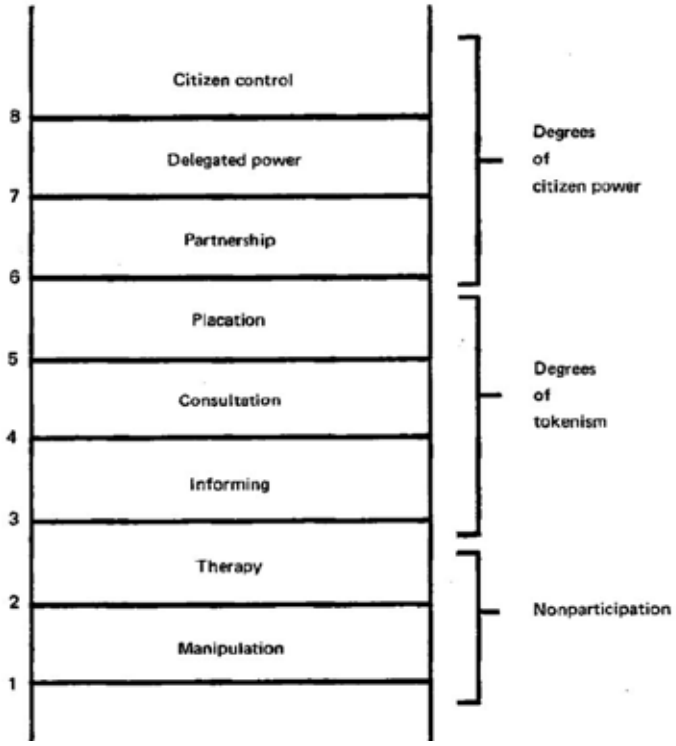


Figure 2:
Eight Rungs on a Ladder of Citizen Participation

Q6 – To what extent does the design concretely address the needs and opinions of all stakeholders?

In the absence of direct engagement with stakeholders, their needs and opinions are known only through research. All scenarios are described from the position of generic unmarked users, which is problematic because generic users are usually based on mainstream ideals (such as a white, middle class male). For example, the assertion "There is a mobility hub within a 10 minute walk of every home" holds several assumptions about an abstract "walker", such as the notion that everybody can walk, and that everybody that can walk does so at the same speed. The key consideration for the unmarked person in the scenario description is distance but there are many other factors that may influence a person's ability and desire to walk, such as safety, discrimination (being subject to harassment or abuse, with incidents against women, ethnic minorities, LGBTQ increasing in several areas, for example), health conditions, people's reason for travelling, and the how of travelling (someone walking with a mobility aid, for example, children, pets, shopping, or luggage) (Peters et al., 2010; Summerton, 2016).

The pilot workshop revealed design opportunities arising from considering supporting cultures and facilities might optimise cycling and walking experiences, by making them easier, more enjoyable, more inclusive, and more accessible. This highlights that engaging stakeholders can increase the creative ambition of innovation. The pilot workshop also showed that engaging stakeholders in discussions that facilitate creative, constructive dissent can be very powerful in increasing the resilience of design to potential failure. For example:

- It emerged that safety, in terms of cycling routes (e.g. unlit routes, perilous terrain) and in terms of bicycle storage ("where can I safely park my bike?"), was paramount and likely to seriously affect the uptake of cycling as a means of travel. These discussions illustrated a need for more systemic consideration of innovations. Innovations, even very established innovations - like the bicycle and associated cycle paths - which might, in isolation, score well in terms of Technology Readiness Assessment or, indeed, Market Readiness Assessment, score poorly in terms of Societal Readiness Levels because when considered in terms of how ready they are for people to realistically appropriate them, they are assessed in terms of their supporting physical, cultural, and affective infrastructures. One break in any of these elements on a cycling route design can render the entire route inaccessible, while provision of supporting infrastructure like secure and weatherproof bicycle parking, and showers and changing facilities in active travel hubs or at work can ensure that active travel, which entails contact with the weather, elements, exposure to pollution, and sweat doesn't interfere with professional requirements.
- Stakeholders have different values (employers want employees to turn up on time and fit for work, developers want to build dwellings that sell, local authorities want political stability and prosperity, nature needs space and freedom from pollution). Value Mapping can reveal frictions and potential synergies.

5.3 Social Good - Optimising the innovation's contribution to broader social, environmental and economic outcomes, such as democracy, transparency, accountability.

Social good implies the attainment of co-benefits in our alternative futures, for example alleviation of poverty and delivering better health outcomes through the land use and mobility choices available to the community. These considerations are not yet well developed in our futures, but unless decarbonisation is addressed robustly there is highly likely to be co-dis-benefits for all. JAM represents a world in which carbon targets are not achieved, and social good outcomes are therefore low, whereas net zero mobility is delivered in DD and UZC futures and there is a prospect of better social good outcomes. However, these are yet to be explored in any real depth and a means of delivery identified.

