transport for quality of life

Friends of the Earth Cymru

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Report

A Wales Transport Policy fit for the Climate Emergency

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Summary

This paper is written by Transport for Quality of Life and endorsed by Friends of the Earth.

It argues that Welsh policymakers need to think afresh about transport policies for the climate emergency. Technological changes are necessary but not enough to achieve the large, rapid reduction in carbon emissions we need. Climate scientists are warning that we also have to make substantial changes to our travel behaviour, driving less and flying less. And we have left it so late that steady incremental changes to our travel will not be enough. In the Welsh policy context, it is clear that achieving the wellbeing goals enshrined in the Wellbeing of Future Generations Act (2015)[1] cannot be achieved without tackling transport as the rogue sector that is performing worst in reducing climate damaging emissions.

Most transport policy experts are unaware of the degree of urgency that climate scientists are trying to communicate. Friends of the Earth therefore commissioned eight in-depth papers (available here) to outline the immediate practical actions that must form the core of our strategy to deliver transport carbon reductions for a safe planet. This paper for Friends of the Earth Cymru is based on and builds on that work, to provide an overview and recommendations specific to Wales. It seeks to address the particular opportunities and challenges for Wales, in anticipation of the planned introduction of a new Wales Transport Strategy during 2020.

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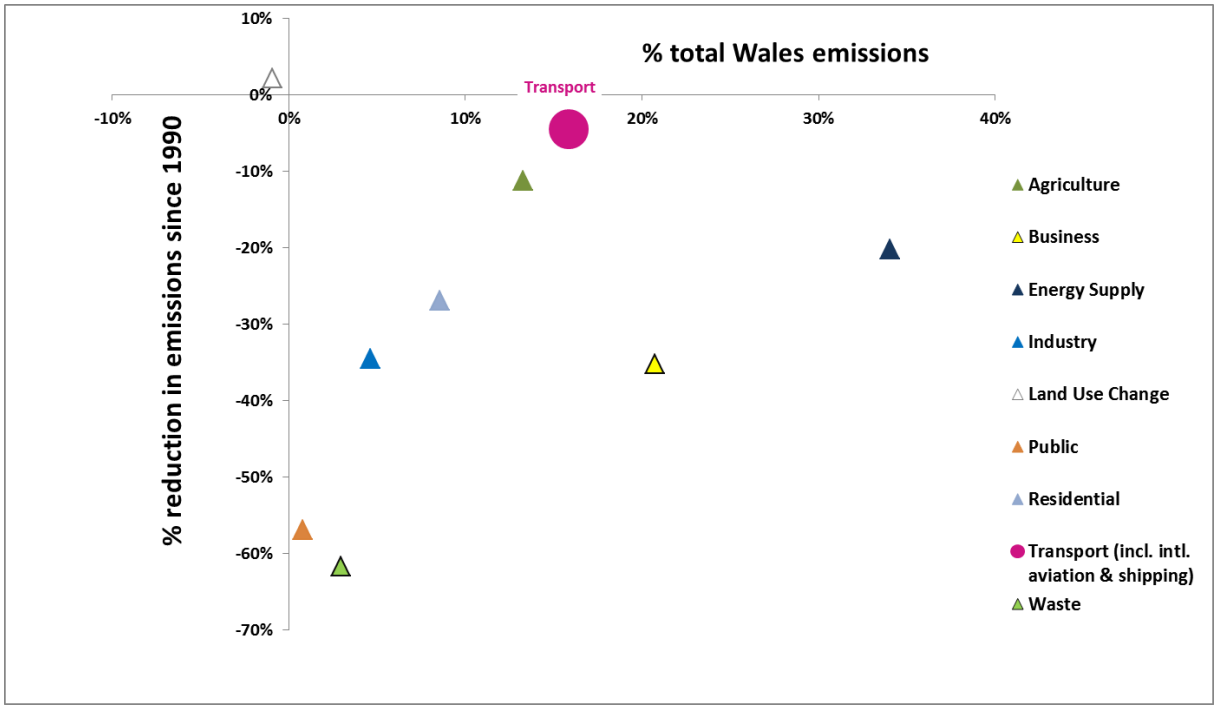
1. The scale of the challenge

Transport is Wales' worst performing sector for climate change. Its 4.5% reduction in emissions since 1990 is much less than the other sectors of the Welsh economy that are net emitters, and its share of emissions has risen over that time from 12% to 16% (including Wales's share of international aviation and shipping). Every other sector of the Welsh economy has significantly cut carbon, but transport is the 'rogue' sector, continuing with many types of activity that make things worse.

Wales greenhouse gas emissions by sector, 2017 (incl. international aviation and shipping)



Source: Greenhouse Gases Emissions Inventory 1990-2017 Issue 1.1 Wales by Source[2]; including Wales' share of international aviation and shipping.

A policy prescription for slow, steady carbon reduction that might have been sufficient 25 years ago is no longer fit for purpose. Because we have left it so late to tackle carbon emissions from transport, we now have to take urgent action. Climate scientists are warning that the carbon targets set by the Committee on Climate Change are too lax, and that we need to reach 'net zero' emissions much sooner[3,4]. But there is an almost total policy disconnect between the advice of these climate scientists and the thinking of the transport profession, which is working on the relatively comfortable assumption that we have until 2050 to get transport carbon emissions down to zero.

There has been much focus on electrifying the vehicle fleet, with Welsh Government aiming for 60% of new car sales in Wales to be ultra-low emissions by 2030[5]. But even if *all* new car sales are electric by 2030, it will still be necessary for car mileage to be at least 20% lower in 2030 than now (and possibly more than this), in order for our emissions not to exceed a fair carbon budget (More than electric cars).

The carbon arithmetic is inescapable. It means that we must instigate a rapid transformation of our transport system to reduce vehicle use, *as well as* achieving a faster transition from petrol and diesel to electric vehicles and significantly cutting aviation emissions.

Rapid action to reduce vehicle use will only be fair and command public consent if it takes place in parallel with big changes to our transport system to give people decent, clean and affordable ways of travelling to work, education and services, by foot, bike or low-carbon public transport. So in order to be able to meet our *obligation* to act on climate change, we need to recognise a basic *right* for everyone to be able to live decently without having to own or drive a car. A transport system for a zero-carbon future must therefore be:

- **Universal:** available to everyone
- **Comprehensive:** the best possible service for all areas, within available resources
- **Affordable:** low-cost, and free for essential local travel
- **Green:** consistent with our obligation to cut carbon emissions to zero in line with the Paris Agreement and to minimise other environmental impacts.

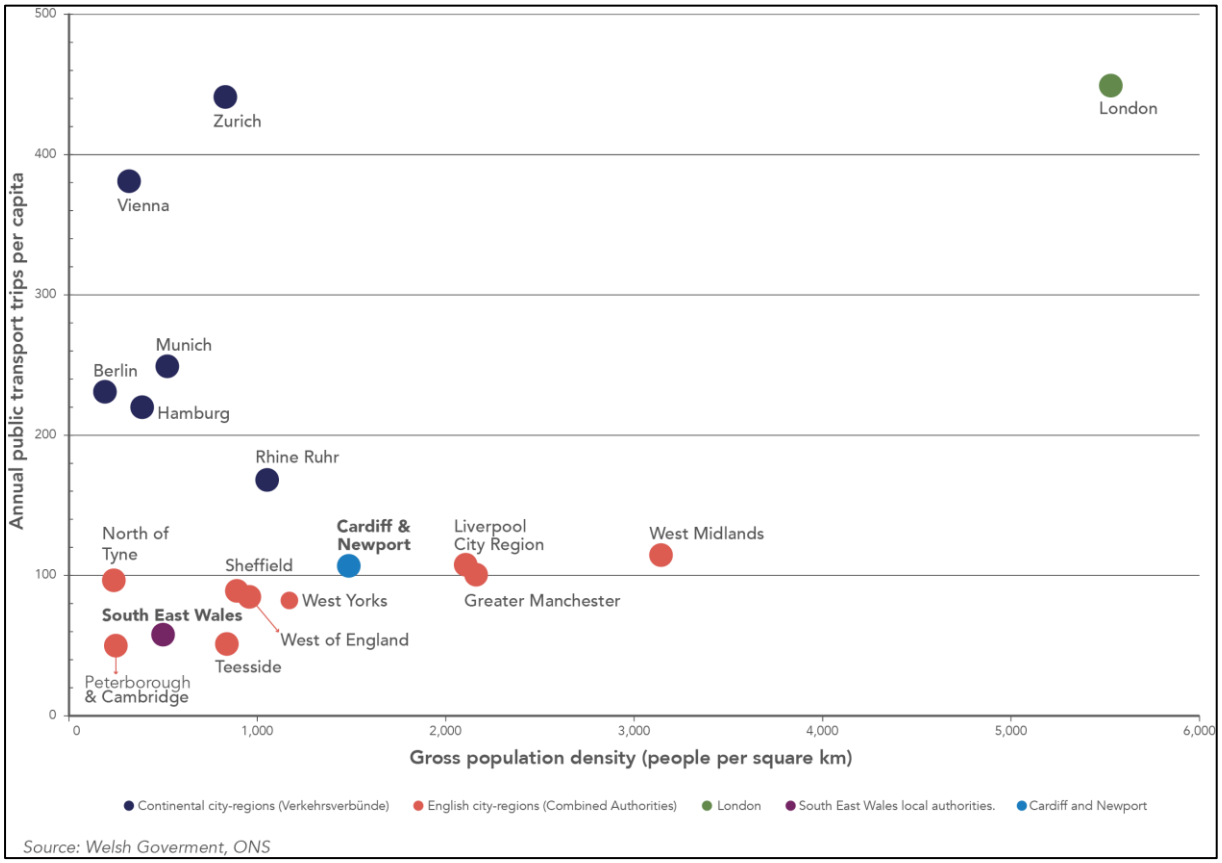
This paper explores how to change our transport system to meet these principles in Wales, how to pay for it, and how to create the right governance to deliver it. It highlights a small number of radical actions that would be transformative, and that could be implemented alongside the many other transport policies, actions and schemes that we already know to be good.

