

Infrastructure 2100

Exploring the future of Wales' infrastructure
through long-run scenarios

A SOIF report for the National Infrastructure Commission of Wales
March 2025

The National Infrastructure Commission for Wales (NICW) was established in 2018 as an independent, non-statutory, advisory body to Welsh Ministers. Its key purpose is to analyse, advise and make recommendations on Wales' longer term strategic economic and environmental infrastructure needs over a 5–80 year period. NICW conducts studies into Wales' most pressing infrastructure challenges and makes recommendations to the Welsh Government. The advice provided by NICW will be impartial, strategic and forward looking in nature. NICW is accountable to the Welsh Ministers for the quality of its advice and recommendations and its use of public funding.

The School of International Futures (SOIF) is a purpose driven non-profit organisation that seeks to transform futures for current and next generations. It works globally with partners such as governments, foundations, civil society and business leaders to enhance innovation and resilience; to better understand and manage risk; and to improve strategic decisions.

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Citation: Curry, A., Todd, R., Strivens, F., and Lewis, A. (2025). *Infrastructure 2100: Exploring the future of Wales' infrastructure through long-run scenarios*. National

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Infrastructure Commission for Wales and School of International Futures (SOIF), Cardiff and London.

Foreword



by David Clubb, Chair, NICW

The National Infrastructure Commission for Wales [NICW] works within a framework that incorporates a range of Welsh Government policy and legislation, including the nature and climate emergencies, the socio-economic duty and the Well-being of Future Generations Act.

We also have a remit and terms of reference that provide further steer on how we should operate. One of the most interesting aspects is the forward-thinking approach; in making recommendations on infrastructure we are required to consider issues that might arise during the period 5-80 years into the future.

All public bodies are also obliged to think long term; it's one of the 'Ways of Working' defined within the Well-being of Future Generations Act. However, implementation of long-term thinking is not uniformly incorporated. Under the pressure of continuing financial pressures and, often, growing demand, many public bodies are too busy fire-fighting in the present day to lift their collective vision to the horizon.

One of our aims is to help public bodies in Wales develop their long-term thinking about infrastructure, and this report sets out how we used long-term scenarios to help transport specialists understand some of the challenges and benefits of this approach in their everyday work.

We hope that the experience of an all-day in-person workshop, and a half day online session, will have given participants from a range of organisations interested in Welsh infrastructure access to a way of thinking that they would not have otherwise experienced. The methodology may also be of interest to others who are considering undertaking similar scenarios.

The report also highlights some transport-related issues pertaining to the very long term that could be of interest when considering adaptation and resilience strategies in Wales.

We will continue to consider the needs of people being born in 2105 and beyond into our thinking, our decision-making and our public communications. We stand ready to support and encourage others to do likewise.

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Executive Summary

- This report summarises the outcomes of an exploratory project that used long-run 75-year scenarios to understand potential implications for shorter term approaches to infrastructure. NICW commissioned the project from SOIF, a public purpose futures practice.
- The project engaged around 35 stakeholders over the course of two workshops, one in person, one online. The participants included technical experts and people with a policy interest in transport and mobility futures.
- The project used a structured approach to develop the long-run scenarios, drawing on a method previously used with the Environment Agency. However, the outputs are mostly qualitative rather than quantitative.
- The four 2100 scenarios included: This Land is Your Land a well-being oriented world with radical changes in democracy; Living in a Materials World, in which infrastructure is transformed by rapid materials innovation; Creatures of Love, with significant inward migration and significant changes in belief systems; and High Water Blues, in which repeated climate shocks lead to long-run economic decline.
- The project was designed to identify issues that emerge now from a consideration of the scenarios. This was done by assessing the futures within the scenarios against the seven well-being goals, and identifying areas where different interventions might improve outcomes.
- The scenarios were tested against four places broadly representative of Wales as a whole, based on analysis of the dimensions of place in *Understanding Welsh Places*. These were: Bridgend/Pen-y-Bont; Ystrad Mynach; Aberteifi/Cardigan, and Blaenau Ffestiniog.
- These issues emerged through the discussion of places and scenarios:
 - The direct and indirect effects of climate change are likely to combine to make transport less convenient and more expensive. Assumptions about transport growth and the ability to maintain infrastructure may not hold.
 - Because getting around is harder, there are likely to be new models of localism. Local transport networks, of all kinds, become strategic assets; ownership of assets, and governance, makes a difference.
 - There will be new forms of repairable, demountable, and rebuildable infrastructure. Innovation in emerging types of vehicles is valuable.
 - More participatory community engagement is needed, as a first step to building capacity, capability, and new learning networks on transport and infrastructure.

Looking to 2100

The remit of the National Infrastructure Commission of Wales [NICW] is to assess the environmental and infrastructure needs of Wales over the next five to 80 years. This is longer than it used to be. In 2022, the timeframe that NICW looked out across was extended from 30 years. This makes sense: most infrastructure has a notional life of 60–70 years, although in practice much of it lasts much longer as it is repaired, refurbished, or upgraded. But this creates new questions about practice, in particular about methods that help us to act in the present against the greater uncertainties of longer-term futures.

Conventional planning tools can make a reasonable fist of anticipating change in the spatial realm across five to 30 years. In terms of social and spatial change, we recognise much of the world of 30 years ago. Anticipating a world 80 years hence, however, is more challenging.

To explore this issue, NICW commissioned the School of International Futures, a public purpose futures practice, to develop a set of scenarios for 2100 with NICW stakeholders, and to use them to explore how the consideration of longer term futures might change our perspective on our shorter term decisions about infrastructure that is likely still to be in use in Wales in 2100.

To this end, this report includes a description of the scenarios that were developed, and the ways that they were used to explore futures in a set of representative Welsh places. It includes a review of some of the implications that emerged from the process and a note on a GIS mapping approach to imagine the spatial dynamics of a longer term future. There is a separate technical report on the method used to develop the scenarios, as well as a short standalone guide to the methodology used to explore the implications for communities, for use by Welsh communities that might wish to try this for themselves.

Building the scenarios

The futurist Roy Amara proposed that there were three types of futures: probable futures, possible futures, and preferred futures.²

Scenarios are a type of possible future. In a world that is a complex emergent system, they characterise different futures, whose outcome depends on different types of change combining in certain ways.

The futures literature includes discussions of the success criteria for scenarios. In general, scenarios come in sets, and the scenarios in a given set should be distinctively different. Each individual scenario should be coherent: the social and economic system it portrays should hang together. And they should be interesting, in terms of policy or strategy.

Long term-scenarios present their own particular problems. The purpose of scenario thinking is not to predict the future, or to make forecasts. To the extent that scenarios are useful, they are useful as a way of testing the resilience of decisions made now against a range of different possible longer term outcomes. They help with 'options thinking' about the future.³

75 years is a long enough period of time for the world to change in ways that are unanticipated. For this reason, scenarios that take a longer term view should have within them elements that are genuinely discomfiting. At the same time, the future is never completely open.

Even over longer time periods there are always some constraints on change. Infrastructure is a case in

Box 1: The world 75 years ago

Over 75 years, values, demographics, technologies, and economics can change significantly. In 1950, for example, more than 100,000 people worked in the Welsh coalfields. There was a handful of valve-based computers worldwide. A long distance telephone call couldn't be made without help from an operator. There were about 2.5 million private cars in Britain (compared to 28 million last year). 80% of men were cigarette smokers, and around 40% of women. Women were still expected to wear hats in public, and men, ties. Male hat-wearing was declining. People would call each other by their surnames at work. Homosexuality and abortion were illegal, and would remain so for almost another 20 years.

