



County Hall
Cardiff
CF10 4UW
Tel: (029) 2087 2000

Neuadd y Sir
Caerdydd
CF10 4UW
Ffôn: (029) 2087 2000

AGENDA

Pwyllgor PWYLLGOR CRAFFU AMGYLCHEDDOL

Dyddiad ac amser y cyfarfod DYDD LLUN, 24 EBRILL 2023, 5.30 PM

Lleoliad YB 4, NEUADD Y SIR, CYFARFOD AML-LEOLIAD

Aelodaeth Cynghorydd Owen Jones (Cadeirydd)
Y Cynghorwyr Derbyshire, Gibson, Green, Lancaster, Lewis,
Lloyd Jones, Jackie Parry a/ac Wood

Tua
Amser.

1 Ymddiheuriadau am Absenoldeb

Derbyn ymddiheuriadau am absenoldeb.

2 Datganiadau Buddiannau

I'w wneud ar ddechrau'r eitem agenda dan sylw, yn unol â Chod Ymddygiad yr Aelodau.

3 Cofnodion *(Tudalennau 5 - 22)*

Cymeradwyo'r cofnodion yn gofnod cywir o'r cyfarfod ar 27 Chwefror a 16 Mawrth 2023.

4 Stryd y Castell - Trefniadau Rheoli Traffig Canol y Ddinas *(Tudalennau 23 - 144)*

5.35 pm

Eitem cyn penderfynu

5 Diweddariad Rheoli Traffig Ledled y Ddinas *(Tudalennau 145 - 192)*

6.35 pm

Eitem cyn penderfynu

6 Eitemau brys (os oes rhai)

7 Y Ffordd Ymlaen

To review the evidence and information gathered during the meeting, agree Members comments, observations and concerns to be passed on to the relevant Cabinet Member by the Chair.

8 Dyddiad y cyfarfod nesaf

Davina Fiore

Cyfarwyddwr Llywodraethu a Gwasanaethau Cyfreithiol

Dyddiad: Dydd Mawrth, 18 Ebrill 2023

Cyswllt: Graham Porter, 02920 873401, g.porter@caerdydd.gov.uk

GWE-DARLLEDU

Caiff y cyfarfod hwn ei ffilmio i'w ddarlledu'n fyw a/neu yn olynol trwy wefan y Cyngor. Caiff yr holl gyfarfod ei ffilmio, heblaw am eitemau eithriedig neu gyfrinachol, a bydd y ffilm ar gael ar y wefan am 12 mis. Cedwir copi o'r recordiad yn unol â pholisi cadw data'r Cyngor.

Gall aelodau'r cyhoedd hefyd ffilmio neu recordio'r cyfarfod hwn

Ar ddechrau'r cyfarfod, bydd y Cadeirydd yn cadarnhau a gaiff y cyfarfod cyfan neu ran ohono ei ffilmio. Fel rheol, ni chaiff ardaloedd y cyhoedd eu ffilmio. Fodd bynnag, wrth fynd i'r ystafell gyfarfod a defnyddio'r ardal gyhoeddus, mae aelodau'r cyhoedd yn cydsynio i gael eu ffilmio ac y defnyddir y lluniau a recordiadau sain hynny o bosibl at ddibenion gwe-ddarlledu a/neu hyfforddi.

Os oes gennych gwestiynau ynghylch gwe-ddarlledu cyfarfodydd, cysylltwch â'r Gwasanaethau Pwyllgorau ac Aelodau ar 02920 872020 neu e-bost [Gwasanethau Democrataidd](#)

Mae'r dudalen hon yn wag yn fwriadol

ENVIRONMENTAL SCRUTINY COMMITTEE

27 FEBRUARY 2023

Present: Councillor Owen Jones(Chairperson)
Councillors Derbyshire, Gibson, Green, Lancaster, Lewis,
Lloyd Jones, Jackie Parry and Wood

Shifa Shahzad and Charlotte Bowen

59 : APOLOGIES FOR ABSENCE

No apologies for absence.

60 : DECLARATIONS OF INTEREST

No declarations of interest.

61 : MINUTES

The minutes of the meeting held on 12 January 2023 were approved by the Committee as a correct record.

62 : DRAFT CORPORATE PLAN 2023-2026 AND DRAFT BUDGETARY PROPOSALS 2023/24

The Committee received a report providing Members with an opportunity to scrutinise those sections of the draft Corporate Plan 2023-26 and draft 2023/24 Budget Proposals that related to the Cabinet Portfolios and service areas within the remit of the Committee. The Cabinet will consider the Committee's comments and recommendations prior to finalising their budget proposals. The draft Cabinet budget proposals will be taken to the Cabinet Meeting on 2 March 2023 for agreement and the Cabinet's budget recommendations would then be considered by Council at its meeting on 9 March 2023.

Members were advised that the 2023-26 Corporate Plan sets out the Council's strategy framework and addresses the administration's priorities as detailed in its policy statement 'Stronger, Fairer, Greener'. The Corporate Plan indicates how the authority will deliver and monitor progress on the following well-being objectives:

- Cardiff is a great place to grow up
- Cardiff is a great place to grow older
- Supporting people out of poverty
- Safe, confident and empowered communities
- A capital city that works for Wales
- One Planet Cardiff
- Modernising and integrating our public services

The report provided a summary of the background and context within which the draft budget proposals have been set and how the draft budget proposals and the draft Capital Programme align with the Corporate Plan 2023-26.

The report indicated that Cardiff will receive a 9.0% increase in Aggregate External Finance in 2023/24 – equating to £48.165 million in cash terms. The above average settlement was linked data highlighting population changes and the number of children in receipt of free school meals.