Questions			Answers	JAM	DD	UZC
7	To what extent have co-benefits, unanticipated consequences, ethical or wider societal implications been considered?	Awareness	Q7-3 High (e.g. The innovation deliberately addresses all of these aspects as part of the development)			
			Q7-2 Medium (e.g. The innovation addresses some, but not all of these aspects)	2	2	2
			Q7-1 Low/I can't tell (e.g. The inn1vation is focussed on its core function)			
8	How actively have unanticipated consequences been explored?	Commitment	Q8-3 High (e.g. There are defined processes for exploring unanticipated consequences through experimental implementations)			
			Q8-2 Medium (e.g. Unanticipated consequences were explored through stakeholder engagement during the design process)			
			Q8-1 Low/I can't tell (e.g. The innovation has been tested by the development team).	1	1	1
9	To what extent has the innovation been adapted to mitigate unanticipated consequences and optmise co-benefits?	Actionability	Q9-3 High (e.g. The innovation is socio-technical and includes defined processes for addressing unanticipated consequences)			
			Q9-2 Medium (e.g.There have been adaptations in response to user feedback)			
			Q9-1 Low/I can't tell (e.g.Mitigation of unanticipated consequences and opitmisation of co-benefits are the users' responsibility)	1	1	1

Table 5: Indicator Questions and scores – social good

Q7 To what extent have co-benefits, unanticipated consequences, ethical or wider societal implications been considered?

Aside from carbon reduction, all three scenarios strive to address co-benefits (such as clean air, liveable streets) and aspects of social justice (for example through affordable housing). It is less clear how they identify and address unanticipated (positive and negative) consequences. Mobility patterns are as personal as fingerprints, and in the DD scenario, for example, business models often imply that corporations 'know everything about us, whereas their operations are designed to be unknowable to us. They accumulate vast domains of new knowledge from us, but not for us.' (Spinney and Lin, 2018; Zuboff, 2017). Considering ways of 'institutionalizing data management of smart and shared mobility as a public good is a wise move that protects mobility users and facilitates efforts to steer shared mobility systems to low-carbon, low-congestion, and inclusive mobility' (Creutzig, 2021). Stakeholder engagement, co-design and speculative design approaches, and experimental implementations can be used to identify and address unanticipated consequences, ethical or wider societal implications.

Q8 How actively have unanticipated consequences been explored?

Aside from the pilot workshop, all three scenarios have been predominantly conceived, designed and evaluated by experts through desk-based analysis within the local authority and Stantec. There has not yet been any effort to actively expose the designs to stakeholder feedback or experimental implementation. This process insulates the design from complexity and forecloses creative search for solutions beyond known remits. It specifically makes it more difficult for social innovations to become part of the vision. The pilot workshop highlighted a number of examples:

- In the DD scenario, we learn that "Each house is provided with an EV charging point which allows the householder cheap access to fuel". On the surface, it appears as if all stakeholders have been considered, because each house has a charging point, which implies fairness. However, who can and who cannot afford an EV or the house? Has there been consideration of people working in toxic and exploitative conditions to extract the precious metals needed to make EV batteries? How will the reduction of fuel tax impact public funding? In the pilot workshop, whilst it was apparent that some participants were excited by the prospect of increased EV production and use, other participants were sceptical and argued that if car use is really necessary, it might be better to 'run our existing cars into the ground' before treating EV as an unproblematic alternative. Arguably, electrification of the existing, maladaptive automobility system does not contribute to social good because it doesn't reduce air pollution or congestion. In fact, electrification, perpetuates a broken automobility system and cements in land-use patterns that permanently take away road space from active travel. Research and public debate about electric vehicles suggest that EVs score pretty low in terms of their readiness for society and are 'not the answer' (Buscher and Cronshaw, 2022; Henderson, 2020)

- In the UZC scenario, we learn that, "Housing development is higher density and mixed use. It is clustered around public transport hubs which provide access to a range of transport services. Higher density development makes efficient use of land, as well as creating extra, well maintained open space which can be used to promote healthy lifestyles, and biodiversity net gain." The pilot workshop allowed participants to explore unanticipated consequences. It was felt that "People will move out to suburban areas if you urbanise the area in this way, especially those with young children who want more (private?) space" and some wondered whether UZC developments might "naturally become a place for the elderly only". There was concern over trust in the system of multi-modal mobility and the ownership of mobility hubs, prompting suggestions of community owned and operated mobility hub/libraries cooperatives.

- Innovations can have complex unanticipated consequences like those described above. Another example: Because e-scooters (and EV) are almost silent in their operation, some have been fitted with an Acoustic Vehicle Alerting System (AVAS) only to find that this was startling for visually impaired people and did nothing to improve safety - in fact, it created new safety issues (Sarah Gayton of National Federation of the Blind of the UK, said if a visually impaired person heard an AVAS noise, they "would probably freeze and stand still but wouldn't be able to get out of the way" (BBC, 2021).

There were many more examples. They underscore the need for stakeholder engagement and assessment to occur iteratively. Stakeholders need to be involved in the conception and design of innovations and schemes, not just in the assessment of them 'after the fact'. If evaluation and consultation occurs late in the day, revisions will be more costly and difficult to implement.