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point. Much of the infrastructure that will be in place in 2100 is already in place now. Even some of the new infrastructure will be a replacement for, or an upgrade to something that already exists, just as we see old stone bridges alongside the modern replacement that carries the weight of the traffic now. Settlement patterns change slowly as well, even as some sites get abandoned as local conditions change. A port might silt up; a village might depopulate.)

Futures work also points us towards two types of change that help us make assessments that help with longer term thinking.

The first are those features of the world that change more slowly, and whose changes one can see coming. These are “the future that already happened”, sometimes called “black elephants” in the futures literature.^{4,5} Demographics is one example of this. The 20th century was shaped by an acceleration of fertility rates and increased longevity, such that the world’s population increased five-fold, from less than two billion in 1900 to almost eight billion in 2000.

⁴ Drucker, P. (1997). ‘The Future That Has Already Happened.’ *Harvard Business Review*. September 1997.

⁵ Sardar, Z. and Sweeney, J. (2017). *The Three Tomorrows of Post Normal Times*, In Sardar, Z. (ed). (2017). *The Post Normal Times Reader*. IIIT.

The story in the 21st century is the reverse of this, in that fertility rates are declining everywhere, and in three-quarters of the countries in the world, including Wales, they are now at or below replacement rate. Populations are therefore ageing, and governments that have used exhortations or incentives to encourage people to have more children have had no success. It looks like a long and deep shift towards a desire for fewer children and smaller families.

But demographics are like an ocean liner: they can slow for a long time before they turn around. But all of the estimates suggest that the global population will be shrinking before 2100, and perhaps as soon as 2050. We can expect that the population of Wales will be older, on average, in 2100, and that the extent to which this is different from the present will likely be down to the extent to which it has welcomed inward migration.

We see a similar slow moving change in the area of the climate emergency and the biodiversity crisis. Even effective action to stabilise and address levels of carbon emissions will take decades, or longer, and the biodiversity crisis, at least in part, is an outcome of increased global population and the food systems that have emerged to feed them. When looking out to 2100 we can make a reasonable case that both will be worse.

Long waves of change

The futures literature also contains some clues to longer waves of change. These are recognisable patterns of change that take several decades to unfold. There are multiple long wave theories, but the two that are most relevant here are first, one that sits at the intersection of technology innovation and investment, and second around the intersection of values, economics, and political institutions.

Innovation and finance

The Venezuelan innovation researcher Carlota Perez has identified five long waves, or surges, of innovation since the industrial revolution, each lasting 50-60 years.⁶ This is a heuristic rather than a law, but each has followed a similar pattern. There is an “installation” phase of 20-30 years, funded mostly by investment finance, followed by a crash, when investors' expectations get too far ahead of the market. There then follows a “deployment” phase in which these technologies are used to deliver real products and services that have a transformative effect.

Much of the 20th century was dominated by the fourth wave, at the nexus of cars, oil, and plastics. The

⁶ Perez, C. (2002). *Technological Revolutions and Financial Capital*. Cheltenham: Edward Elgar.

installation phase of the fifth wave –information and communications technologies [ICT]–started in 1971, but the deployment phase didn't arrive until the early part of the 21st century, when companies such as Google, Amazon and Facebook started to become influential. There are multiple signs now, 50 years on, that this ICT surge is running out of momentum, the noise around AI notwithstanding, as it becomes harder for these companies to generate returns to their investment.

This is the lightest of sketches of this model, and there is much more to it, but in the context of 75-year scenarios it is at least possible that the time between now and 2100 will see a sixth innovation surge of some kind that is distinctively different from the ICT surge, and that there will be only modest clues right now as to what that will be.

Values, economies, and politics

It is well known that values are one of the drivers of longer-term change, working on generational timescales. The American academic Gary Gerstle has also identified interesting multi-generational effects in 20th century American history, running over periods of around 40 years, that seem to have parallels in British history.⁷ His “political orders”

⁷ Allen, S., and Gerstle, G. (eds) (1989). *The Rise and Fall of the New Deal Order*. Oxford University Press; Gerstle, G. (2022). *The*

analysis argues that there are extended periods where there are dominant ideas about the political and economic system, framed by a particular worldview and shaped by legislation and regulation. The emergence of such political orders seem to follow economic crises.

It is possible to identify a similar pattern in the UK over the last century or so. Since the late 19th century, we have seen approximately 40-year cycles of changes in public and institutional values, each following around a decade behind an economic crisis of some kind. The reforms of the last Liberal government in the early 1900s created pensions and free school meals; trades unions acquired a

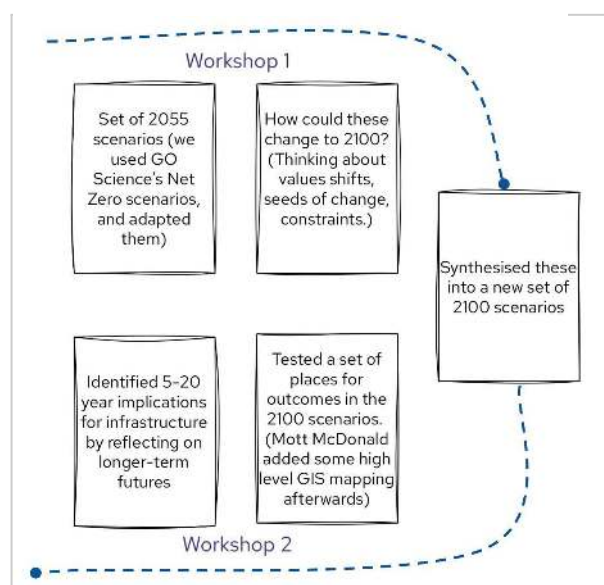
degree of immunity in law from the consequences of industrial action. In the late 1940s, a Labour government introduced the welfare state and nationalised important sectors of the economy. In the 1980s a Conservative government reversed some of this through deregulation and privatisation.

The American researchers Strauss and Howe came to a related conclusion through their generational

Rise and Fall of the Neoliberal Order. Oxford University Press.

research.⁸ Their Fourth Turning model posits that within an 80-year period there is a cycle that runs from Crisis to Crisis, through stages of rebuilding ('High'), benefitting ('Awakening'), 'Unravelling', and 'Crisis'. Although their theory is overly precise, and makes assumptions about generational

Figure 1: Scenario building



Source: SOIF

change that are contested, this four-part pattern is a familiar systems model.⁹ One can trace this pattern in Britain through the twentieth century, for example.¹⁰

There was an additional consideration in the design process. NICW, as the public body responsible

⁸ Strauss W., and Howe, N. (1997). *The Fourth Turning*. Crown.

⁹ Gunderson, L., and Holling, C.C. (2002). *Panarchy*. Island Press.

¹⁰ The 1940s and 1950s were a period of rebuilding; the 1960s and 1970s benefitted; the 1980s and 1990s were an unravelling; the 2000s and 2010s were a period of crisis.

for infrastructure in Wales, would need to follow a relatively structured scenarios development process that was comprehensible, auditable, and if necessary repeatable. The actual process is summarised below. As a result of this, SOIF ruled out more speculative approaches to envisioning 2100 and the related world-building, although these exist in the futures literature.

The scenarios building process

There are relatively few long-run scenarios processes in the futures literature, taking the long run to mean between 75-120 years. Andrew Curry, a member of the SOIF team, had developed a similar process for the English Environment Agency in the 2000s, and this had produced successful outcomes for the client.¹¹ This process was adapted for the NICW work. The approach, built around two participatory workshops, is shown in the schematic.