Specific grant announcements show a £63 million increase overall (at an all-Wales level), although several grants will undergo notable changes. Grants totalling £41 million will cease in 2023/24, whilst £32 million of funding is yet to be confirmed. The most significant changes include an additional £132 million to support non-Covid rate relief in the Retail, Leisure and Hospitality sector, and a reduction of £55.75 million (74%) in the Childcare Offer which will now be paid directly to private childcare providers. Cardiff has received confirmation that its Housing Support Grant will remain at its 2022/23 level of £21.9 million in 2023/24, with indications that it will continue at that level until 31st March 2025.

The final settlement is not expected until early March 2023. The report highlighted one expected change in the final settlement in relation to Fire and Rescue Authority pensions.

A summary of the revenue budget was set out in the report. The summary indicated a budget gap of £24.216 million. The following strategies would be implemented to address the budget gap.

- Efficiency Savings (10,090)
- Corporate Savings and Measures (3,000)
- Reduction in Financial Resilience Mechanism (1,800)
- Service Change Proposals (2,776)
- 3.95% Council Tax Increase (net effect after impact on CTRS) (6,550)

TOTAL (£24.216 million)

The report provided further details on each of the strategies set out above.

Efficiency Savings would be made up from a review of staffing arrangements (£3.385 million); reductions in premises costs (£0.197 million); reductions in external spend (£2.813 million); and increase in income and grant maximisation (£3.695 million).

Corporate Savings and measures would include £1 million reduction to the Council's General Contingency Budget (from £2 million to £1 million); £1 million reduction to the Adult Services specific contingency budget (from £3 million to £2 million); and £1 million savings to corporate budgets including Council Tax Reduction Scheme and Insurance.

The Financial Resilience Mechanism (FRM) is a £3.8 million budget that was established to help the Council deal with funding uncertainty. It is used to invest in priority areas, but investment is one-off and determined each year. It was also proposed that the FRM be reduced by £1.8 million in 2023/24.

The service change proposals that will impact on existing levels of service, and details of the consultation undertaken with effected users, were summarised in Appendix 5b and 7a of the report.

A Council Tax increase of 3.95% would generate a net additional income of £6.550 million.

The report also provided an overview of the draft Capital Programme for 2023/24 to 2027/28/ The proposed 2023/24 Budget outlines capital expenditure proposals of £1.413 billion for the financial years 2023/24 to 2027/28, of which £314 million is earmarked for 2023/24.

63 : CORPORATE OVERVIEW

The Chairperson welcomed Councillor Chris Weaver, Cabinet Member for Finance, Modernisation and Performance, Chris Lee, Corporate Director Resources and Ian Allwood, Head of Finance to the meeting.

Following a statement from the Cabinet Member the officers delivered a presentation providing an overview of the 2023-24 Budget Proposals.

The Chairperson invited Members of the Committee to comment, seek clarification or raised questions on the information provided. Those discussions are summarised as follows:

- Officers were asked whether they were confident that the anticipated level of grant funding would be achieved. The Head of Finance stated that there is an element of risk both in terms of revenue and capital grants. Capital grants are tend to be grants provided for specific schemes and these long-term schemes are reliant on Welsh Government approval. In terms of revenue grants, funding tends to be on a 1-year basis and if these are being used to provide a service then there is an element of risk. Officers were confident that revenue grant funding would be available for the next 2 or 3 years. However, the Medium Term Financial Plan (MTFP) will be refreshed during that term and the security of grant funding will be considered as part of that.
- Officers confirmed that the budget proposals include a reduction of 9.6 FTE posts in services which fall within the remit of the Committee.
- Members asked where the £1.7 million overspend at Month 9 in Waste Management has arisen. Members were advised that there was a significant issue around the volatility of income received by the service. Appendix 2 of the Month 9 monitoring report provided more detail.
- Comments were requested on the proposal to introduce 100% Council Tax premium on empty properties. The Cabinet Member stated that two different

premiums would be brought forward. Currently there is a 50% premium on long-term vacant properties. The proposal would increase this to 100% from March 2023 and it was anticipated that this would raise an additional £300,000 which would be directed to supporting housing costs and addressing homelessness. The second option in relation to introducing a 100% Council Tax premium on second homes is currently being consulted upon. If taken forward then this premium can only be introduced from 2024/25. The 100% premium was chosen as there would be a cost to collecting the premiums and there was also potential for some properties to seek exemptions. The 100% premiums will be monitored, particularly to identify whether empty homes are being brought back into use. If the authority wished to vary either premium in the future then this can be introduced in the following tax year, subject to consultation.

- Members asked for clarification on the corporate policy for increasing fees and charges. The Head of Finance stated that there was a wide range of fees and charges across the authority. Each directorate will have a strategic approach to their fees and charges. A number of components are considered along with what the fees and charges are aiming to achieve. For example, some charges are income generating – some fees and charges are aimed at behaviour change – some fees and changes aim to achieve both income generation and behaviour change. The Council Tax premium and moving traffic offences were good examples of these. The accountancy teams will work closely with colleagues within the directorates in terms of agreeing appropriate levels of fees and charges. Members were advised that an Income Policy Framework will be introduced into the budget strategy from July 2023. The Corporate Director Resources stated that the authority is still in a transition period following the covid-19 pandemic, particularly in areas where income generation is a key driver and therefore finance officers are mindful not to overstretch income assumptions.

RESOLVED – That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

64 : WASTE MANAGEMENT AND RECYCLING

The Chairperson welcomed Councillor Caro Wild, Cabinet Member for Climate Change and officers from the Economic Development directorate.