2. Universal and comprehensive public transport for Wales

The universal, comprehensive public transport that we must now create needs to be like the public transport networks in the city-regions of Munich, Vienna and Zurich. In these areas (which are 10-30 times bigger than the built-up areas of their main cities, and extend to surrounding towns and villages), public transport functions as a single system. Buses, trams and underground and suburban trains are coordinated by public transport governing bodies or Verkehrsverbünde (VV) to provide "one network, one timetable, one ticket" (Transforming public transport).

Levels of public transport use in the VVs are strikingly higher (3-4 times the number of trips) than in comparable areas of Wales and England, as shown in the graph below. It can be estimated that, if similar levels of public transport use to those in Munich, Vienna and Zurich city-regions were to be achieved in these Welsh and English urban areas, then car mileage in those areas would be cut by over 9% [6]. This would get us a significant way towards meeting the minimum reduction in car mileage of 20% that is needed to tackle climate change.

Annual per capita public transport trips in six continental Verkehrsverbünde and equivalent parts of Wales and England



To have public transport systems as good as these city-regions, we will need better transport governance, with all services regulated and operated under the control of a 'guiding mind', as is the norm in Europe. This will only be made possible by changing the structure of the railway so that it is a single entity operating under public control, in the public interest, and with an objective to act in such a way as to reduce carbon emissions from transport to the greatest extent possible. It is difficult to see how this can be done without bringing Britain's entire rail network back into national public ownership[7]. However, even without that, it can be noted that the Welsh Government's control of the Wales and Borders franchise does not extend to having a significant say over the longer-distance cross-border franchises, nor to Network Rail's development of Welsh rail infrastructure. The Welsh Government should seek to use the Williams Review discussions that have resulted from the professional and political consensus that franchising has failed to, firstly, make the case for much better (vertically) integrated alignment of all railway structures with Wales as an area of devolved public transport governance, and, secondly, to push for more substantive control of all rail services and rail infrastructure in Wales. There will always need to be a Britain-wide geographical (horizontal) integration of railway, so a balance is required between devolved and central authorities, but Wales could and should have sufficient powers to properly plan, invest in and develop the railway in Wales so as to integrate it with all other modes of public transport.

It will also be necessary for all local bus and tram services to be brought under the full control of Welsh local authorities or groups of local authorities. We will then be able to set service standards, so people know what quality and frequency of public transport they are entitled to. We will also be able to plan an integrated national and local public transport timetable (what the Swiss call a 'Taktfahrplan', or clock-face timetable), ensuring that all trains and buses connect to form a seamless network[8].

For example, the Zurich VV (which covers a city-region of 1.3 million people, including the city of Zurich, town of Winterthur and smaller towns, suburbs and rural areas) has service levels enshrined in law, described in the box overleaf, which enable convenient travel between any two places bigger than a small village. The following box shows how the Taktfahrplan concept could be applied to the Cambrian line in central Wales.

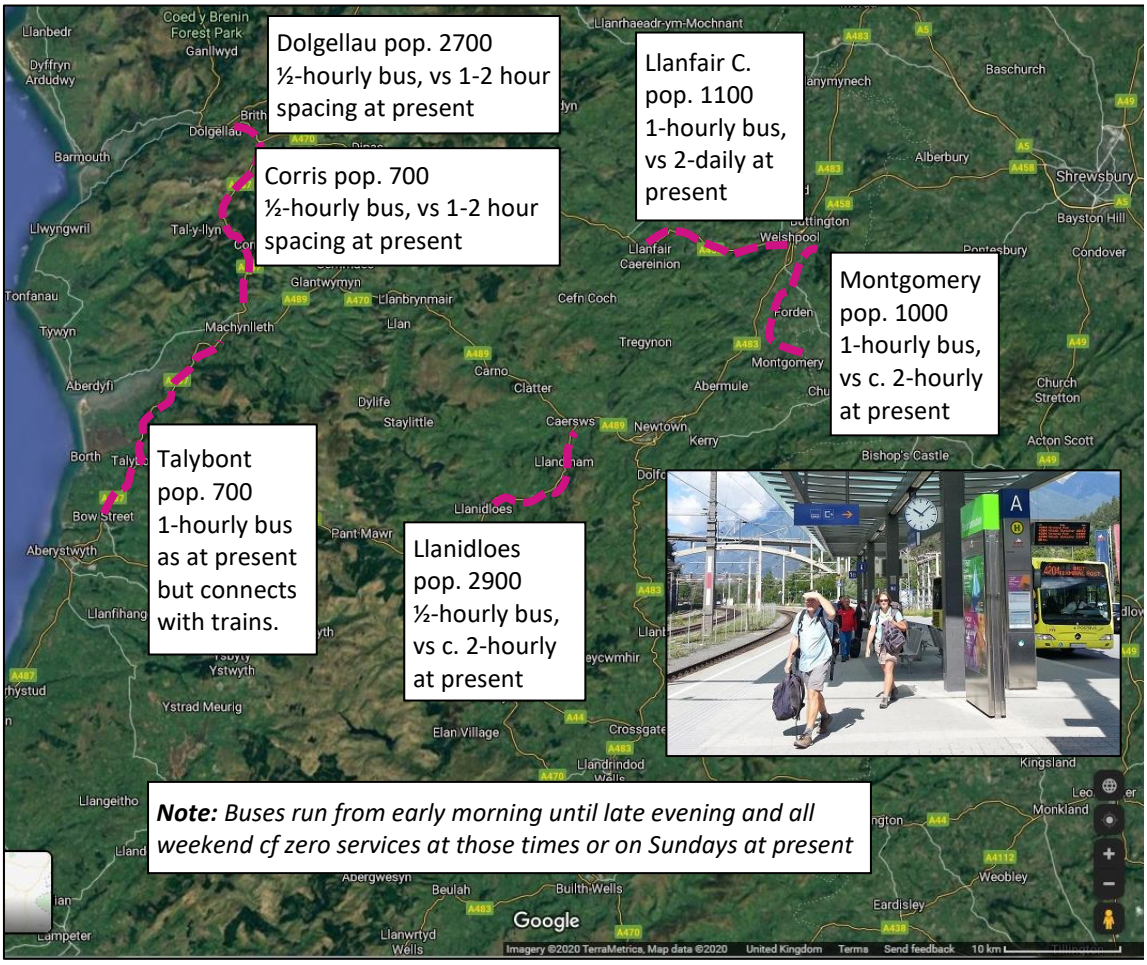
Public transport service standards in Zurich canton

The public transport coordinating body in the canton of Zurich has the following service standards, which are enshrined in law:

- Settlements >300 people – hourly service
- Corridors where multiple settlements give strong demand – service every 30 minutes
- Large dense settlements – services at least every 15 minutes
- Services run 6am to midnight, seven days a week
- Buses and trains connect
- Services repeat hourly at regular intervals on a ‘clock-face timetable’

For example, the small village of Berg am Irchel (population 564, pictured) has two buses per hour to stations on the nearest train line, where there is a 3 minute connection with a train to Winterthur. The whole journey takes about 30 minutes. Services run from before 6am until the last bus at 11.40pm, and are every day of the week including Sundays.

Cambrian Line and feeder bus network as example of possibilities achievable with guaranteed service standards coupled with Taktfahrplan timetabling



As a result of increased support from the Welsh Government, the Cambrian Line now has a train in each direction most hours of the day, most days of the week. Under Swiss-style timetabling and rural public transport service standards many places that lack a train service would be connected to the Cambrian Line with buses timed to connect with *all* the rail services – i.e. one or two buses per hour to meet trains travelling both directions (a single hourly bus can serve stations at Welshpool, which is very close to the crossing points of 'up' and 'down' trains, and Aberystwyth, where the train turns around). Buses would all arrive *before* trains and would wait at the stations and depart *after* trains have departed, so that both outgoing and incoming passengers are catered for.

There would be accompanying redesign of station approaches to allow 'cheek-to-cheek' bus-train transfer, as illustrated with an image from a Verkehrsverbund in Austria.

3. Universal and comprehensive active travel for Wales

We will need to transform our streets so that everyone feels safe walking and cycling, and so cycling is an option for all of us, not just the minority who are young, fit and brave.

This will require rapid construction of networks of segregated cycleways in all urban areas (Segregated cycleways and e-bikes). We can learn from Seville, which built 120km of segregated cycle paths in just four years, achieving a walking and cycling mode share comparable with Berlin, Munich and Hamburg in a city that had been considered 'too hot to cycle'.

We can also learn from the Capital Region of Denmark, which is building a network of nearly 750km of long-distance Cycle Superhighways, radiating up to 40km from Copenhagen. We need a similar Strategic Cycleways Programme in Wales, building continuous segregated cycle and pedestrian paths alongside all single carriageway main roads for 15km either side of every significant settlement (removing road capacity where necessary). Our aim should be to make all main road cycling corridors as good as the best Danish main road cycle provision within five years. A key design criterion in Denmark is to install bridges and underpasses so that people on bikes and electric bikes do not have to stop for vehicle traffic and can complete their journeys in times that are attractive relative to other modes.

We estimate that to equip a Welsh town that is an employment centre at the convergence of four major roads with parallel cycle routes extending 15km in all directions would cost around £24m[9]. The many engineers currently employed in Wales on building major road schemes could be re-deployed to deliver this programme.