The steps were as follows:

1. The GO Sciences Net Zero scenarios for 2050 were reviewed and adapted for a Welsh context.¹² The rationale for this is that they are recent, have been used within

¹¹ Environment Agency Briefing note (undated). Water: Planning ahead for an uncertain future. Curry, A., and Hodgson, T. (2010). Scenarios for the year 2100: discussion paper on method. London: The Futures Company.

¹² GO Science (2023). *Net Zero Society: Scenarios and Pathways*.

government, and were informed by substantial modelling and other assessment work.

2. These scenarios were taken into the first workshop. This was an all day, in-person event. After a short warm-up exercise, participants immersed themselves in these 2050s scenarios to develop a picture of how Wales might change over 30 years.
3. In the afternoon, they then stretched themselves to 2100, developing one or two scenarios that could evolve over the long-term from these 2050s worlds. Stimulus material for this process included thinking about how worldviews and values might change over 40-50 years, as well as a set of prompt cards of weak signals of change.
4. Following the workshop, these were synthesised by the SOIF team into a set of light touch scenarios that were distinctively different, individually coherent, and opened up challenges to thinking about transport, mobility, and infrastructure. One further criteria was applied: that they contained elements that might seem strange in the context of 2025.
5. In a second online workshop, these were tested against the possible futures of a set of four Welsh places. The places are discussed below.

6. Finally, workshop participants considered decisions and actions over the next 5–20 years concerning infrastructure that had the potential to improve long-run outcomes for these communities.
7. In a parallel piece of work, a team from Mott McDonald did some exploratory GIS mapping, based on the long-run changes identified within some of the scenarios (including climate change impacts and possible population movements), to identify ways in which long-run planning assumptions might need to change. This work is summarised in a short technical report, published separately, and is also discussed below.

The 2100 scenarios in brief

The four 2100 scenarios are described below. They are summarised briefly here:

A: This Land Is Your Land¹³

Forms of radical democracy and far greater subsidiarity prioritise the impact of decisions on wellbeing and the environment.

B: Living in a Materials World

A new 'long wave' of technology based on strong, cheap, lightweight materials has transformed the material environment.

(Source: Unsplash)



C: Creatures of Love

Large scale inward migration has brought new skills, climate change has brought new belief systems. The land, and other species are treated with reverence.

D: High Water Blues

The costs of dealing with repeated extreme weather shocks have led to a long economic decline. Food and energy security are highly valued.

The 2100 scenarios

A: This land is your land

It is 2100. Wales has embraced a new model of governance where every community has a say in shaping its future in discussion with the government. Self-sustaining infrastructure powers daily life, and is also designed to protect communities from more intense weather.

Every decision is evaluated for its impact on the environment and on quality of life, to ensure that marginalised communities share in the benefits of sustainability. This decentralisation of power has sparked innovation, but also tension, as rural and urban areas sometimes clash over resources.

New political experiments, like *liquid democracy*—where individuals can delegate their vote to experts in specific fields—have emerged, challenging traditional ideas of representation and reshaping the role of governance.

The stability of this scenario depends on how the balance is struck between national governments (Welsh and UK) and localities, and how the boundary lines are negotiated. The scenario implies a shift to more public and community assets.

What happened to get here?

- **Decentralised power structures:** Local communities gained control over resources and decision-making, promoting sustainable, region-specific solutions.
- **Circular economies and renewables:** reducing reliance on finite resources.
- **Eco-villages and green urbanism are the norm:** People moved to eco-villages and intelligent cities designed for sustainability, self-sufficiency, and strong community ties.

Weak signals that point to this future

Boom in eco-entrepreneurship: An increase in businesses and technologies focused on circular economies.¹⁴

Rising Interest in green urbanism: Knowledge on designing green urban spaces is developing quickly.¹⁵

¹⁴ ECO entrepreneurship in the 21st century. (Undated). B ECO.

¹⁵ Samaranayake, B. (2025). The Rise of Green Urbanism. CYOL.

B: Living in a Materials World

It is 2100. The last 40 years have seen the landscape transformed by new lightweight and programmable materials, which have helped manage the weather impacts of climate change.

Wales has benefitted from this: its universities were heavily engaged in materials research, and entrepreneurs took advantage of this to set up new businesses, supported by the Welsh Government's industrial strategy.

The new materials also enable far more sustainable building renovation and lighter more flexible infrastructure.

Adverse weather events continue to happen, and sea level nudges upwards, but the new materials help with adaptation and quicker response times. Wales now exports this expertise.

In practice, this scenario seems like the only one in which standards of living in Wales in 2100 are comparable with or higher than they are in 2025. The wave of materials innovation creates opportunities both to adapt more effectively to climate shock and develop tradeable and exportable services.

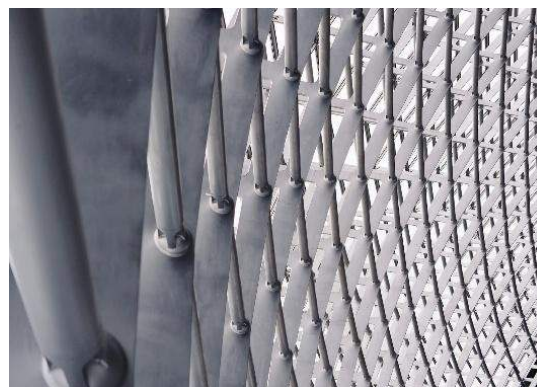
What happened to get here?

- The 'next industrial revolution' is not another wave of AI, but a **new set of technologies based on materials science**.
- Wales positioned itself well for these new technologies, and **built capability**.
- There is **applied learning** about how to ensure that people and systems make the most of these technologies.

Weak signals that point to this future

Graphene and related materials continue to develop.¹⁶

Self assembly research.¹⁷



(Source: Unsplash)

¹⁶ Persson, K. (2024). Graphene—what happened after the hype? RI.SE.

¹⁷ [Research, Self Assembly Lab](#), MIT. Undated. Last accessed 13 March 2025.

C: Creatures of Love

It is 2100. In a warming world Wales is growing different types of food. Over decades it has welcomed migrants to refresh its ageing population and workforce, and to replenish skills. The Welsh population is far more diverse than it used to be.

They have brought skills of all kinds which have helped to grow the new foods and repair, endlessly, the weather damage.

The psychology of dealing with the shocks of climate change and biodiversity loss has also created new forms of religious belief, in which the earth and other species are treated with reverence.

One effect of this is that rewilding is seen as a moral or religious duty, so land that isn't used for other things is actively returned to nature.

The scenario does not relate the circumstances in which upland livestock farming has declined, but it seems likely that this would have left a deep cultural wound, and have damaged Welsh language culture.

What happened to get here?

- **Inward migration** of people with practical agricultural and technical skills
- **New forms of religious and cultural belief** in response to climate change and human failure to mitigate or reduce emissions.
- **Shift in diets** away from animals for practical and religious reasons.

Weak signals that point to this future

Increased interest in **the rights of animals** (in law, the courts, and organisations.)¹⁸

Increased interest in **rewilding**.¹⁹

Migration used as a **regeneration strategy**.²⁰

A history of **fervid religious**

¹⁸ Wright, L. (2022). 'The elephant in the courtroom'. *The New Yorker*, 28 February 2022.

¹⁹ Rewilding Europe. (Undated) 'The Rewilding Movement: from Marginal to Mainstream'. <https://rewildingeurope.com/impact-stories/rewilding-movement/>. Last accessed 26 March 2025.