Q9 - To what extent has the innovation been adapted to mitigate unanticipated consequences and optimise co-benefits?

In light of the above, all three scenarios score low on this question. The scenarios were devised to represent two outer limits of potential alternative futures, with the intention that they lead to a debate about where more likely future outcome might lie, following robust engagement with all stakeholders.

5.4 Fit with a Decarbonised Future - Ensuring the innovation resonates with social practices that lead to decarbonsiation and aligns with and contributes to relevant policies.

Without knowing what social practices will be like in 2040 and beyond, this can only be assessed on the basis of what we know now. This is question is also complicated by the gradual dilution of transport decarbonisation policy, moving away from the policies and commitments needed to meet net zero mobility goals, leading to concern that alignment with government policy may not, at this point, be a 'good thing'. Yet is can reasonably be surmised that both DD and UZC are seeking to create the conditions for rapid decarbonisation of transport systems, both potentially with drawbacks relating to how each future impacts on society in a way that has yet to be fully understood. A distinction is however made between the lighter regulation and unintended consequences of the DD future and the greater integration and co-ordination of the UZC future to create a future that fits the needs of society.

Questions			Answers	JAM	DD	UZC
10	How well does this innovation fit with social practices of low carbon lifestyles in 2040?	Awareness	Q10-3 High (e.g. The innovation aligns with systemic changes in mobility systems)			
			Q10-2 Medium (e.g. There is clear and significant effort to support changes in mobility systems)			2
			Q10-1 Low/I can't tell (e.g. The innovation depends on policy, individuals and society to make sustainable transport choices)	1	1	
11	How well does it align with UK government policies?	Commitment	Q11-3 High (e.g. The innovation challenges policy-makers to make more ambitious sustainable mobility policies)			
			Q11-2 Medium (e.g. The innovation goes beyond existing government policies)		2	2
			Q11-1 Low/I can't tell (e.g. There is fit with all existing policies, but nothing beyond)	1		
12	To what extent does the innovation inspire low carbon society-compatible business models?	Actionability	Q12-3 High (e.g. Businesses and transport operators have co-designed the innovation)			
			Q12-2 Medium (e.g. The innovation promotes mobility as a service or shared mobility)		2	2
			Q12-1 Low/I can't tell (e.g. There is an emphasis on individual electric or autonomous vehicle ownership)	1		

Table 6: Indicator Questions and scores – fit with a decarbonised future

Q10 - How well does this innovation fit with social practices of low carbon lifestyles in 2050?

All three scenarios are searching for a 'fix' to address the challenge of carbon emission reduction. In the JAM scenario, the ambition for reductions is set too low, leading the design to maintain too much of the existing mobility system essentially unchanged to find fit with (of course unknown) low carbon lifestyles. The DD scenario puts its faith in advances in automated and smart mobility, without considering the significant critiques that are emerging around the viability and public value of such 'solutions' e.g. (Cardullo and Kitchin, 2019; Datta, 2015; Jirón et al., 2021; Willis, 2019). The UZC scenario takes an urban masterplanning 'fix' to the challenge. This is by nature a more systemic approach. However, it is constrained by assumptions of how essential mobility patterns will remain the same, assuming, for example that travel for work will require transport (except for home-working). More radical change may enter the frame with AI and automation (ideally) creating more time for local activities and less work, for example, funded by basic income.

Q11 How well does it align with UK government policies?

The ambition of UK zero carbon policies are being reduced. In the area of transport, for example, there has been a decrease of between 50-72% in the ambition of carbon emission reductions since the publication of the Department for Transport's 2020 'Transport Decarbonisation Plan' (DfT, 2020), according to Greg Marsden, speaking at the Cut Carbon Conference 'Decarbonising Transport: Obstacles, Options and Opportunities' 15-19th May 2023. The implications of this reduction include displacement of carbon emission ambitions to elsewhere in the economy, greater dependence on EV, and a growing gap between local/regional/sub-national ambitions for transport and national policy. In this context, being in alignment with UK government policies, as the JAM scenario is, is not a good thing. Both DD and UZC pursue more ambitious goals, but it is unclear how pro-active this approach is in terms of supporting development of more ambitious policies.

Q12 - To what extent does the innovation inspire low carbon society-compatible business models?

When it comes to making system change actionable, for example through supporting new business models, JAM's ambitions are low, assuming that there will be little change to wider society. Both DD and UCZ are more responsive to current trends in the development of new business models that support mobility as a service or shared mobility frameworks. However, these are limited and do not explore opportunities for social innovation (such as walking buses or commoning mobility through mobility cooperatives or mobility libraries, as suggested by participants in the pilot workshop).