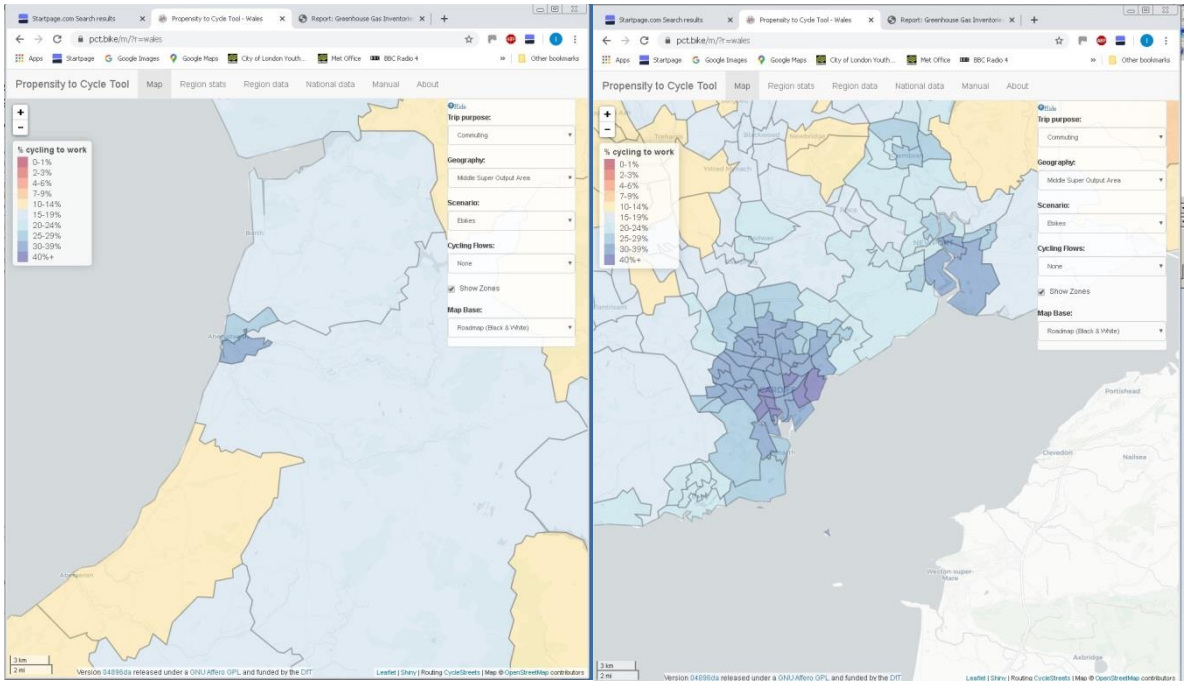
Electric bikes ('e-bikes', which are electrically assisted but that do require pedalling) have great potential to reduce car mileage. Around half of e-bike trips replace trips that would otherwise be made by car. E-bikes are used for longer journeys than conventional bikes, and they have broader appeal, including to older people, women and those who are less active, as well as to the young, men and the physically active. Across Europe, sales of e-bikes are far higher than those of all hybrid and battery-electric cars and vans combined. E-bikes make up 10-30% of all bike sales in Austria, Belgium, Italy, France, Germany, the Netherlands and Sweden – but less than 3% of bike sales in the UK[10]. A main reason for the greater popularity of e-bikes in continental Europe is that their governments have offered grants to incentivise purchase of e-bikes. We should do the same.

It is sometimes assumed that walking and cycling have only a small role to play in reducing carbon emissions. We think this is incorrect, and the potential for active travel to substitute for car mileage and thus carbon emissions is in fact large. Modelling by the Propensity to Cycle Tool[11] suggests that, if e-bikes were widely available and we had a similar cycling infrastructure and culture to the Dutch, around 30% of commuters would cycle to work across many towns and cities in Wales, including Aberystwyth, Cardiff, Newport and Wrexham. The comparison with the Netherlands is not as big a leap as some people might assume since the propensity for cycling tool does factor in Welsh hilliness. It is also relevant

to recall that the Dutch cycling culture did not always exist – their cycling infrastructure and cycling habit have been built up since the 1970s, at which time the Netherlands had assumed a car-based future, become car dominated, and reduced cycling to a marginal activity.

In addition to this switch in personal travel, we also estimate that, if e-cargo bikes took over from delivery and service vehicles for suitable trips, then up to 7.5% of all traffic mileage in urban areas could be removed[12].

Images from Propensity for Cycling Tool showing areas in Aberystwyth, Cardiff and Newport predicted to achieve 30%+ of journeys to work by cycling in their e-bike scenario



Denmark Capital Region Cycle Superhighway Network – Applied to south Wales

Copenhagen is working with neighbouring municipalities to extend their cycle network for many miles beyond the main urban area. Combined with the rise in ownership of e-bikes, this is enabling people to cycle for longer journeys, with substantial carbon savings compared to driving. On the Danish Cycle Superhighway routes that have been completed so far, 25% of users previously drove. The *average* bike commute distance on one Cycle Superhighway route, the Farumruten is 15km.

When the Copenhagen network is projected onto south Wales, centred on Cardiff (unaltered from Denmark, so not as would be actually planned for Welsh valleys and roads), it extends far beyond Newport to the distance of Chepstow, and reaches up the Valleys to Abergavenny, Ebbw Vale and Merthyr Tydfil. It is also evident from this superpositioned image that a network on this scale purposely designed for the south Wales geography would extend beyond Bridgend and reach Port Talbot.

Key: Red lines show routes into Copenhagen that are already completed; black solid lines show routes that are planned and have funding; black dotted lines show routes that are planned but not yet funded. The original image of the cycle route network as it applies to Copenhagen region is provided in Appendix 1.

Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox. Lower image from: Cycle Superhighways, Capital Region of Denmark. Credit for upper image: Google maps, map data 2020

4. An Eco Levy for driving in Welsh urban areas – balanced by free local public transport

A mileage-based Eco Levy for driving in Welsh towns and cities would encourage people to switch to greener, healthier modes of transport for some trips (An Eco Levy for driving). Combining it with free local public transport (Transforming public transport) could make it a politically sellable policy, so that it becomes the norm wherever a good non-car option exists.

Local authorities in Wales (and throughout the UK) have had powers to charge for road use for nearly 20 years. To its credit, Cardiff has signalled that it plans to use them, and it is also encouraging that the Welsh Government has announced[13] an Independent Review to report later this year on options for Wales.

So far, the only substantial UK road pricing scheme is in central London, although the London Ultra-Low Emission Zone will be extended to a much larger area in 2021. Road pricing is also used in Singapore, Stockholm, Gothenburg and Milan. Experience from these cities shows that quite modest charges can stimulate significant change: it is the fact of having to pay *at all* that makes a proportion of people reassess their options. For most people, the additional cost of an Eco Levy could be quite small: in Stockholm, 75% of the congestion charges paid by private vehicles come from just over 5% of Stockholm County's residents.

Traffic volumes in the 'charged' areas of these cities have fallen significantly, with cuts in traffic ranging from 9% (within the charging zone in Gothenburg) to 47% (number of vehicles entering Milan city centre). Effects on car driving are usually larger than the effects on all traffic: for example, in London, the number of cars entering the congestion charging zone fell by 36% by 2007, compared to 13% for vans and 5% for lorries.

The main people to benefit from an Eco Levy would be young people, older people, those on a low income and women, all of whom are bigger users of public transport. Experience in places that have implemented a road user charge is that once residents see how it improves their city, there is net support. In London, the proportion of residents supporting or opposing the congestion charge was evenly balanced shortly before its introduction; but afterwards, over two-thirds of Londoners felt they had gained from the congestion charge or it made no difference to them, whereas only a quarter felt they were worse off. This result was consistent across central, inner and outer London.

So far, no city has tried the combination of an Eco Levy and free public transport, but this is the kind of transformative policy that is now needed.

Although the idea of free local public transport for all might sound radical and unaffordable, local public transport is already fare-free in more than 100 towns across the world (Transforming public transport). Dunkerque, a town of 200,000 people in northern France, made its buses free in autumn 2018, and at the same time increased bus frequencies on the

busiest routes to every 10 minutes and installed bus 'express corridors'. One year on, bus trips are up 85%[14]. Nearly half of new bus users previously drove, one in ten new bus users have sold their second car, and there is anecdotal evidence that the free bus network is leading young people to postpone getting a driving licence. The free buses are especially important to people for whom money was tight, and are seen as a game-changer for a working-class town that was culturally very attached to the car. Other French cities are now following Dunkerque's lead, including Calais in December 2019.

Free local bus services wouldn't be feasible or affordable under the current deregulated privatised regime in Wales. However, the big changes to governance and funding discussed elsewhere in this paper would make it possible: re-regulation, so that local authorities could plan their bus network as a whole; powers to establish municipal bus companies, so that all profits were reinvested; and powers to raise funds from local taxation (see Section 6).

Public money already accounts for over 40% of bus operator revenues[15]. Additional funding would be needed for more bus services, to cater for the increase in demand, and local authorities that operate trams would lose some fare income from these due to abstraction if fares continued to be charged. But it would be entirely achievable for a public transport payroll levy that generated income for Wales at the same level, proportionately, as Versement Transport does for France (VT raises £5 billion per year) to support free bus services. In fact there would be very substantial resources left over for investment in improving bus services, or building tram networks[16]. Even more affordable would be extending free public transport from older people to other groups – like young people, to encourage them to make using public transport a habit rather than learning to drive and becoming car-dependent.

5. Planning land-use in Wales for less car use

Evidence from across the world shows that high levels of walking, cycling and public transport only occur if new development is concentrated in urban areas, and if settlements are compact, dense, and with a diversity of land uses (Planning for less car use). The most important factor is location: central locations generate less car travel and have 2-3 times lower transport carbon emissions than even the best-designed development in a remote location.

To stop car-dependent urban sprawl in its tracks, virtually *all* new development must be on brownfield land in existing urban areas. Developments should only go ahead in places that already have high-quality public transport, or where excellent new public transport infrastructure (such as tram lines or new rail stations) will be provided, in which cases, the new transport provision must be in place and fully operational before the development is occupied, so that incoming residents never get into the habit of relying on a car. New housing should be built at densities of at least 100 dwellings per hectare (and higher in urban centres), to create an urban form that is highly walkable and cycleable. This density can be achieved whilst providing a high quality urban realm with open green spaces. The amount of space allocated to car parking should be reduced, as in an exemplar development

Car-free development in Leeds city centre

The Climate Innovation District in Leeds is a high-density (>100 dph) development of 800 low-rise (3-5 storey), low-carbon homes in the city centre, a short walk/cycle ride from the train station. These are the first houses to be built in Leeds City Centre in over 90 years, and the car-free design, based on European models, is innovative for the UK outside London. It is designed as a car-free environment that encourages walking, cycling and play, focussed around parks and shared gardens. No roads break up the landscape and children will be able to walk to the nearby school without crossing any busy roads. It has underground, centralised car-parking with spaces allocated for a car club. Although required to provide a minimum number of parking spaces the developer CITU do not expect them all to be used. They have built a pedestrian/cycling bridge which links the north and south sides of the city and links to the riverside cycle path.

© CITU

in Leeds (see box on previous page), allowing for environmental improvements and more productive uses of the space freed up, as well as promoting less car use.