²⁰ Conticelli, E., et al. (2019). Inclusion of migrants for rural regeneration through cultural and natural heritage valorization. In C. Gargiulo & C. Zoppi (Eds.), *Planning, nature and ecosystem services*. Naples: FedOAPress.

movements in times of
political and cultural crisis in
Wales.²¹



(Source: Unsplash)

²¹ BBC, (2014). 'The revival'. *Wales History*.
https://www.bbc.co.uk/wales/history/sites/themes/religion/religion_revival.shtml. Last
accessed 26 March 2025.

D: High Water Blues

It is 2100. The costs of dealing with cycles of extreme weather has led to a long economic decline. Coasts have been reshaped by sea-level rise. Some places have been abandoned because of repeated flooding. Food and energy security are highly valued.

Income levels have returned to around those of the 1950s. Electric vehicles are there, but fewer, in private and public transport. Old vehicles are cannibalised.

There is some manufacturing capability. 'Cobots'—rebuildable, reprogrammable robots—work with humans in assembly plants. Renewable energy works. GPS and the web are erratic, but mobile technologies function. The government co-ordinates a civil defence programme: everyone has to volunteer.

The extent to which this is manageable rather than devastating largely depends on the level of investment made ahead of time in designing and refurbishing infrastructure for management and mitigation, and in building community skills and capacity for resilience.

What happened to get here?

- **Repeated adverse weather** events have absorbed money that could otherwise have been invested
- The result has been a **steady decline in income** levels and standards of living
- However, there is '**bottom-up**' **innovation** and social structures to manage crises, and there are **government structures** in Wales to coordinate this.

Weak signals that point to this future

Extreme weather could get worse.²²

Communities find it **harder to rebuild**.²³

Jugaad (frugal) innovation is becoming a more common idea.²⁴

'**Cobots**' are already in use.²⁵



²⁴ Prabhu, J. (2024) Jugaad Innovation Explained. *Asians In Tech*.

²⁵ Fundinger, S. (2024) Cobot vs Robot: What sets them apart? *Essert Industries*.

(Source: Unsplash)

Identifying a set of communities to test

Infrastructure is, of course, also about place. It has a material presence: it exists in particular locations, and over time. For this reason, we tested the 2100 scenarios against a set of specific places within Wales.

To do this we were able to draw on the gazetteer, *Understanding Welsh Places*, developed by the Institute of Welsh Affairs with support from Carnegie.²⁶ This documents all settlements in Wales with a population of 2,000 people or more, covering 193 settlements.

In the workshop setting, we had capacity to test four places. To ensure a degree of representativeness, we developed a matrix to ensure that our places:

- Were representative of the overall range of population size;
- Covered a range of different spatial types within Wales;
- Represented different socio-economic categories that together covered more than two-thirds of the settlements in *Understanding Welsh Places*;
- Represented places with varying types of dependency or interdependency;
- At least one place was predominantly Welsh-speaking.
- We also wanted to ensure that at least one of these places was 'independent'. The relatively small number (eight) of 'Independent' Welsh places in the typology, and their geographical distribution (all but two in the north-west) was a constraint.

Figure: Welsh places, distributed by population and socio-economic category

Category	Number of Places			
	Population: 2,000 – 9,999	Population: 10,000 – 24,999	Population: 25,000 – 99,999	Population: 100,000 and over
1	23	9	2	0
2	28	9	3	0
3	16	13	10	3
4	19	0	0	0
5	27	5	0	0
6	22	2	0	0
7	0	2	0	0

(Source: *Understanding Welsh Places*)

The four places that represented the best fit against these criteria were:

- Bridgend/ Pen-y-Bont ar Ogwr: (larger town on the South Wales transport corridor)
- Ystrad Mynach: medium sized town in the Valleys)
- Aberteifi/ Cardigan: small town in West Wales on the coast;
- Blaenau Ffestiniog: small inland town in Eryri/ Snowdonia.

The set of places here should be thought of as a range of types, representative of places in Wales. A longer project would have had the opportunity to test the scenarios against a wider range of places, and would have included a settlement in north-east Wales.

Details of each of the four places, abstracted from *Understanding Welsh Places*, are included in an annex.



(Source: Unsplash)

Box 2: Dependency criteria

“An **independent** place will have a high number of public, commercial, and social economy assets in relation to its population... It will have a diverse sector base in terms of jobs. Residents will travel short distances to work and services.

“A **dependent** place will have a low number of public, commercial, and social economy assets in relation to its population. It will be reliant on singular sectors in terms of jobs... The place will be reliant on neighbouring places for assets and jobs.

“An **interdependent** place will sit somewhere between independent and dependent places. For some public, commercial and social economy assets it may have a high number in relation to its population and for others a low number. A balance of people will work in the place with others reliant on neighbouring places for work and services.”

1. Bridgend/ Pen-y-Bont ar Ogwr



The pont at Pen-y-Bont (Roger W. Haworth)

When reviewing Bridgend through the lens of the four scenarios, some current characteristics that were noted in the workshop discussion. These included:

- Its relative dependence on the M4 (and the south Wales rail connection) for people travelling in and out of the town for work;
- Flood risk;
- Local raw materials and resources.

In Bridgend, in the **Your Land** scenario, it seems likely that there will have been some spatial reorganisation, with some areas of flood risk turned over to wetland or other forms of water management, and increases in density elsewhere to accommodate those who have been displaced. There is also the potential

to develop existing green routes, for example to Cardiff.

The **Materials** scenario, at least in theory, should offer the best opportunity to maintain living standards—lighter, stronger materials allow for lower energy inputs for transport, industry, and construction, and the potential for new types of innovation. Some of Bridgend’s legacy in manufacturing might have transferred into these new industries as they emerge.

In the **Creatures** scenario, Bridgend would have become much greener, with areas of “wild urbanism” sitting alongside horticulture or city farming.

Finally, in **High Water**, we see urban improvisation, which is managed by improvised vehicles and cannibalised parts. There’s some manufacturing,

again benefitting from the town's long industrial history, but some of the biggest infrastructure is simply too expensive to maintain.

Bridgend/ Pen-y-Bont ar Ogwr

Population (2011) : 46,757

Households (2011): 18,961

Number of jobs: 31,045

Inter-relationship assessment is : **Indicator of 7)**

Place categorisation is: **Category 1**

Category 1 towns tend to have higher proportions of young people (25-44 years old), and single person households and private rented homes.

There tends to be more people in work than the Welsh average and people tend to have higher proportions of people with degrees and higher qualifications.

There are 35 Category 1 towns in the database of 193 settlements.

2. Ystrad Mynach



*Maesycwmmmer Viaduct, Ystrad Mynach
(David Griffiths)*

Ystrad Mynach is a growing town in the mid Valleys. It is situated close to Blackwood and Bargoed. It is connected to Cardiff by a rail route, and has one of the densest networks of active travel routes in the UK, a legacy of the former mining rail and tramways. The mining legacy creates risks of landslips, when more intense rainfall runs through former spoilheaps.

In the **Your Land** scenario, Ystrad Mynach grows—it is inland and has less river-based flood risk than the Valleys towns closer to Cardiff. People move here from flood risk areas along the south Wales M4 corridor. It is possible that the area around Ystrad Mynach—with its proximity to Blackwood and Bargoed—could develop into a new conurbation. This would be

supported by better local transport systems that include both the active travel routes—which can be thought of as a strategic asset—and by investment in better local transport connections in and between the towns for those less able to use e-bikes or other forms of lightweight transport. This might also make Ystrad Mynach less dependent on Cardiff for employment prospects. This is likely also to depend on whether the operation of the rail connection is hampered by more extreme weather.

In the **Materials** scenario, there is the opportunity to find new ways to protect existing infrastructure. Ystrad Mynach is also well-positioned for a number of types of energy production in this scenario, and others, including microgeneration, micro-hydro, and micro-wind.