Annexe 10.6: Place-based SoRA Plan of Work

1.0 Summing up his evaluation of the pilot workshop, Keith Mitchell makes a series of valuable observations:

Keith's observations	Our thoughts
There was a real difficulty in engaging with the broad combination of radical interventions required to make each of the two scenarios work from a technical point of view. To get better outcomes, it seems likely that we will need to define a stepped process of engagement which takes a group through a more collaborative co-creation process, bringing together a range of innovations over time into a preferred strategy – rather than trying to assess the differing readiness of two different hypothetical scenarios.	A stepped and iterative process that incorporates – as much as this is possible – experimental implementations of elements of a new mobility system and – ideally – the whole system. This requires creative thinking and making skills on all parts. Drawing lessons from projects such as Smart Suburbs project in Norway, which provided participants with e-bikes and cameras, accompanied by a qualitative research project to track implementation.
The workshop experience reinforces the importance of societal engagement in the development of strategy – almost completely absent in current professional assessment techniques. Even if the challenge is to make future scenarios/ innovations more ready for community adoption, once adopted, these innovations/ combinations of innovations become the basis for significant behaviour change, so how can we plan, design and implement these without that input? The SoRA forum is an excellent way of managing constructive dissent. A key aspect of this is to ensure that the choices open to the group all involve radical change: • Business as usual mobility policy means very significant climate outcomes and adaptions which themselves will force radical changes in behaviour/ health outcomes/ environmental outcomes etc • Compared with choice to change behaviour now and make the innovations and strategies we adopt as ready as possible for society In this way, we are all in the same boat, making decisions about a future that we can either let happen to us, or seek to influence for the better.	SoRA tries to facilitate this in an efficient way that also 'has teeth'. Recognising that climate mitigation and adaptation are wicked or 'super-wicked' problems that cannot be 'fixed' or 'solved' means that approaches need to be collaborative, creative and reflexive. SoRA supports a (never-ending?) process of formative evaluation, but it punctuates it in a way that allows for negotiation and development of business models. Two responses: 1. SoRA shows that, actually, we are not all in the same boat. Some people are on cruiseliners and some are clinging to sodden pieces of rotten wood. Some are more involved in producing the future ('good' and 'bad') than others. Addressing this inequality is powerful. The 2022 IPCC WG III report finds that 'employing social justice as an orienting principle can increase the political feasibility of low-carbon policies' (Climate Change 2022, 2022): 3–114. It involves working constructively with dissent. 2. UN Secretary António Guterres' repeat warnings that our responses to climate change are 'inconsistent with human survival' (United Nations, 2023) underline that humanity, as a species and as a value, require a sense of crisis where we are all in the same boat and what harms some of us, harms all of us. The support for dissent that SoRA provides creates a temporary platform where 'we' are allowed to see that we are all in that same boat - the planet and a possibly response-able, agonistic humanity, interdependent and tied into unequal relational webs. SoRA makes visible just how privileged some are at the expense of others - human and non-human, and where it becomes possible to address this in a more dialogic way. This is probably only possible in short ideal moments - we can only imperfectly make that happen, but that's the aim of SoRA. All workshops platform diverse participants and facilitate dissent through a variety of tools.

2.0 Bringing these reflections together, we have prepared a menu of potential SoRA related activities which would, if undertaken, address many of the issues identified through this report, and begin the process of using SoRA as a way of creating a platform for change. These should not be seen as a linear work programme, but points on an iterative process, where certain elements repeat (e.g. SoRA self-assessment), and each activity is designed to enhance the societal readiness of the innovation(s).

A. SoRA self-assessments using prototype online SoRA platform – Possible participants: Stantec team, Bury Council, invited external parties (e.g. Greg Marsden ITS Leeds)

B. Facilitated discussion of self-assessments and co-design of a first version SoRA plan - Possible participants: Stantec team, Bury Council, invited external parties

C. A series of workshops that platform different voices and facilitate dissent through structured communications, including knowledge exchange talks, circle of voices, fishbowl, forum theatre

C.1 Stakeholder Mapping - Possible participants: Stantec team, Bury Council, Third Sector experts, including organisations like Bury2Gether (parents of children with special needs), Transport for All, Youth Climate Groups, climate justice experts. Aim to produce a 1st iteration of a mapping of the range of stakeholders positively or negatively impacted by the different scenarios.

C.2 Value Mapping - Possible participants as above: Aim to produce a 1st iteration of a mapping of the different values and expectations that stakeholders hold, what they need from others and what they provide to others. For example, local governments value prosperity and growth, they need votes, they provide services and security. Voters value high quality environments, they need universal affordable, secure and reliable mobility, they provide votes. Transport operators value security and growth, they need a growing revenue stream and profits, they provide cost effective mobility services.

D. Forming a Stakeholder Reference Group (SRG) - The SRG can advise on issues arising intermittently and provide reviews at regular intervals. The use of SRGs in the context of SoRA can provide a more democratic and inclusive process for shaping decarbonising innovations. The role of SRGs in societal readiness assessment includes considering the scope and terms of reference for the assessment, supporting the assessment team in identifying sources of information and analysis, reviewing and providing feedback at key stages in the assessment process, and facilitating the platforming and consideration of other relevant voices. In addition, SRGs can communicate information to a wider group of relevant stakeholders, making the assessment process more transparent and inclusive. By including diverse stakeholders in the assessment process, SRGs can help ensure that the needs and perspectives of those who are often excluded from traditional consumer choice-based approaches are considered. This can help promote more equitable and effective decarbonizing innovations that address the needs of all members of society, regardless of their financial means or access to information

E. Methodological reflection Example: The DD scenario might describe how local stakeholders are invited to visit a future scenario website to get a flavour of the proposed scheme and encouraged to share their opinions online. Evaluation of this approach might problematise the way in which invitation to comment on the scheme was advertised on a developer's website and through social media channels, meaning that many were unaware of this opportunity, particularly those without internet access. This means of engaging with stakeholders might also be problematised on the basis that feedback has been reportedly sought through exclusionary channels that require English proficiency and the ability to read and write, as well as access to digital platforms.