Following a brief statement by the Cabinet Member, the Committee were invited to comment, seek clarification or raise questions on the information received. Those discussions are summarised as follows:

- Members asked whether the proposal to reduce the opening hours in HWRC's could lead to an increase in flytipping and what the service area was doing to minimise those risks. Officers stated that the intention was to ensure that there will always be at least one HWRC facility open every day. The HWRCs are operating at 50% on low-use days at present (Tuesdays and Wednesdays) so it was anticipated that the closing of each HWRC on alternate days would not affect

the overall amount of recycling received. The proposals would require the workforce to change their work patterns and consultation with the trade unions regarding the proposals was ongoing. Officers confirmed that the proposed decision to close was data led. Staff working hours would be reduced to 37 hours, their current contracted hours, wherever possible. There would be no job losses as a result of the proposal.

- Members asked whether there were any plans to continue with the programme of 'pop up' recycling centres. Officers advised that the 'pop up' centres worked reasonably well at the start of the programme but after a while usage reduced significantly. Consideration was now being given to providing facilities for vulnerable users who did not have access to cars and the potential to pilot mobile facilities during the coming year. The mobile facilities would use specific locations around the city in order to collect materials that cannot be collected by kerbside collections such as wood, small electrical items, etc.
- Members asked whether there were any plans to improve recycling from communal bins in particular. Officers stated that the segregated recycling scheme is currently being rolled out to standard housing stock throughout the city. Once that phase is completed there would be increased focus on flats and HMOs. Officers were aware that communal bins facilities were being misused at various locations throughout the city and discussions were taking place around improving security and who has access to those bins. A pilot scheme is also underway providing segregated aperture bins to flats for paper/card but not general waste.
- Members noted that £815,000 was set aside in the budget for a review of implantation of approved options arising from a review of the Recycling Service Strategy. Members asked for a breakdown of that figure and whether that would include the cost of purchasing vehicles. Officers indicated that the figure was not related to the base budget and would not be used to purchase vehicles. The sum would be allocated towards 'one off' costs such as reusable bags and communication/engagement with residents. The pilot schemes have provided an indication of the resources required to deliver a segregated recycling service over a period of 12 months.
- Members asked what budget was made available to purchase the new vehicles required. Officers stated that the budget for vehicles would not change significantly. A new type of vehicle would be introduced for separate glass collections and these vehicles will be financed from glass recycling income. The model represents a sustainable cost-neutral position moving forward.
- Members asked for an update on the authority's commitment to find a site for a recycling facility in the north of the city. Officers recognised that a recycling and reuse facility was needed in the north of the city. Discussions were ongoing with 3rd sector partners with a view to potentially establishing a re-use initiative. The

Director of Economic Development assured the Committee that the provision of a facility in the north of the city remains a priority for the administration.

- Members noted that charges for bulky waste collections had increased by 60% and a booking fee of £5 had also been introduced. Members asked whether the booking fee was additional or included within the total cost, the rationale for the increase and for comments on the potential impact on flytipping. Officers stated that the digitalisation of the bulky waste collection service had increased the amount of materials being collected. The charge for the waste being collected was unchanged. The booking fee was additional to the fee charged and it was introduced in order to minimise inefficiencies. Evidence shows that large numbers of people book bulky waste collections but do not subsequently present any waste for collection. The Director stated that it was anticipated that the introduction of a booking fee would reduce time wasting and subsequently lead to an improvement in performance. This would consequently help reduce the risk of flytipping.
- A Member asked whether it was possible to reduce the amount of single use plastic bottles provided to pupils in schools. Officers stated that the authority is promoting re-fill facilities and is currently installing re-fill station in high use buildings in the city centre. A step-change was anticipated in the next few years in this regard. The authority is also working with schools to improve their arrangements. Officers considered that plastic bottles are not problematic if they are properly recycled.
- Members noted that HWRC were operating at 50% capacity at certain times. Members asked whether interrogation of the data available would allow an opportunity to be more flexible with opening hours, to reflect the hours residents wish to use the facilities, and thereby increase efficiency. Officers stated that good data was available from HWRCs since the booking system was introduced. Usage throughout the day has been looked at. There is low usage at certain times and on certain days. The options to curtail hours or close on a certain day was publicly consulted upon. The consultation favoured closing on a certain day. Officers suggested that the provision of an efficient kerbside collection service has an effect on usage at HWRCs.
- Officers confirmed that the capital allocation set aside in the budget was allocated for the provision of a recycling centre in the north of the city. Members noted that no revenue funding was allocated at present. Officers were asked whether it was anticipated that a future 3rd sector partner would be expected to take on the revenue cost. Members were advised that consideration is being given to working in partnership with a group of voluntary sector organisations, each with a distinct role, with Keep Wales Tidy potentially having an over-arching role and Cardiff Council providing governance. Some revenue funding would be available via grants from Welsh Government. The Director of Economic Development reminded members that any proposals would be subject to a full business case, which would include the capital costs and revenue funding, prior to

approval by the Cabinet. Officers advised that the costs set aside in the budget were indicative and would allow for a business case to be developed quickly if a suitable site is identified.

- Members asked officers to comment on the likely impact the new waste collection system would have on budgets. Officers stated that the pilot and the Welsh Government's blueprint model indicated that the vehicle fleet would need to be increased by approximately 20 vehicles. Specialised vehicles will be required for each type of collection – e.g. the food waste vehicle will be sealed, the glass collection vehicle would be insulated to limit noise, etc. A number of vehicles will be hired so rounds can be rebalanced in the future if necessary. The current segregated collection scheme model for standard collections in regular housing stock is cost neutral. The costs associated with segregated collections in HMOs and flats will need to be modelled in the future.