In the **Creatures** scenario, there would be more horticulture in the area, without ever coming close to becoming self-sustaining. It is also possible that innovation in rewilding might find ways of using nature to help stabilise the spoil heaps and other areas prone to landslip. There's a history of successful inward migration into the Valleys over more than a century that may mean the new migration is welcomed.

In **High Water**, as in Your Land, there is internal migration into the area from places elsewhere in Wales with greater flood risks. But heavier

rainfall creates greater risk of landslips. Already (in 2025) a number of the active travel routes in the area are blocked by landslips.

Ystrad Mynach

Population (2011) : 19,204

Households (2011): 7,670

Number of jobs: 9,585

Inter-relationship assessment is: **Interdependent (#4 of 7)**

Place categorisation is : **Category 3**

Category 3 towns tend to have higher proportions of people aged 25-44 years old and lower numbers of retired people than in other places in Wales. There tends to be slightly higher proportions of home ownership and higher levels of social rented homes.

More people are in work and in full-time employment than the Welsh average and multiple car ownership is very high.

There are 42 Category 3 towns in the Understanding Welsh Places database of 193 settlements.

3. Aberteifi/ Cardigan



Tower of St Mary's Church, Aberteifi (Rod Grealish)

Aberteifi is the only coastal town in the set, although its particular geography gives it some protection from sea level rise. In the *Understanding Welsh Places* it is also an 'independent' town, one of eight identified, meaning that it has a high level of self-sufficiency.

The **Your Land** scenario is already a direction of travel for Aberteifi. There would have been investment to improve the public realm, especially in areas along the coast, and better local transport systems. This might involve solar powered drones to deliver goods to outlying villages, and electric marine vessels on the river and in coastal waters—these might be autonomous, assuming digital coverage was sufficiently robust. Although day-to-day travel distances might be shorter, this might also feed into a sense of wanderlust, with some slow travel and slow tourism.

In the **Materials** scenario, new materials would be expected to feed into the practice and production of local craftspeople, for example leading to new types of textile production. There would be more freight, better transport links and infrastructure would be easier to maintain in this scenario.

In the **Creatures** scenario, it seems likely that the livestock industry—always hanging by a thread—has collapsed over the second half of the twenty-first century. This was a huge cultural loss, both in terms of the long heritage of Welsh farming, and because the agricultural and forestry sectors were so deeply connected with the Welsh language.

In **High Water**, smaller places like Aberteifi would be less of a priority in the face of a welter of competing claims. The community would be thrown onto its own resources to

hack together infrastructure and work out the best ways to adapt to repeated weather shocks.

Aberteifi/ Cardigan

Population (2011) : 4,184

Households (2011): 2,005

Number of jobs: 2,325

Inter-relationship assessment is : **Independent (#1 of 7)**

Place categorisation is: **Category 5**

Category 5 towns tend to have higher proportions of people aged over 65 years old and fewer people aged between 16 and 44 years old than in Wales as a whole.

There tends to be a higher proportion of retired people and single people and fewer married households with children. There tends to be a higher proportion of people who are self-employed or work part-time, especially in accommodation, food and services industries.

The places tend more to be in rural locations although multiple car ownership is lower than average.

There are 32 Category 5 towns in the Understanding Welsh Places database of 193 settlements.

4. Blaenau Ffestiniog



Railway bridge, Blaenau Ffestiniog (Andrew Hill)

Blaenau Ffestiniog was selected as an example of an inland community that was relatively disconnected from nearby towns. It is also a predominantly Welsh-speaking community. On the 'Interdependence' scale it is the most dependent of the settlements that were selected for review in the second workshop, characterised as having "some diversity of jobs", while being "reliant on some neighbouring places for some assets and jobs".

In **Your Land**, Blaenau Ffestiniog has an economic function, since the slate that it has traditionally produced is an effective and environmentally beneficial material. The current tourist infrastructure of tramways, zipwires, and the railway have been repurposed as community assets. Although local connectivity seems likely to improve, places like Blaenau

may still be disconnected from regional or national transport systems, unless the different levels of decision-making are well articulated with each other. On the other hand, Blaenau's relative isolation means that there is a long history of community initiatives that draw on existing solidarities. But Blaenau also has a sense of itself as a place with a history both of defiance and as a pioneer.

In the **Materials** scenario, Blaenau sees the development of modular infrastructure that works cost-effectively and can be repurposed. The old industrial topography has long been repurposed for energy and gas storage.

As in Aberteifi, the **Creatures** scenario was seen as a threat to the Welsh language, unless incomers—or their children—can be persuaded to learn the language as they arrive in the place and its culture. The circumstances in which the farming culture has declined would shape outcomes, but there seems potential for conflict here. Dissident or rebellious behaviour might involve hunting birds or animals.

In Blaenau Ffestiniog, the **High Water Blues** scenario was less depressing than in other locations. As

a community it has been overlooked so often that it is used to falling back on its own resources, relying on the community and its assets. Indeed there are already (in 2025) a range of economic assets in community ownership and forms of social and

community enterprise that are designed to improve economic resilience and are also significant employers in their own right.

Blaenau Ffestiniog

Population (2011): 3,662

Households (2011): 2,283

Number of jobs: 1,165

Inter-relationship assessment is : **Interdependent to Dependent (#5 of 7)**

Place categorisation is: **Category 6**

Category 6 towns or neighbourhoods tend to be in rural locations and overall reflect the average demographic and socio-economic characteristics of many places in Wales, although there tends to be slightly higher incidence of people with ill health, economic inactivity and part-time employment.

One key characteristic is that these places have proportionally more people who were born in Wales, identify as having Welsh nationality, and speak Welsh, than the average for Wales.

There are 24 Category 6 towns in the Understanding Welsh Places database of 193 settlements.

The future of transport 2100

Scenarios are not predictions. They do, however, offer windows into possible futures. This section therefore summarises some of the possible characteristics of transport in Wales in 2100 that have emerged from the project.

Looking across the combination of both scenarios and places, a number of features of a future transport system come into view, along with some of the uncertainties that accompany them. Some of these are underlined by the separate and indicative GIS analysis undertaken by Mott MacDonald in support of the project. This is discussed below.

The direct and indirect effects of climate change combine to make transport less convenient and more expensive. It is also more prone to disruption and therefore more unreliable. While this is more the case in the High Water Blues scenario, and less so in Materials World, in general the consequences of more extreme weather, with more money going into repair and adaptation as a result, means that there is lower investment in new infrastructure and in upgrades or repair. It is also possible that some transport routes will become unrepairable. In one scenario (Little Creatures) values change to make a virtue of this.

This in turn makes it more difficult to travel, because of potential disruption to transport infrastructure. This might be because of landslips, which are difficult to remedy, bridge failure, or lower levels of maintenance on some routes. It seems possible that people might prioritise other aspects of travel than speed. This might include safety, reliability, and predictability, and perhaps even pleasure, as well as cost. One further implication is that supply chains will be more erratic.

People are likely to move as a result of climate-related displacement. This might include people moving away from some coastal areas because of sea level rise, and areas of housing at higher risk of flood that either become uninsurable or which become used as managed floodplains.

The scenarios assume that these people are likely to remain in Wales, since local and regional resettlement is the general pattern of such displacement globally and historically. However, it is not clear whether they remain in the same area, or whether they move to other parts of Wales, to settlements in upland areas with less history of flooding. However, it is reasonable to expect that the transport system of 2100 will in

places be configured around different population distributions.

Increased difficulty in travelling leads to greater decentralisation and more local provision.