F. Dedicated Dissent workshops "Dissent relates to nonconformity, having opinions or beliefs that differ from the majority or those in charge. This is not a championing of the underdog. We are not suggesting that the minority view is always going to be aligned with living more sustainably or concerned with how to nurture others. Covid-19 has shown us that, sometimes, marginal views (conspiracy theories relating to 5G, microchips, coronavirus, for example) can be dangerous and destructive – but there do need to be avenues for dialogue. It is only through the exchange of ideas, stories,

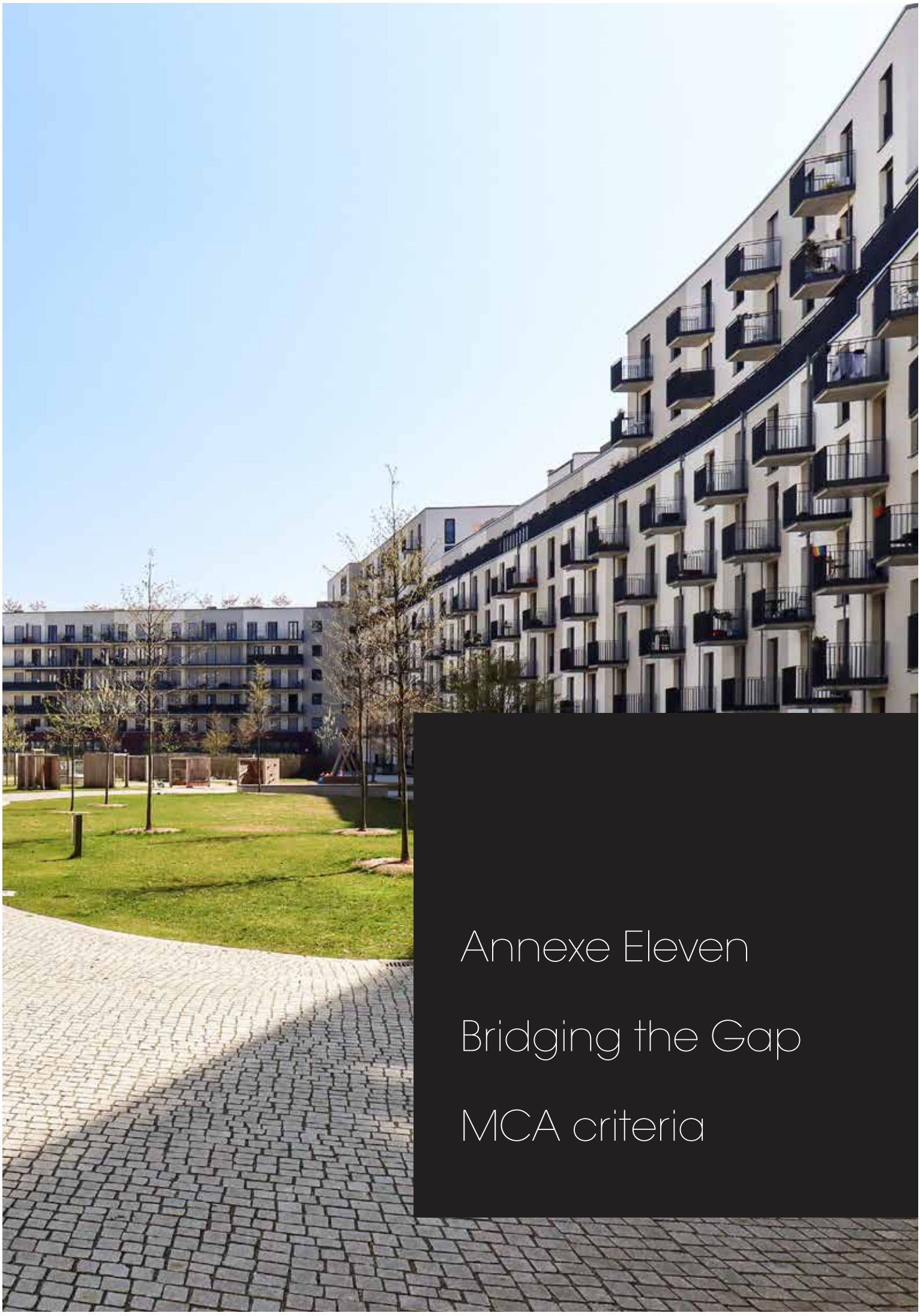
worries, concerns, hopes, and dreams that new horizons begin to form." (Buscher and Cronshaw, 2022). Dissent workshops could take many different forms. Here are a couple of examples:

- 'Innovating across the divide': very small groups (pairs, even) who knowingly disagree on an issue, or who have diverging views regarding a particular innovation or initiative, are charged with creating a shared vision that elevates SRL for both parties. Although the process may entail compromise, the focus isn't concession-making but rather innovation and creativity.