RESOLVED – That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

65 : CLIMATE CHANGE

Following a brief statement by the Cabinet Member, the Director of Planning, Transport and Environment provided a presentation. The Committee were invited to comment, seek clarification or raise questions on the information received. Those discussions are summarised as follows:

- Members requested further details regarding the strategy for providing real-time air quality monitoring. Members were advised that a network of air quality monitoring stations is installed across the city and there were plans in place to increase the number of stations further. However, the responsible officer has left the authority and the post has yet to be filled.
- Members noted the £300,000 set aside for the low-emission taxi vehicles pilot. A Member considered that the moratorium on the number of vehicle licences permitted in the city was acting as a barrier to participation in the pilot. Officers were asked to explain how the £300,000 would be allocated. The Director stated that those issues were being worked through as part of the Taxi Strategy, including discussion around how to create incentives to develop a low-carbon taxi fleet in the city. It was accepted that the current arrangements, whereby vehicles are purchased and leased back to members of the trade, were unsatisfactory. The scheme is being reviewed and best practice in this area around the UK is being considered.
- Responding to a point raised by a Member of the Committee, the Director stated that the cross-border taxi issue was a regional issue and was within the remit of the Welsh Government.

- Members asked whether EV charging points for the taxi trade would be considered as part of the transition plan. The Director stated that opportunities to identify suitable locations for charging points were being investigated.
- A Member asked whether SUDs schemes including provision for the treatment of sewage. Members were advised that SUDs schemes relate to the treatment of surface water only. SUDs schemes are compulsory in developments of more than 1 unit.

RESOLVED – That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

66 : TRANSPORT AND STRATEGY PLANNING

The Chairperson welcomed Councillor Dan De'Ath, Cabinet Member for Transport and Strategy Planning and officers from the Planning, Transport and Environment directorate.

Following a brief statement by the Cabinet Member, the Committee were invited to comment, seek clarification or raise questions on the information received. Those discussions are summarised as follows:

- In respect of the increase in charges for bereavement services, Members asked whether support would be provided for low-income households or whether charges could be means tested. The Director stated that Cardiff has been cautious around increasing charges in this area. The charges are benchmarked against other authorities and are low than average. The Director agreed to provide further details of the support provided for low-cost funerals following the meeting.
- Members referred to the changes in costs for residents parking permits. It was understood that historically the costs of a second permit was high in order to deter second car ownership. Members asked why the differential between first and second permits was not maintained. Members also asked whether there was any scope for increasing the costs of permits based upon the vehicle size or emissions in future. The Director stated that the differential between first and second permits was not logical and it had not been reviewed for over 10 years. The charges now seek to benchmark against other UK cities. Cardiff is charging significantly less than comparators. The opportunity to use vehicle size or emissions to calculate the permit charge was complicated and may disadvantage those who were unable to afford new/electric vehicles. The proposal was rated red/amber as there was likely to be high public interest and scrutiny.

- A Member anecdotally observed that when a local school crossing patrol was removed the number of parents driving children to school increase and this had an adverse effect on air quality and congestion. The Director stated that school crossing had been invested in and improved. Locations are very closely monitored in terms of their safety.
- Members asked whether recent announcement regarding funding for buses were presenting any challenges for the Bus Strategy. The Director stated that there were concerns regarding the support provided to bus services in the city. The Welsh Government supported routes during the pandemic but that support is now been pulled back.
- The Director confirmed that Cardiff's parking charges compare favourably with other cities in the region. The intention is to remain just below the average cost charged in other cities.
- Responding to a question from the Committee, the Director confirmed that the charge for pre-application consultation on planning applications is a statutory fee set by legislation. The service is looking at the possibility of bringing forward supplementary charges which would better represent the value of the service offered for larger developments. Planning Performance Agreements would also enable a more targeted service and separate funding regime in terms of pre-application advice.

RESOLVED – That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

67 : URGENT ITEMS (IF ANY)

No urgent items.

68 : DATE OF NEXT MEETING

Members were advised that the next Environment Scrutiny Committee is scheduled for 16 March 2023.

The meeting terminated at 7.20 pm

This page is intentionally left blank

ENVIRONMENTAL SCRUTINY COMMITTEE

16 MARCH 2023

Present: Councillor Owen Jones(Chairperson)
Councillors Derbyshire, Gibson, Lancaster, Lewis, Lloyd Jones,
Jackie Parry and Wood

Shifa Shahzad and Charlotte Bowden

69 : APOLOGIES FOR ABSENCE

Apologies were received from Cllr Green.

70 : DECLARATIONS OF INTEREST

No declarations of interest.

71 : RECYCLING STRATEGY FOR CARDIFF

The Committee received a report providing Members with an update on the roll-out of the Recycling Strategy for Cardiff 2021-25, progress towards achieving the Welsh Government's Recycling targets, and an opportunity to hear from Councillors whose wards are currently segregating their recycling.

Members were advised that the Welsh Government is committed to supporting local authorities improve their recycling performance and becoming a zero-waste nation. As a result Cardiff's recycling performance has improved but it is still behind other Welsh local authorities. Cardiff was required to achieved a 64% recycling rate by 2021/22, and 70% by 2024/25.

Officers provided a presentation summarising the current service provision for residents and information regarding the segregated recycling pilot undertaken in a number of wards. The presentation also highlighted the proposed timeline for introducing segregated recycling across the city and the changes being introduced in trade waste, which will also be required to introduce segregated recycling.

The Committee also received representations from a number of Councillors representing the wards involved in the segregated recycling pilot.