In versions of this future, places that are self-sufficient in assets—a version of the ‘Understanding Welsh Places’ category of ‘independent settlements’—and with better local

access are likely to be more desirable. As with the discussion of the local travel networks in Ystrad Mynach, above, such networks would be a strategic asset in most of the 2100 scenarios. Although discussion of decentralisation conventionally leads to expectations that places with poorer resources and skills will be further disadvantaged, other research suggests that decentralisation has an enabling effect on communities and in general improves a range of outcomes.



(Source: Unsplash)

Digital services may become erratic in some scenarios. The current overall direction of transport thinking embeds digital connectivity in three ways. The first is as part of Triple Access Planning, which treats digital provision as an equal partner, alongside physical mobility and spatial proximity, in access to goods and services.²⁷ The second is as a method to share transport

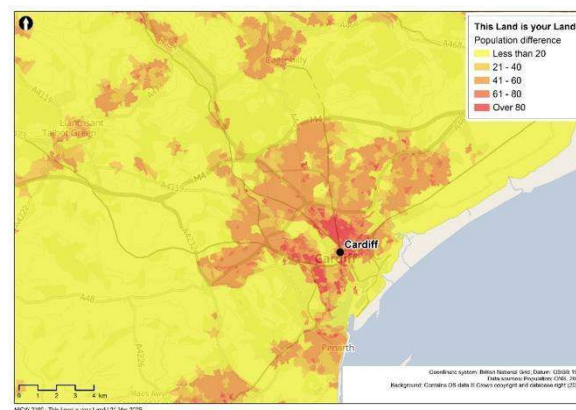
Source: Unsplash

information and also to ensure access, payment, and rights to travel,. (For example, in both public transport systems and through bike or e-bike hire systems). The third is in the role of PNT [Position, Navigation, and Timing] technologies that underpin the GPS systems that underpin much travel and logistics provision. Long term planning for transport and mobility needs to have an adaptation plan, rather than assuming that the current information and communications technologies will continue to work in the way they presently do. These would integrate lower-tech solutions, possibly solid state solutions such as older card-based systems, to reduce digital dependency.

²⁷ Lyons, G., et al (2024). Triple Access Planning for Uncertain Futures – A Handbook for Practitioners (Summary version), March.
<https://uwe-repository.worktribe.com/output/11751967/>.

Transport resilience in 2100 will require renovation and repair. This is likely to involve a mix of new skills and traditional skills, as well as access to shared information. It may also involve solutions that are less centralised and more adaptive. Knowledge of what has worked elsewhere, in similar situations, may have more value, and networks that are able to hold this knowledge and share it will therefore also have value. Such knowledge-sharing may also need to be incentivised, either within the networks or by forms of encouragement and reward from central government.

The history of places matters in influencing their future transport options. Just as the future is not completely open, so places have particular histories that persist over time. In some cases, these involve transport systems and networks built for one purpose that can be repurposed in different ways to adapt to emerging circumstances. These histories also include different types of legacies, including skills, culture,



Cardiff: This Land Is your Land (Source: Mott MacDonald)

and particular types of local social organisation and local experience. Aspects of these histories can increase local resilience in the longer term. Policy-making should take note of these positive legacies and seek to build on them.

Mapping the future



As part of the project, members of the systems team at Mott MacDonald used GIS mapping tools to project the long term landscape for transport against some of the places and scenarios developed in the project. This work was illustrative in nature.²⁸

²⁸ There is more detail in Mapping 2100 Scenarios, a technical note prepared by Mott

Bridgend: This Land Is your Land (Source: Mott MacDonald)

In particular, they projected two of the scenarios: This Land is Our Land, and Creatures of Love. The rationale for this choice was that This Land is closest to the Welsh Government's vision in the Wellbeing of Future Generations Act, while Creatures of Love was most divergent in terms of population distribution.

A selection of their GIS maps are shown on the following pages, with a discussion of outcomes and implications. Their technical note is available as an Annex document.

In the mapping for This Land, they drew on existing baseline population assumptions for Wales, and similarly on base case climate change effects to 2100. They assumed that people displaced by climate effects would attempt to remain locally. The intensity of the colours show the rate of change, not absolute population levels.

The effect of this is to increase density, notably in Cardiff, but also in Bridgend and Ystrad Mynach. (The Mott McDonald team did not prepare maps of Aberteifi or Blaenau Ffestiniog because the populations of the towns are too small currently to show the impact of changes.)

McDonald for the project, which is available as a separate Annex to this report.

This increase in density has an

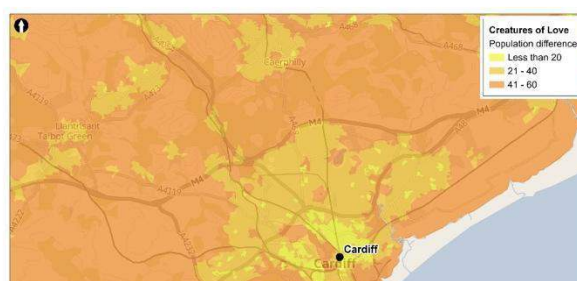
immediate impact: it means that different types of shared transport solutions become more viable. In other words, the relationship between density and transport viability creates a virtuous cycle within the This Land scenario.

In the case of Bridgend, the modelling projects that the increases in density will be absorbed in the north of the town, closer to the M4, which may involve new design for livability in that area of the town.²⁹

The mapping also suggests that there is increasing density in the Valleys, which makes shared or public transport between places here more valuable and more viable.

The Creatures of Love scenario has two underlying assumptions. The first is that there is higher inward migration into Wales than in the population base case, and the second is that the population is generally more evenly spread throughout Wales. In the maps, because the colours show rates of change against existing population, this change is visually overstated.

Cardiff: C
MacDon



However, this more even distribution of population immediately raises questions about mobility. Although the scenario implies that—as a result of values shifts—people will be happier living and working locally, if this is not the case they will either increase their car use, if they can, or be using digital communications technologies, or require an imaginative redesign of how shared or public transport works. Each of these raises its own separate questions about the future of transport.

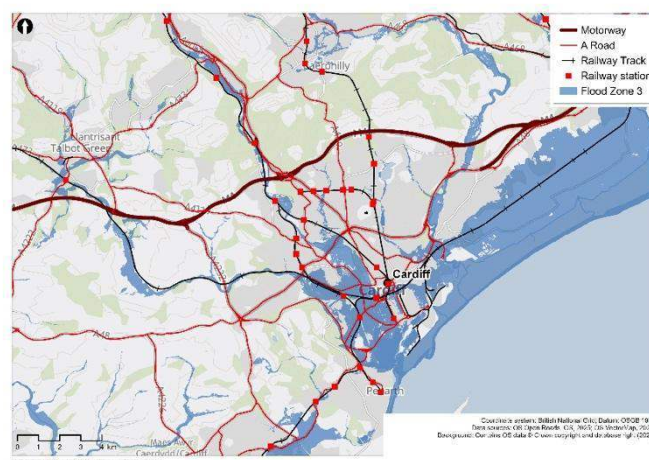
In the first of these cases, it requires that there is enough energy to power the vehicles. Given the current transition to electric vehicles, this is likely to involve local or regional electricity production from renewable sources of energy.