- Travelling Tales - In the workshop, there was not enough time to make use of the Travelling Tales cards but, in future work, the cards could be used with various stakeholders in relation to particular aspects of the FTS to facilitate dissent and stimulate discussion. Example: In the workshop, there was surprisingly little discussion about Artificial Intelligence and data sovereignty. This could be for any number of reasons (people were focused on different issues, people were not aware of these issues, people were aware of these issues but not phased by them, and so on) but the introduction of the Technological Sovereinity card, which reads "Smart transport all too often requires that people hand over personal data to corporations. Indeed, data about individual mobilities can identify people as accurately as a fingerprint. Cities like Barcelona are pioneering approaches to technological sovereignty where a set of new protocols governing the sharing and use of data are underpinned by new contractual arrangements with citizens and service providers." might have provoked critical and creative exploration of relevant facets of the FTS that were otherwise left uninvestiagted and uncharted.

In the workshop, there was some discussion about LTNs, and resistance to their introduction was framed as ignorant, misinformed and invested in 'conspiracy theories'. Without infrastrucuring for dissent, it is easy to jump to conclusions and dismiss opposing ideas without fully examining them. In 2022, three letters problematising LTNs were published in The Guardian. The writers carefully outlined their objections , as they described the detrimental effects LTN were having on their local areas (e.g. traffic displacement, resituated air pollution, increased journey times to local amenities, reduced frequency of buses, etc.). One author objected to "labelling all people with logical objections to low-traffic neighbourhoods as barbarians, myth-makers and right wing debate-deniers" and another wrote that George Monbiot's framing of opposition to LTNs as "down to the influence of angry men across the Atlantic with hard-right politics….only serves to alienate any democratic opposition.".

G. Co-design and experimental implementations – Ultimately, there is a need to move quickly, and be fleet of foot. One way of doing this is to identify potential quick win/ low downside projects, and to develop these using SoRA techniques through implementation, monitoring and development phases.



Annexe Eleven

Bridging the Gap

MCA criteria

MCA criteria

Author Jesper Howe, Environmental Planner,
Stantec. May 2023

National Policy Statement for National Networks

Criteria
Air Quality
Carbon Emissions
Biodiversity and Ecological Conservation
Waste Management
Civil and Military Aviation and Defence Interests
Coastal Change
Dust, Odour, Artificial Light, Smoke and Steam
Flood Risk
Land Instability
Historic Environment
Landscape and Visual Impacts
Land Use - Including Open Space, Green Infrastructure and Green Belt
Noise and Vibration
Impacts on Transport Networks
Water Quality and Resources

National Planning Policy Framework

Criteria
Achieving sustainable development
Delivering a sufficient supply of homes
Building a strong, competitive economy
Ensuring the vitality of town centres
Promoting healthy and safe communities
Making effective use of land
Achieving well designed places
Protecting Green Belt land
Meeting the challenge of climate change, flooding and coastal change
Conserving and enhancing the natural environment
Conserving and enhancing the historic environment
Facilitating the sustainable use of minerals

Transport Analysis Guidance (TAG)

Criteria	
Economy	Business users and transport providers
	Reliability impact on business users
	Regeneration
	Wider impacts
Environmental	Noise
	Air quality
	Greenhouse gases
	Landscape
	Townscape
	Historic environment
	Biodiversity
	Water environment
Social	Commuting and other users
	Reliability impact on commuting and other users
	Physical activity
	Journey quality
	Accidents
	Security
	Access to services
	Affordability
	Severance

Adopted Bury Unitary Development Plan

Criteria			
Economy	EC1 - Employment and land provision	Open Land	OL1 - Green Belt
	EC2 - Existing industrial areas and premesis		OL2 - Other protected open land
	EC3 - Improvement of older industrial areas and premesis		OL3 - Urban open space
	EC4 - Small and growing businesses		OL4 - Agriculture
	EC5 - Offices		OL5 - River valleys
	EC6 - New businesses, industrial and commercial development		OL6 - Multi-functional countryside
			OL7 - Special open land areas
Housing	H1 - Housing land provision	Recreation and Tourism	RT1 - Existing provision for recreation in the urban area
	H2 - Housing environment and design		RT2 - New provision for recreation in the urban area
	H3 - Incompatible uses in residential areas		RT3 - Recreation in the countryside
	H4 - Housing need		RT4 - Tourism
	H5 - Housing Improvement		
Environment	EN1 - Built environment	Highways and Transportation	HT1 - A balanced transportation strategy
	EN2 - Conservation and listed buildings		HT2 - Highway network
	EN3 - Archaeology		HT3 - Public transport
	EN4 - Energy conservation		HT4 - New development
	EN5 - Flood protection and defence		HT5 - Accessibility for those with special needs
	EN6 - Conservation of the natural environment		HT6 - Pedestrians and cyclists
	EN7 - Pollution control		HT7 - Freight
	EN8 - Woodland and trees		
	EN9 - Landscape		
	EN10 - Environmental improvement		