The Chairperson opened the debate on this item. Members were invited to comment, seek clarification or raise questions on the information received. Those discussions are summarised as follows:

- A Member stated that residents were generally supportive of the principal of recycling. However, there were some practical problems that need to be addressed. For instance both recycling bags have the same symbols on them and it is unclear what products go in each bag. The bags are also not being fully emptied, they are not being returned properly and they are being blown around by the wind.

- Members raised concerns re the elderly and disabled peoples' ability to segregate their waste. It was suggested that perhaps a bespoke service may be offered to vulnerable groups such as these.
- Members asked for a breakdown of the rate of recycling per ward across the City. Officers advised that it was not possible to provide an accurate estimation of the rate of recycling in each ward because waste collections rounds cross ward boundaries. Officers stated that it was possible to provide a breakdown of waste collected from types of residence. Members welcomed that data.
- Members noted that Newport was achieving the best rate in recycling for all cities in the UK. Members asked what Newport was doing differently. Officers stated that Wastesavers are contracted to operate a segregated recycling service for some time on behalf of Newport City Council. Members were asked to note that the majority of authorities performing better than Cardiff operate segregated recycling schemes. However, those authorities may not process the same amount of trade waste that Cardiff is collecting. At present trade waste adversely affects Cardiff's recycling rate but this position will be reversed when new legislation, requiring that all trade waste is recycled, is introduced in the near future.
- Members asked for details of the current rate of sickness absence within the Waste Management Service. Officers stated that the target for the service area is 20 days sick leave per person. This is a reduction from the target of 24 days in the previous year. There has been a lot of effort made to manage sickness absence and improve well-being and health. Occupation Health support is provided at the Lamby Way Depot – 7 days per week – where they can meet staff directly.
- Members asked whether the total amount of waste presented for recycling during the pilot had increased or whether the improved recycling rate was as a result of a reduction in cross-contamination. Officers stated that the co-mingled bags have approximately 30% contamination. It is estimated that contamination from segregated recycling will be around 1.6%
- Members noted that approximately 50,000 properties that were mainly flats and HMOs were not included within the new arrangements. Members asked how the properties are identified and what any future pilot for those types of properties would seek to establish. Officers stated that some pilot schemes are operating on smaller blocks of flats at present, including the provision of communal recycling facilities. It was accepted that there were issues to resolve around the storage of segregated bins in some types of residence. HMOs will need a different scheme and further consideration is being given to those. Responding to a question from the Committee officers advised that HMOs in the areas

participating in the pilot received the same number and type of containers as other properties.

- Officers provided clarification on the various 'strands' or work programmes being undertaken that are needed to achieved the Welsh Government's 70% recycling target.
- Officers stated that the majority of recycling - 50,000 tonnes is processed in Wales, 30,000 tonnes is processed in England the remaining waste is taken to Germany and India. Members were advised that the Welsh Government – 'My Recycling Wales' website contains a breakdown of where each local authority's waste is processed. Natural Resources Wales also require that waste flow data identifies where materials are sent and what happens to them.
- Members referred to feedback received and requested further comments from officers on the segregated recycling containers provided to residents. Concerns were raised that once emptied containers are being blown around in windy conditions or they were not being returned to residents satisfactorily once emptied by operatives. There can also be a long period between them being emptied and residents returning home to collect them. Officers stated that the feedback received was accepted and changes will be forthcoming as a result. The paper and card bag will be changed and flaps will be added to prevent rainwater going into it. The bags are weighted to a similar weight as every other local authority across Wales. A training issue was also identified as there is an appropriate method in presenting the containers back to residents which is not being adopted. In future a different split-back refuse vehicle will be used as this will make it easier for bags to be emptied.
- Members requested information regarding recycling performance in those areas participating in the scheme versus those areas not currently segregating their recycling. Officers agreed to provide feedback and identify the total reduction in contaminated recycling. However, it would not be possible to provide figures on a ward by ward basis.
- Members asked whether tetra-paks will be included in the recycling scheme in future. Officers stated that a pilot scheme is being undertaken currently to post-sort tetra-paks. If that pilot proves to be successful then residents will be asked to present tetra-paks in their plastic/metal container.
- Members asked for details of the timeframe for the rollout of segregated recycling flats and HMOs. Officers advised that pilot schemes will run for approximately a year and schemes would then rollout in 2024/25. The service would need to ensure that there were sufficient resources in place to support public engagement during the roll out of any changes, particularly in terms of the student population.

- Responding to a question from the Committee, Officers advised that textiles and fabrics should be presented at HWRCs and at community hubs. Officers are also investigating whether it will be possible to provide an accessible clothes bank service in schools.
- Officers advised that there were no plans to expand the workforce. However, data and digital systems would be used to increase efficiency. Officers acknowledged that the service also needs to improve how it presents information to residents. There were also around 500 volunteers working in community litter picking groups in the city.
- Members asked whether a weekly collection of bottles and jars was sufficient. Officers stated that the service wishes to encourage residents to recycling as much as possible and residents can be provided with as many recycling containers as they need. The move to two-weekly collections of glass has come about as a result of data received during the pilot phase. A two weekly collection of glass would be more efficient as less than 50% of residents present their glass container weekly, as opposed to 80% when two weekly.
- Officers confirmed that staff have accepted the change to segregated recycling. It was suggested that the Committee might like receive feedback from staff in around 6-months time.

RESOLVED: That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

72 : CARDIFF CROSSRAIL

The Committee received a briefing report on the Cardiff Crossrail project following the announcement of a successful 'Levelling Up' funding bid.