There should be no low density development in rural areas or on the edge of towns. This approach ***is*** entirely commensurate with the pressing need for affordable homes in rural Wales to give young people growing up in those areas the chance to remain locally near family and friends and to continue to support their community and language. Even in rural areas, the great majority of the population does not live in tiny hamlets but lives in more substantial settlements, many of them long-standing local centres such as the market towns. The cores of these older settlements have traditionally been built very compactly, to densities that make them highly walkable. The multiple problem that has arisen in many areas is that: (i) where these settlements have seen new development, much of it has been far from the centre of the town; (ii) the new development has been built to expanded car-based plans rather than compact walkable-cyclable plans; (iii) many of the houses built have been large detached homes rather than affordable homes; (iv) there has been development completely away from these local centres where people are too far from shops and facilities to walk and cycle, and where it is very much harder to provide public transport provision, let alone public transport provision of high quality and frequency. For its local people, rural Wales needs genuinely affordable, compact homes built close to the existing rural centres that provide shops, schools, jobs and facilities, so they get around by walking, cycling or taking public transport, for which it is feasible to undertake a major programme of improvements for services within, to, and between these rural centres. This approach to planning and transport is not just a plan for climate stabilisation – it is what is needed to achieve social equity, strong communities, good health and a high quality of life. Car-based development in remote locations is bad for all of these things and should be prevented.

6. How can we pay for what Wales needs?

In the next 10 years we must invest at an unprecedented rate in new tram networks, rail electrification, bus priority networks and green electric buses, cycleways and healthy streets for walking. Substantial ongoing revenue funding will be required to run free local public transport services and to improve those services.

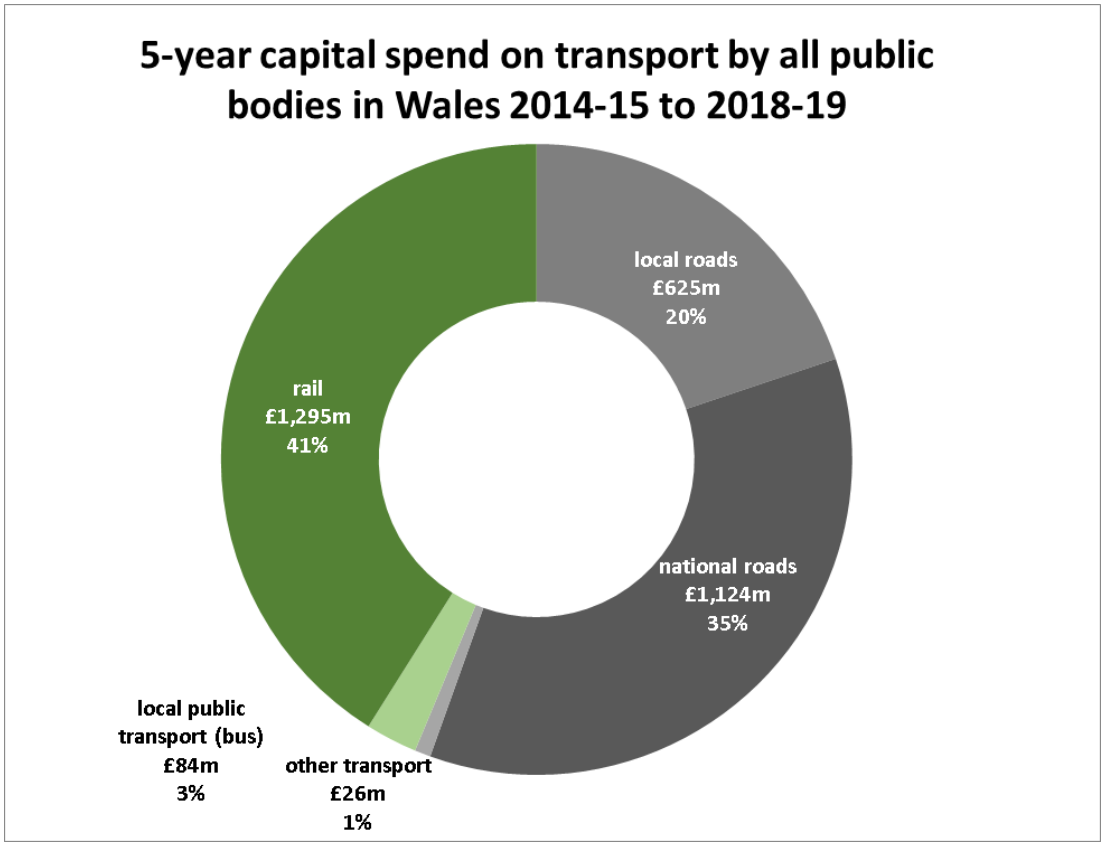
This cost can be offset by the major expenditure on road schemes, which can and should be reallocated in its entirety (Transforming transport funding to meet our climate targets). Over the past five years, capital spending by public bodies in Wales on local and national roads has outweighed all other transport capital spending (see first chart on following page)[17]. Moreover, the Welsh Government's 'pipeline' of transport infrastructure project expenditure for the next five years shows an even worse bias towards road building (see second chart on following page)[18].

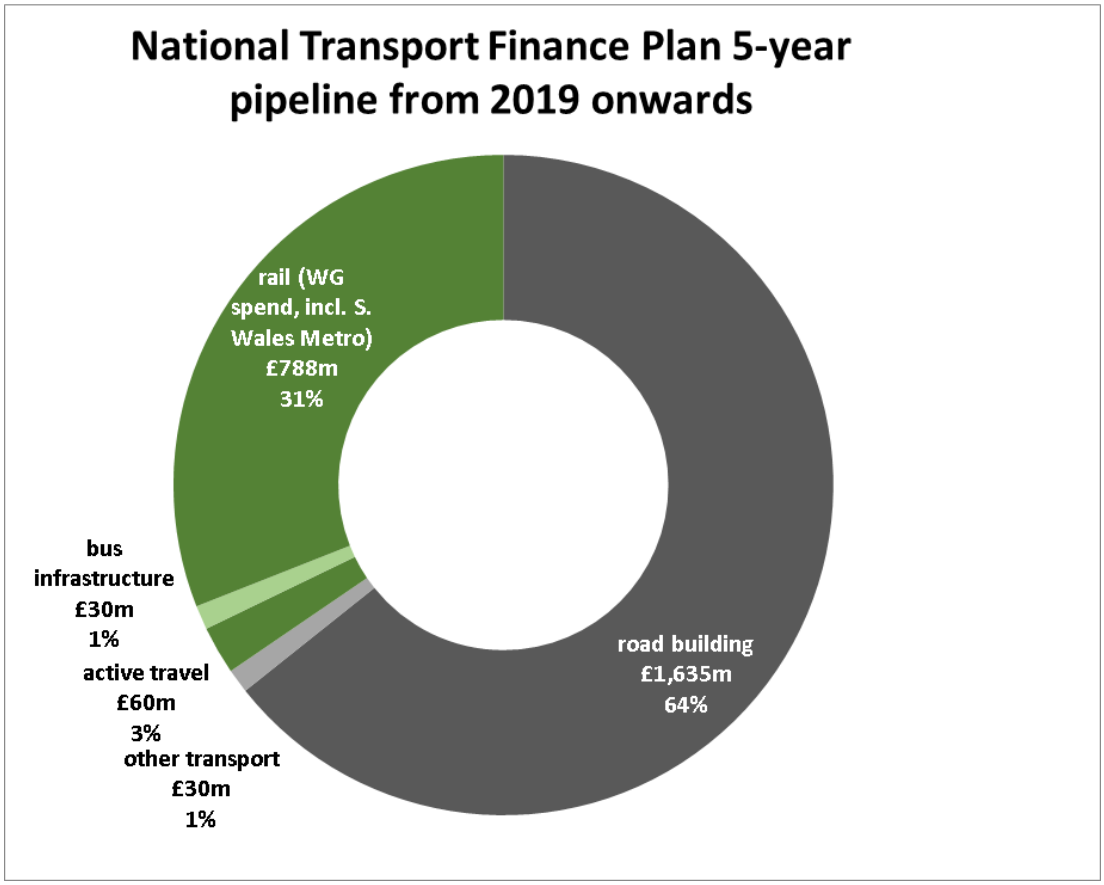
The project list from the National Transport Finance Plan for the next 5 years is headed with exactly the right words: "Decarbonisation is at the heart of decision making for infrastructure developments". However, the overwhelming emphasis on road building within the actual list makes it seem that these fine words are present only for purposes of irony or greenwash. The evidence of this data is that there is still a substantial amount of road building being publicly funded in Wales. This will increase traffic and carbon emissions and is completely counter to the necessary spending priority required to tackle the Climate Emergency recognised by the Senedd and Welsh Government.

Substituting 'bad' transport investment for 'good' investment will be a double win for Wales, switching £100s of millions per year from building roads that make carbon emissions worse, to tram lines, bus priority networks, cycleways and healthy streets for walking.

There is also potential for much more funding for clean, green, affordable transport to be raised at the devolved level by the Welsh Government and at local authority level. In other countries devolved authorities have far greater powers to raise money locally for sustainable transport investment.

- The renaissance of trams in France has been funded by local payroll levies on employers (the 'Versement Transport').
- Many cities (e.g. Paris) and countries (e.g. Switzerland) use a visitor lodging tax to pay for better sustainable transport.
- Stockholm is funding its metro extension from a charge on cars entering the city.
- There is further potential outside cities to raise more money by applying an Eco Levy to cars and vans on main roads and to apply a distance-based HGV charge (as used in Germany and other European countries).
- Local authorities in Germany and the Netherlands capture a far greater proportion of land value uplift that results from them granting planning permission for major developments, which they then use to spend on transport infrastructure.


5-year capital spend on transport by all public bodies in Wales 2014-15 to 2018-19
local roads £625m 20%
national roads £1,124m 35%
other transport £26m 1%
local public transport (bus) £84m 3%
rail £1,295m 41%


National Transport Finance Plan 5-year pipeline from 2019 onwards
road building £1,635m 64%
other transport £30m 1%
active travel £60m 3%
bus infrastructure £30m 1%
rail (WG spend, incl. S. Wales Metro) £788m 31%

The Welsh Government should lobby the Westminster government for ***all*** of these fund-raising powers where they do not have them. For those already available, the Welsh Government should use them at national level and make them available for Welsh local authorities to use where local authority level is the most appropriate level for application.