The Greater Manchester Strategy

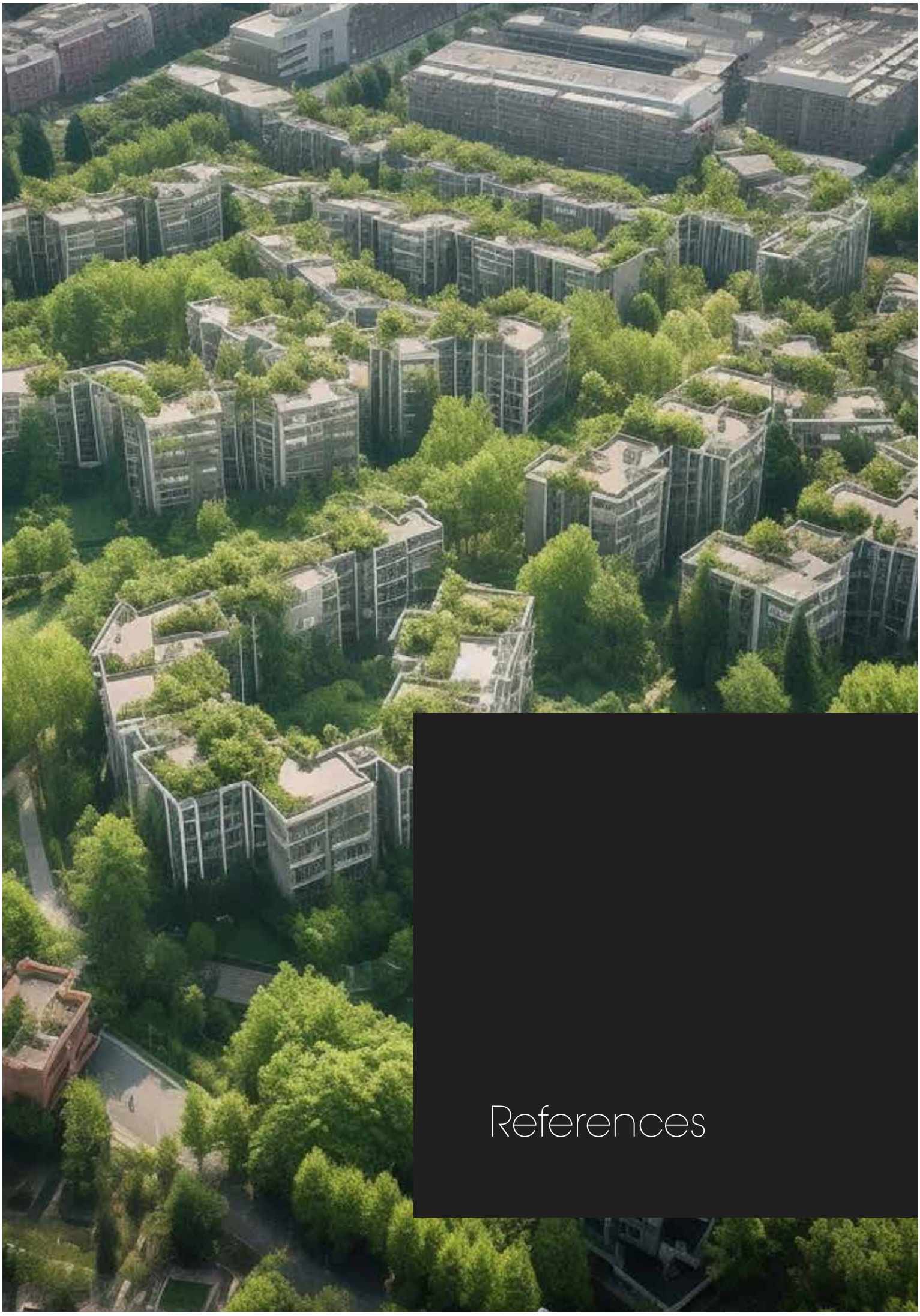
Criteria
Priority 1: Children starting school ready to learn
Priority 2: Young people equipped for life
Priority 3: Good jobs, with opportunities for people to progress and develop
Priority 4: A thriving and productive economy in all parts of Greater Manchester
Priority 5: World-class connectivity that keeps Greater Manchester moving
Priority 6: Safe, decent and affordable housing
Priority 7: A green city-region and a high quality culture and leisure for all
Priority 8: Safer and stronger communities
Priority 9: Healthy lives, with quality care available for those that need it
Priority 10: An age-friendly Greater Manchester

Greater Manchester Transport Strategy 2040

Criteria
Supporting sustainable economic growth
Improving the quality of life
Protecting our environment
Developing an innovative city region