Members were advised that confirmation of the successful £50 million Cardiff Crossrail (CXR) Phase 1 bid was published by the UK Government in January 2023. The Welsh Government match funded the budget and a total of £100 million is available to deliver Phase 1 of the development. The role of Transport for Wales in developing the bid and the outline business case was acknowledged.

The project aims to deliver a regular tram service from Cardiff Central to a new platform at Cardiff Bay train station; two new platforms at Cardiff Central Train Station; public realm improvements around the existing and new train platforms; and a new road layout which allows safe transition for the public to use between road, rail, cycling and walking.

The Chairperson welcomed Claire Moggridge, Operational Manager, Head of Transport and Jason Dixon, Operational Manager – Transport Development and Network Management to the meeting. The officers were invited to deliver a presentation.

The Chairperson opened the debate on this item. Members were invited to comment, seek clarification or raised questions on the information received. Those discussions are summarised as follows:

- Members asked what capacity Phase 1 of the project would have. Officers stated that there would be enough capacity to run upwards of 12 trains per hour between Cardiff Central and Cardiff Bay. The evaluation in 2019 estimated approximately 1.9 million passengers per year. The forecast, depending on development in the Bay, could be up to 2.5 million per year.
- Members asked for details of the timeline for the next phase of the project towards the east of the city. Officers stated the Phase 1 would be completed by 2027/28. Further funding bids would be forthcoming to continue with the project further east.
- Members asked what effect industrial action or another event causing a rail network failure would have on the city. Officers stated that the rail operators have a legal responsibility to provide an alternative service for any blockages or works taking place on the network. However, industrial action, would bring elements of the transport system to a standstill and this would bring challenges.
- Officers confirmed that major events in the Bay will have a travel plan. Crossrail will be invaluable in supporting that and it will be a vast improvement on current provisions. Events will also be supported with park and ride, priority bus services and walking/cycling.
- Members asked whether officers were confident that the funding for the remaining sections of the Metro project would be forthcoming and whether there would be sufficient linkages between the CXR and those sections. Officers stated that the CXR would allow for Cardiff Central to be linked to Cardiff Bay using existing mainline and regional services. Existing services from Cardiff Queen Street would also remain.
- Members requested details of the current modal split between walking/cycling/bus/train/car. Officers stated that those figures are currently being reviewed and agreed to report back to the Committee.
- Members asked how travel projections have been affected by the Covid-19 pandemic. Officers stated that some travel patterns have returned to pre-pandemic pattern – but over a 12-hour period those patterns have changed. The

morning peak is later and lasts longer. However, the hourly flow rate appears to be slightly lower at times. There has been an increase in cycling and walking. Cycling is remaining high and the service area is keen to maintain that. Rail and bus patronage has returned on some routes and has not returned on others. It is now at approximately 80% of where they were pre-pandemic. Concessionary fares have not returned to pre-pandemic nationally.

- A Member noted that since the end of the pandemic more people are working from home. People are also shopping online more and the cost of living crisis is having an effect on their spending. Officers were asked to comment on the overall viability of the project. Members were advised that footfall in the city centre is higher in the city centre than in most core cities. The development of the indoor arena in the Bay will increase footfall further. A mass transit system that is sustainable and reliable is therefore essential.
- Officers stated that preparatory works around the highway network for the project are advanced and Members can be reassurance that the start of those works are some way forward. These works are timely and will be fully integrated with work on the heat network and the indoor arena development. The works will require a Transport Regulation (Wales) Order to be approved by the Welsh Government and planning approval before they commence.
- Members asked whether officers were confident the Council has sufficient capacity to deliver the range of transport projects planned. The Head of Transport acknowledged that resources are under pressure. However, officers are confident that the projects will be delivered.
- Officers stated that a key requirement of the project would be joint ticketing. Joint ticketing is being led by Transport for Wales (TfW) and the Council is working closely with them. Officers confirmed that TfW will operate CXR.

RESOLVED: That the Chairperson writes to the Cabinet Member on behalf of the Committee to convey any comments, observations and recommendations made during the way forward.

73 : COMMITTEE BUSINESS

Members were asked to agree the Environmental Scrutiny Committee section of the Scrutiny Annual Report 2022/23.

RESOLVED – That the Environmental Scrutiny Committee pages of the Scrutiny Annual Report 2022/23 be approved.

Expressions of interest were sought for Members interested in participating in the Replacement Development Plan Joint Scrutiny Task and Finish Group.

RESOLVED That expressions of interest in participating in the Replacement Development Plan Joint Scrutiny Task and Finish Group be provided to the Principal Scrutiny Officer by 24 March 2023.

74 : URGENT ITEMS (IF ANY)

No urgent items.

75 : WAY FORWARD

76 : DATE OF NEXT MEETING

Members were advised that the next Environment Scrutiny Committee is scheduled for 20 April 2023.

The meeting terminated at 6.45 pm

This page is intentionally left blank

CYNGOR CAERDYDD
CARDIFF COUNCIL

ENVIRONMENTAL SCRUTINY COMMITTEE

24 APRIL 2023

DELIVERING A PERMANENT IMPROVEMENT IN AIR QUALITY ON CASTLE STREET IN THE CONTEXT OF CITY WIDE SUSTAINABLE TRANSPORT PROPOSALS

This Report contains an appendix is not for publication as it contains exempt information of the description in paragraph 16 of Schedule 12A of the Local Government Act 1972

Purpose of the Report

1. The Cabinet Report, attached at **Appendix A** (*and its subsequent Appendices*), are due to be considered by the Cabinet meeting on 27 April 2023. The purpose of this Cover Report is to provide Members with background information, and to act as a signposting tool to enable their pre-decision scrutiny of the report to Cabinet.