In the second case, given the role of digital access in Triple Access

clear that this will be the case in all scenarios. However, it may be more straightforward to enable local microgrids in such scenarios, as has already happened in some weather emergencies, and this would further underline the value of localness.³⁰

Flood risk in the GIS mapping

The GIS mapping note also maps the effect on Cardiff of flood events at Flood Risk Zone 3 (more than once in a hundred years for river flooding, once in two hundred years for coastal flooding). It is possible that these will become more frequent given climate projections that anticipate accelerating climate impacts. It finds that a significant number of Cardiff’s major roads are at risk of flooding, along with a large section of the main railway line and Cardiff Central rail



Planning, discussed above, this requires regular (if not continuous) access to digital services. It is not

³⁰ Greenfield, A. (2024). *Lifehouses*. Verso Books.

station. The 'Mapping 2100 Scenarios' report notes that:

"[I]n this scenario, significant investment would be required to mitigate flood-risks in order to reduce the impact on transport infrastructure of more frequent flood events and eventual loss to sea-level rises, or to provide alternative infrastructure that is not vulnerable to flooding or coastal land loss."

Implications for infrastructure over the next 5-20 years

Getting from scenarios to policy can be a struggle. The scenarios here are looking out at a longer-term future, whereas policy is made in the short-to-medium term. In general the futures literature in this area is under-developed. However, there are some conceptual models that help. These create a bridge from the possible futures that are represented by the scenarios to policy and strategy via an organisation's preferred future.

As a Welsh public body, NICW has a well-defined preferred future. It is bound by the policy of the Welsh Government set out under the Well-being of Future Generations Act of 2015.³¹ This places a duty on public bodies "to carry out sustainable development," defined as "improving the economic, social, environmental and cultural well-being of Wales."³²

This duty also requires public bodies to consider seven wellbeing goals,

³¹ Well-being of Future Generations Act (Wales) 2015. <https://www.legislation.gov.uk/anaw/2015/2/contents>. Last accessed 27 March 2025.

³² Welsh Government (2019). *SPSF 2: Shared Purpose: Shared Future. Statutory guidance on the Well-being of Future Generations (Wales) Act 2015*. <https://www.gov.wales/sites/default/files/publications/2019-02/spsf-2-individual-role-public-bodies.pdf>. Last accessed 12 March 2025.

usually summarised visually. These represent NICW's preferred long-run outcomes. One of the implications here is that it is necessary to think about infrastructure more broadly—beyond the narrower technical discussions that might be involved in other jurisdictions.

Figure 2: The seven well-being goals



(Source: Welsh Government)

One way to think of this is to think of the futures scenarios as a set of possible path-dependent outcomes, and review them against your preferred outcomes. The policy approach then becomes a question of the extent to which policies and actions in the short-term can influence the path in the long-term, in such a way that it has the potential to amplify long-term outcomes that

are closer to your vision, and mitigate long-term outcomes that might be damaging to the vision.

with some relevant research evidence.

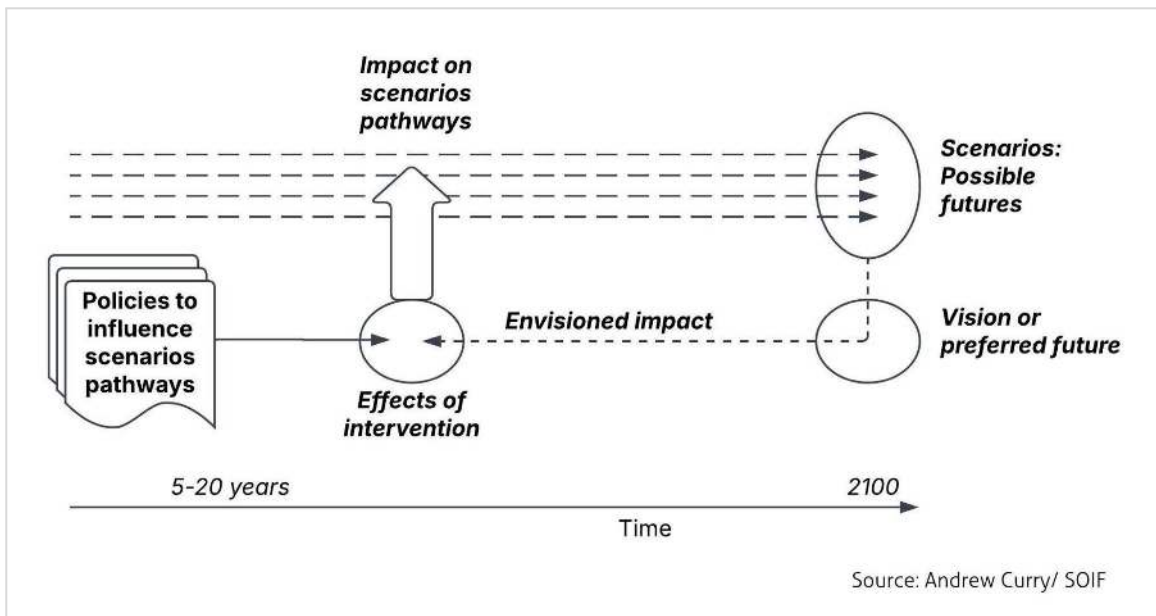


Figure 3: From scenarios to policy

There are important caveats here. In working with scenarios, we are always dealing with complex emergent systems. They may behave in unexpected ways. Interventions need to be prudentially assessed, and should be reversible if there is risk of future harm, for both practical and ethical reasons.

Allowing for these considerations, one of the tasks of participants in the second workshop was to review the scenarios discussions for each of the four communities, and propose policies that could be developed in the next 5-20 years that were likely to improve well-being outcomes in the longer term.

The section that follows represents a synthesis of these policy proposals,

Developing strategic options

The language of strategic options might be helpful here. Testing policies against a range of scenarios can help you to identify different types of potential outcomes. These fall into four types:

[1] Policies that appear to improve outcomes across all the scenarios, which you would implement and then monitor for unanticipated effects;

[2] Policies that improve outcomes in a majority of scenarios, which you would implement while both monitoring for unanticipated effects and also scanning for changes in the external contextual environment. Such policies need to have a clear exit strategy. These are the equivalent of a 'put' option in financial options.

[3] Policies that improve outcomes in one or two scenarios. These require current investment in sufficient capability now to operationalise them in the future if required. This involves investing in 'minimum viable capacity' while scanning for changes in the external environment. These are the equivalent of a 'call' option in financial options.

[4] Policies that do not improve outcomes in any scenario. In practice, given the nature of policy-making, these are more likely to fail because they have insufficient impact rather than because they are counter-productive. You can abandon these proposals or review ways to increase their impact.

Paul de Ruijter describes options in this way: "We generate options to create the range of alternative actions which would be at our disposal and which would be effective under different possible circumstances, and with the help of which we can anticipate these circumstances."³³

An example of a 'call' option in the present set of scenarios is that we will not know for several decades if the materials in Materials World will scale in a viable way; but if they do, they are likely to be transformational. A 'call' strategy to ensure minimum viable capacity involves, for example, monitoring the science and supporting research capacity in Welsh universities and technical organisations.

³³ Paul de Ruijter (2016). *Scenarios Based Strategy: Navigate the Future*. Routledge.

Policy interventions in the next 5-20 years

This section discusses the findings from the scenarios research and workshop process, and identifies some areas that might deserve further investigation.

1. The past is not a reliable guide to the future

Across the scenarios there are multiple signs that the 20th century planning assumptions of both continuing growth in transport demand, and sufficient resources to maintain infrastructure are likely to be challenged. The effects of climate-induced extreme weather effects—even on conservative assumptions about rates of warning—are likely to lead to different spatial patterns.

These can be expected to include different spatial patterns, with parts of communities being abandoned because of flood risk—or perhaps whole settlements. As discussed in the GIS mapping analysis, there are likely to be movements of people, either within their own communities, enabled by greater density or to other communities that are less exposed to coastal river-based flood risk.