Combined Criteria

Category	Criteria	Sub-Criteria
Society	Air quality	Dust emissions
		Vehicular emissions
	Noise and vibration	Noise emissions
		Vibration generation
	Health	
	Safety	
	Impact on commuting journeys	
	Impact on leisure journeys	
	Affordability	
	Severance	
Economy	Impact on businesses	
	Impact on regeneration	
	Impact on town centres	
	Supporting housing provision	
Environment	Biodiversity and nature conservation	Impact on internationally and nationally designated sites
		Impact on irreplaceable habitat and priority habitat
		Impact on regionally and locally designated sites
	Landscape, townscape and visual amenity	Impact on designated landscapes
		Impact on visual amenity
	Impact on flood risk	Impact on flood risk
		Impact on flood defences
	Water quality and resources	Impact on water quality
		Impact on watercourse geomorphology and hydrology
	Historic environment	Impact on nationally important assets
		Impact on regionally important assets
		Impact on locally designated assets
	Carbon emissions and climate change	Embodied carbon
		Carbon emissions
		Impact on climate adaptation
	Impact on land use - Green Belt and open space	



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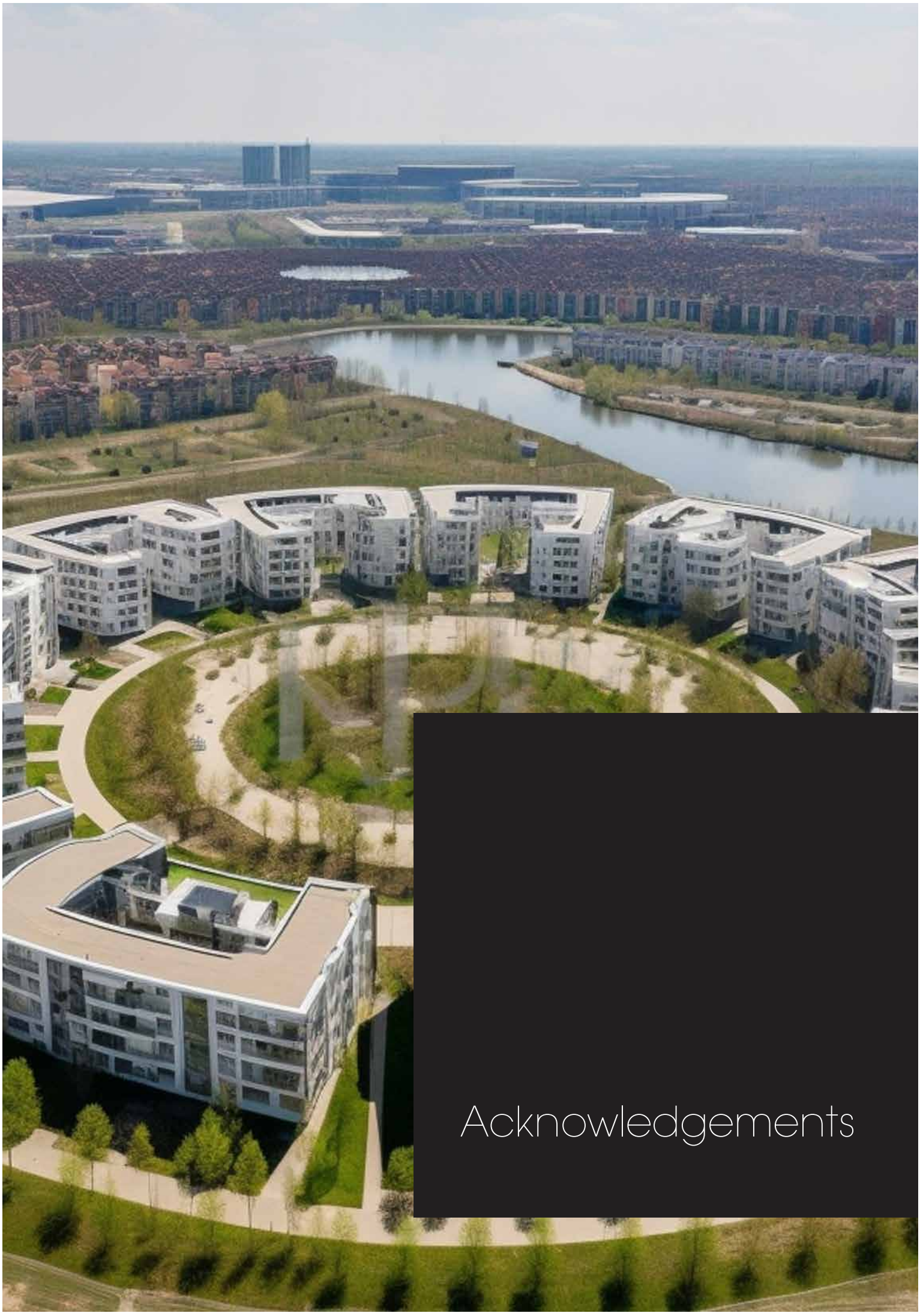

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