Structure of the Papers

2. Attached to this report are:
 - **Appendix A** - Cabinet Report
 - **Appendix A1** - Project Area Map
 - **Appendix A2** - City Centre West and South Option Modelling
 - **Appendix A3** - Castle Street Option Design
 - **Appendix A4** - Traffic Modelling and Air Quality Technical Information (SEWTM)
 - **Appendix A5 – Exempt Legal Implication**
3. The report at appendix A2 considers the two proposed options using VISSIM, a multimodal **traffic simulation** software which allows the local impact of a proposed scheme to be assessed, providing detailed visualisation and statistical outputs for individual modes of transport, with a focus on the impact to bus travel times.

4. The report at Appendix A4 is in two parts a Clean Air feasibility Study using modelling software PTV Visum and the South East Wales Transport Model as a basis. It forecasts a 'Do- Minimum' scheme including schemes already delivered and a 'Do-Something' scheme outcomes, in which Castle Street Proposal have been included for both Option 1 'All Traffic' and Option 2 'Bus Gated' proposals, and an updated Air Quality assessment report by Ricardo.
5. The report contains the following sections:
 - Section 1 outlines the process undertaken to develop the base year (2022) cordon model;
 - Section 2 details the forecasting process used to develop the 2024 forecasts;
 - Section 3 provides a brief overview of the modelling results; and
 - Section 4 provides details of the economic assessment using Transport User Benefit Analysis (TUBA)

Scope of Scrutiny

6. During this scrutiny, Members have the opportunity to explore:
 - The possible transport option for Castle Street and its impact on:
 - Air quality.
 - Transport and planning policy.
 - Sustainability.
 - Climate Emergency.
 - Whether there are any risks to the Council, financial or otherwise;
 - The timeline and next steps for delivering these proposals; and
 - The recommendations to Cabinet.

Background

7. In 2018, the Welsh Government issued a legal Direction requiring the Council to comply with the EU limit value for nitrogen dioxide (NO₂) found in air. The Council developed a Clean Air Plan to achieve NO₂ compliance and Cabinet approved this in June 2019, which can be found here: [Cabinet 13 June 2019 Clean Air Appendix 1 Clean Air FBC.pdf \(moderngov.co.uk\)](#)

8. The Clean Air Plan contains a scheme for Castle Street, which allows all traffic with restricted capacity and achieves air quality compliance re NO₂. The Clean Air Plan also contains the City Centre East scheme, aiming to achieve high quality, active travel infrastructure and connect key developments in a sustainable way. The scheme covers Dumfries Place, Station Terrace, Churchill Way, including the Canal reopening, and Bute Terrace.
9. The Covid-19 national lockdown led to the pausing of the above schemes. In Summer 2020 Castle Street was closed to all traffic to accommodate an outdoor dining area and Station Terrace was restricted to bus, taxi and limited access only. In autumn 2020 the outdoor dining area in Castle Street was removed, the south pavement extended to facilitate social distancing and Castle Street reopened to buses, taxis and access vehicles. Station Terrace reopened to all traffic. In addition, a series of Pop-Up cycleways were installed in the city centre.

Issues Identified in the Cabinet Report

10. **Point 9** clarifies the temporary traffic interventions that were put in place during the Covid 19 pandemic.
11. **Points 10 – 16** identify the post Covid position and recent developments, which include:
 - Castle Street reopening
 - the current temporary scheme
 - ongoing air quality and traffic monitoring
 - re-testing options
 - air quality compliance
 - Welsh Government direction.
12. The Castle Street modelling results are noted in **points 17 – 22** and includes details about the two options that have been considered and figures that model the traffic flows for each of the proposed models:
 - Figure 1 - Transportation Model Flows for Option 1 - 2024
 - Figure 2 - Transportation Model Flows Option 2 - 2024

13. Air Quality Modelling information is provided in **points 23 – 28** and includes tables and figures for modelled air quality on a number of key strategic routes:
- Table 1 - Modelled NO₂ Concentrations µg/m³ of Option 1 and 2
 - Figure 1 - Modelled NO₂ Concentrations Option 1 - 2024
 - Figure 2 - Modelled NO₂ Concentrations Option 2 - 2024
14. The conclusions of the air quality monitoring are noted in **points 29 – 32**, which are:
- i. **Both** Option 1 and Option 2 achieve air quality compliance on Castle Street.
 - ii. Whilst **neither** option cause dangerous levels of NO₂ on the surrounding network, the increased traffic displacement caused by Option 2 causes a net gain of NO₂ Concentrations µg/m³ on the wider network. With notable increases reported on both the A4119 and the A48.
 - iii. The chosen option must provide network resilience and support the enabling of future transport network and city development projects
15. **Points 33 – 37** highlight the Strategic Network Challenges and Risks, and include:
- major A roads in residential areas that also include schools and healthcare settings.
 - Limited options to offer east-west routes across the city, due to the river running north-south through the city, particularly in light of an incident on any of the key arterial roads (A48, A470, A4232, M4) which can cause significant disruption in the city
 - The importance of maintaining network resilience due to increasing pressure on some routes in and out of the city
16. Information on Major New Sustainable Transport schemes are noted in points **38 – 46** and include:
- Metro: Crossrail
 - ❖ Figure 5: Cardiff Region Tram Network
 - Strategic Bus Enhancements
 - ❖ Figure 7: Current Bus Corridors in WeITAG Development Stages
 - Strategic Cycle Enhancements
 - ❖ Figure 8: Primary and Secondary Cycle Route Aspirations

17. Protecting and facilitating the transport network development are mentioned in **points 47 and 48**, to meet the needs of Cardiff's [Transport White Paper](#).