Of the various funding sources listed above as bullet points, we believe that existing Welsh Government devolved powers would allow implementation of a visitor lodging tax and various forms of vehicle road use charging. We are not aware of any powers through which the Welsh Government could enact a French-style payroll levy on employers, so that appears to require allocation of powers to Wales from the Westminster government. Planning is fully devolved to Wales, so there may be scope within existing powers for Welsh Government to alter the land compensation laws. However, there may be a requirement for Westminster Government action to facilitate this, since devolution of planning to Wales post-dated the 1961 Land Compensation Act that prevents public authorities capturing land value uplift by buying land at 'existing use' value (public authorities buying land presently cannot capture the uplift in value from their investment in it, because they must pay land owners excessive prices based on the 'hope value' of 'prospective planning permission', calcuated according to what the land value ***will become*** after the public authority has allowed planning permission and invested in the site and transport infrastructure to serve it).

These funding sources could provide £100s of millions per year for Wales. They show that the key issue that needs to be fixed, other than redirecting road building expenditure, is to put in place mechanisms that secure contributions from all those who will benefit from better public transport and active travel infrastructure even if they are not direct users, including the many businesses and individuals that reap benefits.

- Employers benefit, because good transport enables their staff to travel to work, and increases the catchment area from which they can recruit employees: a public transport payroll levy would be a fair way for them to contribute.
- Tourists benefit, because good transport enables them to explore the city or countryside they are visiting: a visitor lodging levy could capture this.
- Land and property owners benefit, because transport improvements increase the value of their asset: changes to land compensation law, and better capture of property value uplift due to transport improvements, would be win-win.
- Car-users benefit, because good transport reduces congestion, and because most drivers would prefer to swap their cars for public transport if services were better: a distance-based Eco Levy for driving in urban areas would provide them with decent public transport and a real choice.

If all beneficiaries make a contribution to the costs, it will become possible to design ambitious transport investment packages that make everyone better off.

7. Powerful transport governance in Wales to steer the right course

To make the right decisions, and deliver the massive change in our transport system that is required, we will need clear and sure-footed governance.

Cutting carbon to address the Climate Emergency must become the Welsh Government's top priority for transport.

Wales's national carbon reduction budgets should be translated into binding targets and carbon budgets for the transport sector, with carbon budgets for Transport for Wales and local authorities, and mechanisms to monitor and enforce progress.

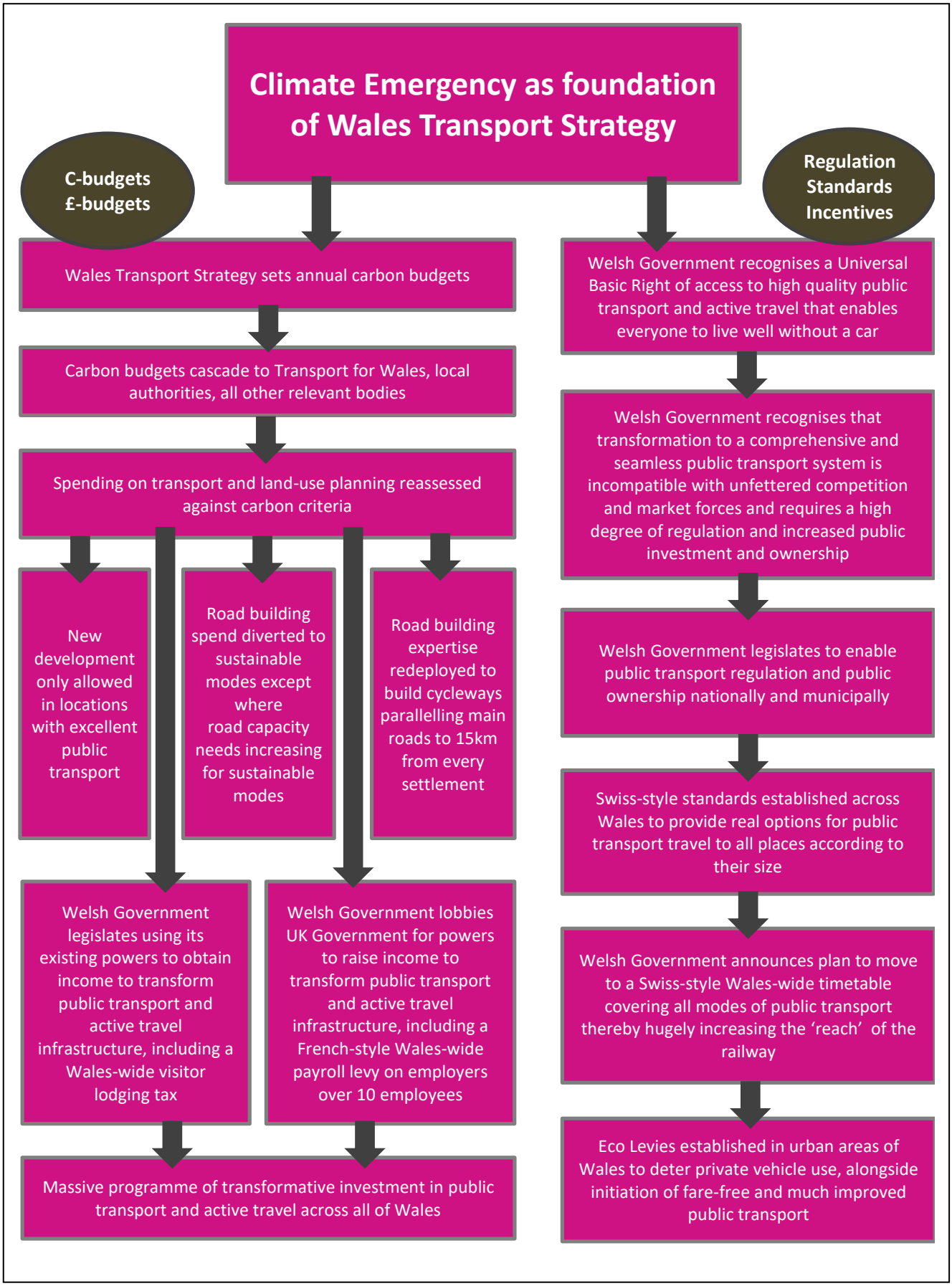
The 5-year carbon budgeting periods established for Wales are an excellent start, but given the urgency of the Climate Emergency, these need to be translated into annual carbon targets and budgets, so that progress can be strictly monitored and policies and implementation amended where necessary.

All Welsh national and local transport strategies and plans should demonstrate that their carbon impacts are consistent with the carbon targets and carbon budgets.

Until Wales is on track to reduce emissions in line with the agreed national carbon reduction pathway, the method for appraising transport projects should be replaced by a 'climate emergency appraisal method', which prioritises projects primarily according to their cost-effectiveness in reducing carbon emissions, and only secondarily according to their other benefits. Every major decision will then take account of the carbon budget as well as the financial budget.

8. The overall transport policy package

Logic map for Wales decision-makers' transport response to the Climate Emergency



A logic map laying out the major actions that the Welsh Government could take to start reducing transport carbon emissions on the scale that climate scientists advise is provided in the box. Together these form a logically-linked package of decisions that enhance each other.

In summary, the six big actions proposed in this briefing paper are these:

1. **Make carbon reduction the Welsh Government's top priority for transport.** This means adopting a 'whole transport sector' carbon budget (including international aviation and shipping) and translating the national target into subsidiary targets for all government departments, regional and local bodies.
2. **Bring spending budgets into line with this climate priority and carbon budgets.** This means transferring money presently spent on climate 'bads' into climate 'goods', and in particular shifting ***all*** current spending on road-building to invest in sustainable local transport, whilst bringing in other national and local sources of funding for sustainable transport, including a public transport payroll levy.
3. **Ensure planning policy supports carbon budgets.** This means putting in place strict rules that ***all*** new development of a significant scale must only be in locations that are served by excellent public transport.
4. **Redeploy engineers from road building to climate-positive road redesign that propels modal shift to sustainable transport**. This means, amongst other things, putting this engineering capacity to use building a strategic cycleway network alongside or parallelling all main roads, to 15km either side of every settlement; redesigning all urban main roads to give safe segregated space to cyclists and to give buses priority so they can speed past traffic congestion and be more time-efficient than private vehicle use; wholesale remodelling of minor and residential urban roads to introduce modal filters that give safe direct routes to people on bikes and people walking whilst deterring rat-running and vehicle use for short trips.
5. **Change the entire approach to governance of rail and buses in Wales so that it can provide viable travel options that match up to the Climate Emergency.** This means regulating the entire system so that Welsh Government can recognise the principle of a Universal Basic Right to excellent public transport, can set according standards for public transport frequencies based on settlement size, and can adopt a Swiss-style integrated national and local public transport timetable, with buses and trains fully under public control to ensure they are run in the public interest, and with increased public ownership wherever necessary to achieve that most efficiently.
6. **Back up the massively increased investment in sustainable transport with incentives for modal shift from private vehicles that maximise the effectiveness of that investment.** This means bringing in an Eco Levy for driving in urban areas, and balancing this by making local public transport fare-free.