Although workshop participants were concerned by the local acceptability of greater density, research suggests that settlements can increase density to the point of

creating walkability and ensuring viable local services with only modest changes to housing provision, and without building high-rise buildings.³⁴

2. New models of localism

If the scenarios are right in suggesting that transport will become more difficult, then local transport will become more important. This could include the upgrading of active travel routes and greenways to ensure that they remain viable in the face of both climate change and other budget pressures. In the long-term, such routes will be seen as strategic assets, and options analysis therefore suggests that investment now to protect them in the longer term becomes a prudent strategy.

Innovation in other forms of local transport provision could also be valuable. This might include thinking beyond the current local bus model to smaller 'swarm' buses with intelligent route provision,

³⁴ Wilding, M. (2017). How housing schemes are achieving high densities without tall buildings. *Planning*, 27 September 2017. Lange, M. (2024). Designing density: How to increase the supply of housing in existing residential areas. *Centre for Cities*, 23 May 2024. Karlsson J., and Mace, A. (2022). Delivering higher-density suburban development. *LSE Blogs*, 21 February 2022.

depending on demand.³⁵ Innovation around old forms of transport and in emerging forms of new transport, from electric and even self-powered inshore vessels to lightweight all-terrain electric vehicles, to drones, will be needed to ensure a diverse range of mobility options.

3. Participatory engagement

Community engagement in shared issues concerning their future becomes more important. One of the elements of climate change is a phenomenon known as ‘solastalgia’, a form of grief in which individuals or groups mourn vanished or disappearing aspects of their local geographies.³⁶ The place-based scenario discussions identified a number of examples. It will be necessary for communities to go through this phase of grief before it is possible to engage with approaches that are more future-facing. This suggests a need for more participatory and more open-ended approaches to community engagement than are seen in conventional planning and spatial consultations. NICW has been trialling such an approach involving

³⁵ Potter, S. et al. (2022).

Demand-responsive transport returns to Milton Keynes—lessons for a bus industry in crisis? *Town and Country Planning*, 91(5).

³⁶ Travers, M. (2023). A psychologist offers three tips to deal with solastalgia’. *Forbes*, 14 September 2023.

creative methods in the Grangetown district of Cardiff.^{37,38}

4. More adaptable infrastructure

Understanding transport resilience becomes a critical task in transport planning. There are already approaches emerging to do this.³⁹ Over the longer term, infrastructure may need to become more repairable by people in the communities that they serve, and may also need to become less permanent. There is a niche literature on the nature of demountable buildings that might be extended to consider the future forms of infrastructure.⁴⁰ The analogy here is with how the Army’s Corps of Royal Engineers approaches infrastructure as being constructable, deconstructable, and

³⁷ Nicholl, A., Todd, R., Strivens F., and Lewis A., (2025), *Engaging diverse place-based communities in conversations about climate adaptation and infrastructure*. National Infrastructure Commission for Wales and School of International Futures (SOIF), Cardiff and London

³⁸ Strivens, F., Todd, R., Nicholl, and A., Lewis, A., (2025). *Toolkit: Engaging Diverse Communities in Climate Adaptation Conversations*. National Infrastructure Commission for Wales and School of International Futures (SOIF), Cardiff and London.

³⁹ ITF (2024), *Transport System Resilience: Summary and Conclusions*, ITF Roundtable Reports, No. 194, OECD Publishing, Paris.

⁴⁰ Yang, Y, et al (2024). Disassembly and Reuse of Demountable Modular Building Systems. *Journal of Management in Engineering*. Vol. 41, Issue 1.

rebuildable. Both repair and rebuild imply that new skills will be needed—or in some cases, the recovery of older skills.

5. Governance and ownership

If communities become more dependent on local infrastructure for their mobility, governance and ownership of mobility and infrastructure assets becomes more important, to help to ensure community viability. This extends beyond physical assets to data assets, where both open data and interoperability become important. (It is also worth noting that the scenarios include futures in which data and communications coverage are patchier and more unreliable than they are now.)

This suggests that new ownership models may be needed to underpin the shared ownership of assets, and that new financial models might be needed to ensure viability of critical community assets. There are also questions about how to underwrite the insurance of assets in areas of flood risk, and the point at which such assets become uninsurable—and the consequences of this.

6. Community capacity

An important finding from the research is the importance of building community capacity and capability for resilience in the face of weather-related shocks. Many communities are becoming aware of

the risks that they may face as a result of climate change; some communities in Wales have already an experience of the devastating effects of extreme weather.⁴¹ But while the world's global cities have a mechanism for sharing international learning—through the C40 Cities network⁴²—much of this is unhelpful or irrelevant to communities of only a few thousand people.

There's some evidence already of like-minded smaller communities learning from each other in an ad hoc way or through more informal networks. But there still seems to be a gap here. While there are already learning networks within Wales, what would the equivalent of an international learning network similar to the C40 network look like for communities the size of Aberteifi, Blaenau Ffestiniog, or Ystrad Mynach?

7. Climate change will involve a sense of loss.

This will be true of everyone, not just those who have to move. We may need to help communities to adjust to these losses—a form of shared

⁴¹ Parr, J. (2020). Storm Dennis - one of the most devastating storms to hit Wales in recent history. Natural Resources Wales, 24 February 2020.

<https://naturalresources.wales/about-us/news-and-blogs/blogs/storm-dennis-one-of-the-most-devastating-storms-to-hit-wales-in-recent-history/?lang=en>

⁴² C40 Cities. <https://www.c40.org>. Last accessed 26 March 2025.

grieving—as part of changing expectations about the future so they can also start to shape that future.

§ § §

It is beyond the scope of this report to make specific policy recommendations to NICW. Nonetheless, taking these together suggests that there is a set of questions here about the future of infrastructure and mobility that feed directly into the intentions of the Wellbeing of Future Generations Act and the seven wellbeing goals.

Between NICW and the Welsh government, these could constitute a rich agenda for an action learning programme that is designed to improve resilience of multiple kinds in the face of climate change—without waiting for 2100.

Bringing futures thinking into practice

Participants in the process reported that they found that it helped them to think differently about possible futures; and that it had increased their confidence in applying futures thinking. There was also an increase in participants' reported ability to apply long-term thinking in their day-to-day work.

Qualitatively, the responses indicated that the approach had encouraged more systemic thinking. While survey responses remain unattributable, participants shared insightful reflections:

Q *"It highlighted the importance of resilience, sustainability, and emerging technologies in shaping the future of the Welsh Strategic Road Network. The discussions encouraged a more data-driven, forward-looking approach, balancing immediate needs with long-term sustainability."*

Q *"The workshop reinforced the need for a long-term, systems-based approach to planning, highlighting challenges like climate resilience and technology. It strengthened my view on cross-sector collaboration and the urgency of integrating future-proofing into current decisions."*

This shift in thinking was not just theoretical; for some, it offered practical insights they were interested in applying to their work.

Q *"It was useful taking a place-based approach and thinking about different needs, this is something I would like to implement in future work."*

The Opportunity for Wales

One of the most striking observations was the recognition that Wales is in a unique position to lead in future-proofing infrastructure. With the Well-being of Future Generations Act as a policy foundation, there is a real opportunity to turn foresight into action.

Q *"A big takeaway was how to exploit the specific opportunity of the context in Wales to make many of the ambitions a reality. The policy backdrop is there to leverage."*

Thanks

Thanks to: Martin Paretti and Evie Brook of Mott MacDonald for their GIS mapping analysis; and to Lynne Reynolds for translation of workshop materials.

Project Participants

The below is a list of participants who took part across the two workshops, presented from left to right in alphabetical order by first name.

Source: SOIF

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p.41: Project Participant list, SOIF

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