Assessment of current Welsh Government policies against these six big recommendations

1. Making carbon reduction the Welsh Government's top priority for transport	
✓	We applaud the Welsh Government for the legally binding foundation for carbon reduction in the Environment Wales Act (2016) and for producing a low carbon delivery plan[19].
✓	It is very good that the low carbon delivery plan recognises that electric vehicles do not offer a technological 'silver bullet' that will sufficiently reduce emissions and accordingly recognises a crucial need to achieve demand management of private vehicles and modal shift to more sustainable transport: *'We will encourage a shift from an over reliance on the private car to more sustainable transport modes... This shift has a key role to play in emissions reduction in the near-term'.*
✓	The Welsh Government is to be commended in including Wales's share of international aviation and shipping in its carbon budgeting approach.
✓ ✗	It is commendable that the Welsh Government has indicated it will use regulations to amend the present target of emissions reduction of 80% from 1990 levels by 2050 to a target of 95% reduction by 2050 and net zero by the same date[20]. However, this remains slower than many climate scientists believe is necessary, and Friends of the Earth believe net zero must be achieved by 2045 or earlier.
✗	The low carbon delivery plan does not say the transport sector will have to meet a sectoral target that is on the same level as other sectors. Nor does it indicate how other key bodies for transport governance, such as local authorities and Transport for Wales will be required to meet carbon budgets and targets to reduce them. Whilst it is logical that the Environment Wales Act (2016) put primary responsibility on ministers, Wales does also need sectoral targets, and sub-sectoral targets. For the transport sector in particular, it must be clear that it has to achieve reductions as big as other sectors, rather than continuing to be allowed to 'go rogue'.
✗	The low carbon delivery plan misses out many vital specific actions. It does not consider reduction of speed limits on main roads. It does not commit to stop road building. It does not commit to stop airport expansion or to oppose any reduction in Air Passenger Duty. It does not commit to stop development where there is not excellent public transport. It does not offer incentives for e-bike purchase or commit to an affordable e-bike scheme[21]. It does not mention freight transport and the potential to tackle the rapid unsustainable growth in van traffic with e-cargo bikes. It does not commit to any disincentives to driving, such as road user charging or parking levies. It does not look to demand powers to either raise more money for sustainable transport or to tax climate 'bads', such as applying charges to more polluting vehicles. It does not commit to an integrated rail-bus timetable. It does not commit to sufficiently powerful bus re-regulation and Wales-wide system coordination rather than weak 'partnerships'. It does not commit to any strategy to reduce the cost of public transport to make it competitive with car use.
✗	It is completely against climate objectives for the Welsh Government to invest in Wales's

	airport infrastructure and to subsidise internal flights. It should disinvest in Cardiff airport and remove support for flights between north and south Wales (and any other flights).
Further comments	
The low carbon delivery plan's approach to transport will not come close to doing what is required to tackle the Climate Emergency. It will be essential that the forthcoming Wales Transport Strategy is founded on quickly achieving a zero carbon transport system, including rapid changes to shift travel from private cars to sustainable modes.	
Like the Welsh Government, the Scottish Government will produce a new Transport Strategy during 2020. The Infrastructure Commission for Scotland's recent recommendations for the Transport Strategy[22] are highly relevant to Wales and are reproduced in Appendix 2.	

2. Bringing spending budgets into line with carbon budgets.	
✓	The First Minister deserves considerable credit for the bold decision early in his premiership to reject an additional arm of M4 motorway across the Gwent Levels. This project would have increased traffic and emissions (on top of immense local ecological damage) and the estimated expenditure of £1.4 to £2 billion can now be turned to building sustainable transport alternatives[23].
✓	It is laudable that the Welsh Government has allocated more than £40m to active travel schemes in 2019-20[24].
✗	Analysis (see Section 6) of the actual profile of past and projected spending shows a heavy bias towards road building that will increase traffic and carbon emissions.
✗	Welsh active travel organisations have been calling for £20 per capita annual spend on active travel, which would be a spend of over £60m per year. And to grade up to the standards of provision advocated in this paper, sustained spend at comparable levels to the European and UK best practice will be required - i.e. c.£50 per capita per year as in Netherlands presently and as projected in London and Manchester.
Further comments	
The infrastructure project pipeline needs to be completely revised so it really does emphasise sustainable transport.	

3. Ensuring planning policy reflects climate and carbon priorities	
✓	We commend Planning Policy Wales edition 10 (2018) for its approach to transport[25].
✓	The policy's 'National Sustainable Placemaking Outcomes' lists *'Accessible by means of active travel and public transport/ Not car dependent/ Minimises the need to travel'.*
✓	The policy states that *'Spatial strategies should support the objectives of minimising the need to travel, reducing reliance on the private car and increasing walking, cycling and use of public transport'* and that *'Planning authorities should adopt policies to locate major generators of travel demand, such as housing, employment, retailing, leisure and recreation, and community facilities (including libraries, schools, doctor's surgeries and hospitals), within*

	existing urban areas or areas which are, or can be, easily reached by walking or cycling, and are well served by public transport'.
✓	The policy emphasises the need for integration of planning and transport and the importance of adherence to a *'Sustainable Transport Hierarchy for Planning'* which puts active travel at the top, public transport next and private vehicles last. It explicitly requires local authorities' development plans to set out how they will *'reduce the need to travel/ reduce dependency on private vehicles/ prioritise and support walking, cycling and use of public transport'.*
Further comments	
These are all excellent provisions. The remaining requirement is for Welsh Government to put in place strong procedures and resources to monitor and enforce actual implementation so that it matches up to the aspiration.	
The policy would be much more powerful and likely to succeed in achieving climate objectives for transport if it included a powerful absolute ***prohibition*** on development of any significant scale where is not excellent public transport.	

4. Redeploying engineering skills from road building to road re-design for modal shift to sustainable transport.	
✓	The Active Travel Act was a world-leading step by the Welsh Government, and we welcome the funding allocated during the last year to turn it into practical measures on the ground. This will lead to a resurgence of cycling and walking engineering and project management professional capacity at local authority level.
✗	The continued bias of funding towards road building, that facilitates vehicle use rather than modal shift to sustainable modes, shows there is still a long way to go to ensure the deployment of human and financial resources reflects climate priorities.
Further comments	
Leadership from the top at Welsh Government and local authority levels is urgently needed to change the management culture so it places highest value on engineering and expenditure for sustainable modes of transport, rather than treating these as side-issues or as temporary fads.	

5. Public transport regulation, integrated timetabling, standards and rights that match up to the Climate Emergency.	
✓	We believe the Welsh Government's commitment to legislate for a Public Transport (Wales) Act has potential to be a game-changing measure in achieving public transport fit to tackle the Climate Emergency.
✓	We welcome the minister's recognition that it is necessary for the Bill to *"address some of the negative impacts of de-regulation"* in order to achieve his stated *"ambition of a high quality, low carbon, multi-modal and integrated public transport network"*, and that he is looking *"to explore how bus services can be improved by better integrating routes and*

	timetables, for example, with the railway"[26].
✗	The level of vision seems to fall short. The ministerial statement contemplates an option for "enhanced partnership working" which implies continued prioritisation of commercial interests over pressing public needs. All sorts of partnership arrangements have been tried over many years and all fall far short of the sorts of regulation required and proven to deliver from continental European regulatory models of public transport governance.
✗	The same ministerial statement announced plans to raise the age threshold for older people's free bus travel. This will reduce bus use and runs completely counter to the sorts of measures that are needed to make bus use more affordable and give more people free access to bus services.
Further comments	
The vision needs to be raised to look to recognising a Universal Basic Right to good public transport, and putting in place an Act that delivers guaranteed public transport standards, with a Wales-wide national multi-modal timetable and regulation that can deliver those standards.	

6. Backing increased investment in sustainable transport with an Eco Levy financial disincentive that enhances modal shift from private vehicles.	
✓	We welcome the public statements and the Cardiff White Paper that indicate that a road user charge is being considered for Cardiff[27] [28]. The political leadership being provided by the City Council in this regard is to be commended, and should be backed to the full by Welsh Government. It is good that the intention is to use funds to improve sustainable transport options and that clean air has been part of the stated rationale.
Further comments	
Cardiff City Council White Paper indicates a range charging approaches will be considered. In our view it would be best ***not*** to focus this charge on congestion and instead show it is being implemented as an ***Eco Levy*** to tackle the most pressing and important priorities facing society – the Climate Emergency and local toxic emissions. This is important for communication purposes, but also because the purpose influences the way the levy will be designed and develop in future.	

9. Top ten practical first steps across Wales

In the face of the challenge of the Climate Emergency, it can be hard to see where to start. This section suggests ten practical first steps that the Welsh Government could take now.

1. **Trial Swiss-style integrated timetabling and guaranteed public transport service standards in one area.** The Cambrian line corridor offers possibilities, as discussed previously. In areas with planned Metro systems in south Wales and north Wales, rail or tram services may attain 'turn up and go' spacings of just a few minutes. Although frequent rail / tram services don't require Taktfahrplan, the areas around them will require public transport service frequency standards. The benefits of the rail/tram services will be spread more widely if all surrounding settlements have guaranteed frequent (re-regulated) bus services feeding into the Metro network.
2. **Press ahead with mooted plans for road user charging in the greater Cardiff area, but re-cast this as an Eco Levy.** The levy should be specifically directed at tackling the Climate Emergency and toxic local air pollution, rather than a congestion or revenue-raising measure.
3. **Initiate trials of free public transport in Cardiff in advance of the Eco Levy, and in at least one town elsewhere.** The trial should follow the Dunkirk model that is using free public transport for reasons of economic regeneration. Free public transport that treats public transport as a universal basic right is a potentially important element of achieving greater social justice, and would strongly support the Future Generations Act well-being goals, particularly the goal for a more equal Wales by helping people to fulfil their potential, and the goal for a Wales of cohesive communities by helping provide well-connected communities. Wrexham might be a possible candidate, as a substantial place that acts as a centre for a set of bus services, and as the focus for intended bus-orientated NE Wales Metro developments across the Wrexham-Deeside area[29].
4. **Showcase the potential for longer-distance cycleways along the strategic road network and other main roads radiating 15km from a regional centre that draws significant commuter traffic.** Aberystwyth, Bangor or Merthyr Tydfil might be suitable starting points, although as illustrated earlier, this approach should be the ambition for the whole of the Valleys hinterland to the Cardiff-Newport area.
5. **Institute a local pilot programme of 'Affordable E-bikes for Everyone'**. Logically this should combine with construction of excellent rapid uninterrupted cycleways as above, and the intended expansion of Nextbike in the Cardiff area to e-bikes could link with this. Consideration should be given to provision of free or cheap e-bikes for job-seekers both when seeking work and for their initial period after successfully gaining employment. A scheme of e-bike purchase incentives to mirror e-vehicle grants should also be implemented. Employers in the Cardiff travel-to-work area should be incentivised to purchase free annual Nextbike memberships for employees who will use them to commute at least one day per week on average.

This would have a similar effect to the employee e-bike hire system recently announced by the Netherlands government, through which employers will provide e-bikes worth £2,500 to employees for a cost of less than 20p per day[30]. The programme's take-up will be increaed by complementary e-bike infrastructure measures – especially fund of e-bike charging points and secure bike parking (e-bikes are valuable).

6. **Create a demonstration city to show the potential for e-cargo bikes to replace vans and cut HGV traffic**. This means setting up 'micro-consolidation depots' for HGV loads, regulating to ensure delivery firms have to use them, and subsidising delivery companies to switch to e-cargo bikes. Some continental European cities have replaced a majority of van deliveries with cargo bikes, whilst improving delivery efficiency, and offer exemplars (pictured)[31].

Micro-consolidation depot e-cargo bike pilot in Berlin based on shipping containers

Photo credit Hermes https://newsroom.hermesworld.com/international/logistics-micro-depots-successful-solutions-for-last-mile-sustainability-1333/

Swansea could be an appropriate location, and the high levels of van traffic on the congested part of the M4 corridor between Newport and Cardiff indicate that an initiative in that area may also be worthwhile.

7. **Expand Welsh Government's aspirations for lower speed limits.** The stated aspiration for 20mph to be the default speed limit in all built up areas and the successful trials of 50mph limits on sections of previously 70mph roads should be expanded to establish lower speed limits elsewhere for climate reasons (in addition to the present stated reasons of local air quality). All motorway and dual carriageway speeds in Wales should be cut from 70mph to 60mph (or, in congested or polluted areas, 50mph) and strictly enforced. This would cut at least 15% of the annual emissions from traffic travelling on those roads[32]. All single carriageway speed limits should be set at 50mph. In Wales's national park areas the limit should be set at 40mph, in conjunction with increased park-and-ride and other public transport improvements, to encourage mode shift for climate reasons (whilst also

increasing tranquillity and amenity value). These measures are commensurate with the scale and urgency of the Climate Emergency and should be communicated as such[33].

8. **Institute a nationwide visitor lodging tax, with most of the income returned to the areas it is raised, ring-fenced for expenditure on sustainable transport services and infrastructure.** It would be sensible to follow the Swiss practice of providing visitors with free local public transport the day following their overnight payment.
9. **Lobby the Westminster government for powers to implement a public transport payroll levy of employers in Wales.** This should be entirely used to fund climate-friendly transport.
10. **Establish an e-bike industrial strategy to ensure that the above support for e-bikes results in manufacturing of e-bikes in Wales.** The Bicycle Association have pointed to the need for and the potential of a publicly funded 'E-bike Valley' cluster covering research, development and manufacture. Wales has existing bicycle manufacture expertise (particularly Frog Bikes' factory at Pontypool) and many transferable skills from its automotive and other engineering traditional strengths. Neath - Port Talbot area would be one obvious candidate, given its strong history of manufacturing, the local skills base, and the availability of suitable sites for a manufacturing facility.

These actions should be complemented by many other changes that are outlined in the eight more detailed papers.

Many of the actions proposed above are win-win-win, for the economy, for quality of life, and for the environment. They are highly relevant to the wellbeing goals in the Wellbeing of Future Generations Act (2015). Those to raise funds and to dissuade people from climate damaging activities require political leadership from the Welsh Government.

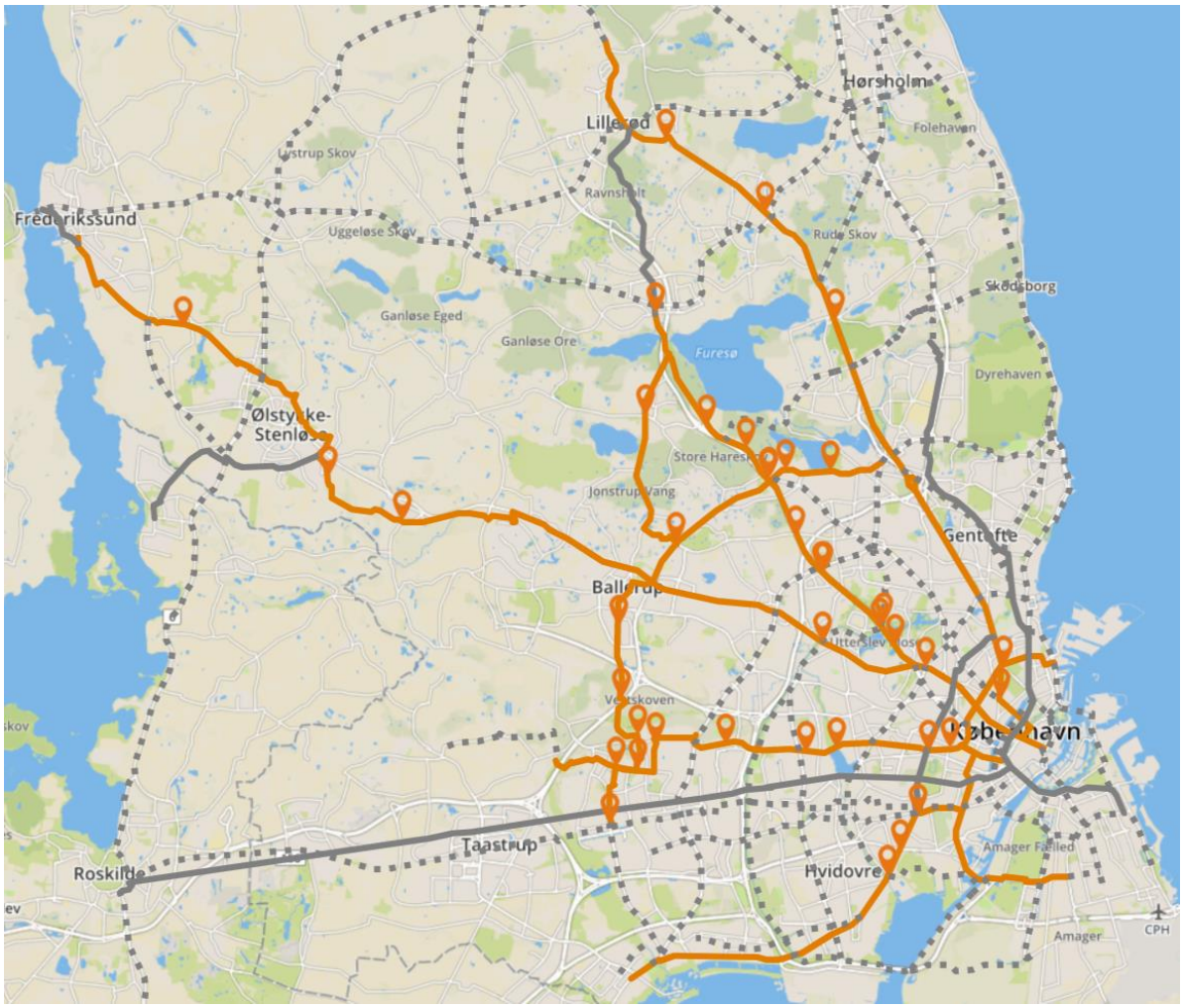
10. Conclusion

There is no opt-out from climate change. If we don't like the steps that are necessary to prevent it, and fail to act, the cost both to us and future generations will be enormous. But if we can find an effective path to cut carbon emissions from transport over the next 10 years, the benefits are large. The radical policies advocated in this paper would not only help to ensure that future generations have a planet that is worth living on. They will also give us air that is clean to breathe, and neighbourhoods that are quieter, greener, nicer places to spend time. They will make us healthier. They will give us new tram networks, green buses and cycle-ways that make it easier for all of us to get around our towns, cities and rural areas. And they will generate high-value jobs that will be sustained in the long term because they are founded in the essential and inevitable transition to a climate-friendly industrial base and green economy. The transport policy fit for the Climate Emergency laid out in this paper will greatly aid achievement of the wellbeing goals laid out in the Wellbeing of Future Generations Act.

Cars will not disappear. But we will use them much less often, because other means of transport will be more efficient, affordable and attractive. The biggest winners will be those who are worst off now: older people, children, and low income households (nearly half of which don't have access to a car). Wales has a fine tradition of concern for social justice, and that concern, coupled with Wales' world-leading commitment to the wellbeing of future generations, means that here in Wales we have one of the best possible foundations for leadership to tackle the climate emergency.

Appendix 1

Copenhagen region of Denmark showing the cycle superhighway network



Key: Coloured lines show routes into Copenhagen that are already completed; black solid lines show routes that are planned and have funding; black dotted lines show routes that are planned but not yet funded.

This map shows the cycle superhighway programme that is under way in the Capital Region of Denmark. Copenhagen and the surrounding municipalities are working together to build nearly 750km of long distance Cycle Superhighways radiating up to 40km from Copenhagen.

The growing popularity of e-bikes is one reason why these routes, designed for commuters, are proving so successful. On the routes completed so far 25% of users previously drove and the average bike commute distance is 15km.

Belgium, the Netherlands and Germany are also starting to build long-distance cycle superhighways radiating from their main towns.

Appendix 2

Infrastructure Commission for Scotland: transport recommendations relevant to Wales

1. *The Scottish Government should ensure that its new National Transport Strategy and Strategic Transport Projects Review 2, which are due to be published during 2020, fully reflect the need to deliver an inclusive net zero carbon economy ... This should include:*

> Aligning strategic investment decisions to address fully the requirement for demand management, a substantial increase in the proportion of journeys made by active travel, and opportunities for shared mobility as well as a much greater role for public transport.

> There should be a presumption in favour of investment to future proof existing road infrastructure and to make it safer, resilient and more reliable rather than increase road capacity;

> When new/upgraded road capacity (such as bypasses) is deemed necessary it must be as part of a package of interventions that includes a broadly equal reduction in road capacity for private vehicles on the existing network;

> Following on from the above, and to help arrest the decline in bus patronage, there should be a general programme of reallocating significant road space from private vehicles to public transport in each of Scotland's cities and the larger towns;

> There should be a binding national target for road traffic in Scotland derived from the requirement to achieve Net Zero Carbon by 2045, with targets set for each 5-year milestone from the 2020 baseline to 2045;

> A national integrated fares scheme for all public transport prioritising a substantial reduction in the cost of local trips should be costed by 2022;

2. *Investment decision making based on the above framework will require a significant change to investment guidance. Therefore, by the end of 2021, the Scottish Government and Transport Scotland should develop a new investment appraisal and decision-making process, incorporating necessary changes to the current Scottish Transport Appraisal Guidance (STAG) and Investment Decision Making Guidance...putting the requirement to achieve net zero carbon as the unequivocal priority of the transport infrastructure project appraisal system;*

> Appraising all potential future projects on the basis of their impact on the carbon and inclusion outcomes of the overall mobility system rather than specific transport issues in isolation.

> All Scottish Government funded projects included in its 2020 Infrastructure Investment Plan should be prioritised against available inclusive net zero carbon economy outcomes.

3. *To enable a managed transition to an inclusive net zero carbon economy road infrastructure, the Scottish and UK Governments should immediately commit to work together to establish a charging/payment regime alternative to the existing fuel and road taxation based structure.*

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[1] Wellbeing of Future Generations (Wales) Act 2015

[2] Greenhouse Gases Emissions Inventory 1990-2017 Issue 1.1 Wales by Source

[3] For example, Anderson K. (2019) Aligning UK car emissions with Paris (1.5-2°C) provisional carbon budget analysis calculates that for the UK to make its 'fair' contribution to the Paris "well below 2°C commitment", the carbon budget for the car sector is equivalent to just 7-8 years of current carbon emissions. This means that there must be an immediate tightening of new car emission standards to <100gCO2/km, a complete transition to electric vehicles by 2035, a shift to very low carbon electricity by 2030-35 – and even then, a rapid reduction in vehicle kilometres of 40-60% is still required.

[4] Jackson T. (2019) Zero Carbon Sooner: the case for an early zero carbon target for the UK *CUSP Working Paper No. 18* argues that "every year that progress is delayed, the challenge only gets bigger. Remaining within a fair carbon budget for the rest of this century requires deep and early decarbonisation". He calculates that the UK needs to set a target for net zero carbon emissions by 2030 or earlier (rather than aiming for net zero by 2050, as assumed by the Committee on Climate Change).

[5] Welsh Government 2019 Prosperity for All - A Low Carbon Wales see p.105

[6] Estimate assumes: (a) the Combined Authority areas achieve public transport patronage of 282 trips per annum per person (average of the figure for the six case study Verkehrsverbünde); (b) 35% of new public transport trips would otherwise have been made by car, in line with DfT-recommended diversion factors for bus interventions (adjusted to exclude rail and light rail) as given in Dunkerley F., Wardman M., Rohr C. and Fearnley N. (2018) Bus fare and journey time elasticities and diversion factors for all modes: a rapid evidence assessment Report to Department for Transport; (c) trips that switch from car to public transport have an average trip length of 4.9 miles, in line with average bus passenger journey length from National Travel Survey

NTS0303 for 2016; (d) car mileage in Combined Authority areas is as given in Department for Transport statistics TRA8905; (e) population is constant.

[7] It is worth explaining why we believe that changing the structure of the railway so that it is a single entity operating under public control is necessary in the context of a climate emergency, as the very live debate about the structure of the railways has not been framed in the context of action on climate change. There are four reasons why we believe that the current poor governance of the railway is a climate issue. First, under the present system, Network Rail receives bids for train paths from train operators and has to try its best to fit them together. This is rather like trying to form a coherent picture from random pieces of different jigsaw puzzles. Network Rail has no power to design the most operationally-efficient timetable, or to create the most attractive offer to travellers. Were it to try to do this, it might receive legal challenges about access rights from the train operating companies or the Office of Rail and Road. Exacerbating this, the specification for each franchise is made in isolation and with little or no consultation with Network Rail, precluding a system-wide approach to timetabling. This means that it is next-to-impossible under the current structure of the railways to create a Swiss-style integrated clock-face timetable, which is essential as part of a universal, comprehensive public transport network. Second, under the current structure of the railways, ticket purchase for anything but a straightforward journey with a single train operating company is excessively complex, and this, together with the high cost of rail travel, deters many people from travelling by train. Third, fragmentation of the railway between multiple competing train operating companies means that when things go wrong, the passenger is often stuck in the middle: trains are not held to meet delayed services run by other operators (even if the delay is of a few minutes), and a ticket for one operator's trains may not be accepted by another. Again, this means that people feel that they cannot trust public transport, and so they travel by car. Finally, there is no objective for the railway to be run in a way that reduces carbon emissions – and nor can there be, because 'the railway', as a single entity, does not exist. These problems are *structural,* and it is only by changing the structure of the railway so that it is a single entity operating under public control, in the public interest, and with an objective to act in such a way as to reduce carbon emissions from transport to the greatest extent possible, that they can be resolved. Transport for Quality of Life has carried out research in this area and is of the view that public ownership is necessary to achieve this. Friends of the Earth have not carried out research in this area so do not have a position on public ownership, but do believe that the structure of the railway needs to change to be managed as a single entity and under public control.

[8] Sloman L. and Tyler J. (2019) Public transport everywhere with a national timetable Transport for Quality of Life Radical Transport Policy Two-Pager #6.

[9] The 746km of Cycle Superhighways planned for the Capital Region of Denmark are expected to cost €295 million, which is roughly equivalent to £400,000 per km.

[10] Newson C. and Sloman L. (2019) The case for a UK incentive for e-bikes Report for the Bicycle Association.

[11] Propensity to Cycle Tool Wales Relevant scenario is defined by 'trip purpose = commuting'; geography = 'middle super output area'; 'scenario = ebikes'.

[12] CairnsS. and Sloman L. (2019) Potential for e-cargo bikes to reduce congestion and pollution from vans in cities Report for the Bicycle Association.

[13] BBC (2020) Welsh road tolls to be considered in review

[14] Huré M., Javary C-M. and Vincent J (2019) Le nouveau réseau de transport gratuit à Dunkerque Observatoire des Villes du Transport Gratuit.

[15] Through local authority contracts, reimbursement for trips made by concessionary pass-holders, and government grants. Taylor I. and Sloman L. (2016) op. cit.

[16] For example, the Nottingham Workplace Parking Levy, a charge on workplace parking spaces, has raised about £9 million each year, helping to fund extension of the tram network, redevelopment of the train station and creation of an all-electric park and ride. Nottingham City Council (2018) Workplace parking levy wins praise from independent bodies. News article, 30 January 2018. Accessed 04.12.2018.

[17] Source: National Statistics (2019) Country and regional analysis interactive tables which reports expenditure in five categories: 'local public transport' (which in the Welsh context we interpret as buses); 'rail'; 'local roads'; 'national roads'; and 'other'. This dataset includes expenditure by all public bodies – local government as well as the Welsh Government and any transport agencies and companies. The 'other' category may contain some walking and cycling expenditure, but is a small category. Whilst it is possible that some of the roads capital spending is also on sustainable modes of travel, such as cycle lanes, and bus priority measures, it is not plausible that these are a major proportion, given that total active travel investment in 2019-20 has been of

the order of £40m (see Waters L (2019) Active travel projects announcement) and furthermore, this total may not all be capital spending). There is also a likelihood that some of this spending is road maintenance, rather than new road building, but much road maintenance comes from revenue rather than capital spending, and the accompanying analysis of actual road projects for the next 5 years strongly tends to confirm that road building spend is the major bulk of capital expenditure.

[18] Source: Welsh Government (2019) Welsh Infrastructure Improvement Plan project pipeline update 2019 which reports Welsh Government capital expenditure expected from the 5-year National Transport Finance Plan. In addition this report lists expenditure directed via local government, which documents, in addition to the data plotted in the chart, a further £158m of capital spending on roads anticipated over the 5-year pipeline period, although at this level many funding allocation definitions are obscure and may contain mixtures of road building and road maintenance and mixtures of road spending directed at general traffic and roads spending directed at sustainable modes.

[19] Welsh Government 2019 Prosperity for All - A Low Carbon Wales

[20] Welsh Government 2019 Wales accepts committee-climate-change-95-emissions-reduction-target_press release

[21] It does profile the Nextbike scheme and its expansion into e-bikes and asserts that this will enhance access to affordable transport by socially and economically disadvantaged people, but it fails to state how this will in practice be targeted at those people and how they will be given affordable hire options.

[22] Infrastructure Commission for Scotland (2020) key findings report

[23] Cost and local ecological damage were given precedence in the decision letter, but Mark Drakeford's speech to Assembly Members announcing the decision also puts it in the broader context of the declaration of a Climate Emergency by the National Assembly for Wales. Drakeford 2019 Address to Welsh Assembly on M4 Decision

[24] Lee Waters 2019 Active travel funding announcement Dec Note: it is not clear whether the £40m referred to in this announcement may include revenue funding as well as capital funding.

[25] Welsh Government 2018 Planning Policy Wales edition 10

[26] Skates K (2019) Written Statement of Update on Public Transport Wales Bill and Wider Bus Reform Agenda

[27] Walesonline 2020 Cardiff Congestion Charge for Drivers

[28] Cardiff City Council 2019 Cardiff's Transport White Paper: Transport Vision to 2030

[29] By way of comparison, Dunkirk is 90,000. Wrexham at 66,000 is the largest town in N. Wales. Local industry includes biopharmaceuticals, automotive supply chain, food and brewing, plus aerospace-linked work with Airbus at Broughton 10km away. There is more industry in the broader Deeside area. The NE Wales Metro vision is based around providing sustainable transport access to the area's multiple employment sites, primarily through bus services. One possible obstacle may be that Wrexham is only 15km from Chester which may make independent management of bus services somewhat more difficult.

[30] Ebike Tips (2020) Netherlands_expecting_even_greater_e-bike_boom_as_tax_breaks_and_incentives_kick_in_for_2020

[31] Cairns S and Sloman L (2019) Potential for e-cargo bikes to reduce congestion and pollution from vans in cities Potential for e-cargo bikes to reduce congestion and pollution from vans in cities Transport for Quality of Life report for the Bicycle Association p.17.

[32] Anable J & Ledbury M (2006) *ERC Quick Hits 2: Limiting Speed* for UK Energy Research Council. The authors note that this number is conservative because it only looks at vehicle efficiencies. In practice speed limit reductions would also cause a significant reduction in numbers of trips and trip lengths. The 2008 and 2009 reports of the Committee on Climate Change provide calculations of carbon savings that appear to be somewhat higher for this reason and a pilot study by CE Delft also factors in this traffic reduction effect CE_Delft_2010_Why Slower Is Better.

[33] Arguably these measures are less draconian than the cuts in speed limits in America and other countries during the 1970s 'Oil Crisis', which viewed in terms of existential impacts was a lesser 'emergency'.