The reasons for the proposed recommendation of **Option 1**, are laid out in **points 49 – 54** which provide further information in relation to:

- Ensuring air quality compliance
- Providing network resilience
- Protecting residential areas
- Supporting wider sustainable transport and
- The need for a permanent scheme

18. The next steps in relation to Castle Street and the wider transport network are outlined in **points 55 & 56**.

19. Castle Street requires circa £7m from Welsh Government to take forward the preferred option with building works starting in early 2024 following a tender process.

20. **Point 57** notes previous public consultation in relation to a permanent solution for Castle Street as:

- i. April - May 2019: City Centre Clean Air Plans
- ii. December 2019 - January 2020: Castle Street Option 1
- iii. March - May 2021: Castle Street Option 1 and Option 2

21. The need for further consultation on the chosen option following cabinet approval is noted in **point 58**.

22. Construction costs for the project will be from the Welsh Governments Clean Air funding and fees linked to delivering the project are estimated to be £250,000, from April 2023 onwards, **points 59 & 60**

23. It is noted the maintenance costs for 2 years on the hard infrastructure and for 5 years on soft landscaping are covered by 'construction' costs. However, **point 62**, acknowledges the need for future cleaning and maintenance cost to be discussed and negotiated with relevant teams to ensure the investment is continued.

24. Previous local member consultation it noted in **point 63** and **point 64** highlight their future involvement as part of the Traffic Regulation Order (TRO) process going forward.

25. The Cabinet Report notes the reasons for the recommendations as the following **(points 65 – 69)**:

- To comply with the Welsh Government direction placed on the Council to ensure continued air quality compliance is achieved on Castle Street.
- To ensure that the temporary scheme currently in place is upgraded to a level that satisfies design guidance, road safety and future maintenance.
- The delivery of these highway works are critical to achieving continued air quality compliance on Castle Street.
- This transport project will deliver key commitments in the Transport White Paper and will greatly assist with meeting targets in that paper, and also the One Planet Strategy.
- To maintain network resilience and support the future development of the transport network.

26. The Financial Implications of the scheme are noted in **points 70 – 74**, which note that the delivery of the proposed scheme is dependant on the level of funding secured from the Welsh Government and the Councils commitment to fund the ongoing revenue and maintenance costs.

27. The Legal Implications are recorded in **points 75 – 89**, which include the Equality Act 2010, The Well-Being of Future Generations (Wales) Act 2015 and the Welsh Language (Wales) Measure 2011

28. No HR Implications are stated.

29. No Property Implications are documented.

Previous Scrutiny

30. In June 2021 the Committee considered a report to cabinet that provided feedback on the public consultation and modelling work undertaken for Castle Street. The report sought approval for modifications to the road layout to achieve clean air compliance and to commission further modelling and analysis of the impact of these modifications on clean air, congestions and wider city recovery and renewal.

31. Following the meeting a letter was sent to Cabinet (pages 7 – 10) and a response received (pages 11 – 14), the link to this correspondence is [here](#).

32. The committee asked the following:

- Clarity and insight into how much of the decision to pursue ‘Option One’ was due to the results of the consultation.
- How the decisions to re-open up Castle Street to private traffic has been levelled out against the issue of ‘induced demand’ and the principles of clean air.
- In 9 months time, Committee receives a report detailing how closely the actual activity on Castle Street since its re-opening, has resembled the modelling predicted in the papers.
- Further clarity and rationale surrounding if electric buses will be included on this key route, why it has not already been included and when there will be capacity to do so.

RECOMMENDATIONS TO CABINET

33. Cabinet is recommended to:

- *Note the modelling work carried out on the future of Castle St.*
- *Approve Option 1 (Do Minimum) to be delivered as a permanent scheme.*
- *Delegate authority to the Director of Planning, Transport & Environment in consultation with the Corporate Director of Resources to deal with all aspects of the procurement process (including approving the evaluation criteria to be used and authorising the award of the proposed contract).*
- *Note and support the aspirations to improve the wider transport network in line with the decision to leave Castle Street open to traffic.*

Way Forward

34. Cllr Dan De’Ath, Cabinet Member for Transport & Strategic Planning and Andrew Gregory, Director of Planning Transport & Environment have been invited to make a statement and answer Member’s questions. They have been asked to make a brief presentation followed by Member’s questions.

Legal Implications

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters, there are no direct legal implications. However, legal implications may arise if and when the matters under review are implemented with or without any modifications. Any report with recommendations for decision that goes to Cabinet/Council will set out any legal implications arising from those recommendations. All decisions taken by or on behalf of the Council must (a) be within the legal powers of the Council; (b) comply with any procedural requirement imposed by law; (c) be within the powers of the body or person exercising powers on behalf of the Council; (d) be undertaken in accordance with the procedural requirements imposed by the Council e.g. Scrutiny Procedure Rules; (e) be fully and properly informed; (f) be properly motivated; (g) be taken having regard to the Council's fiduciary duty to its taxpayers; and (h) be reasonable and proper in all the circumstances.

Financial Implications

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters, there are no direct financial implications at this stage in relation to any of the work programme. However, financial implications may arise if and when the matters under review are implemented with or without any modifications. Any report with recommendations for decision that goes to Cabinet/Council will set out any financial implications arising from those recommendations.

RECOMMENDATION

The Committee is recommended to:

- i) Consider the information in this report, and the presentation and any further information presented at the meeting; and
- ii) Determine whether they would like to make any comments, observations or recommendations on this matter to Cabinet.

DAVINA FIORE

Director of Governance & Legal Services

17th April 2023

CARDIFF COUNCIL CYNGOR CAERDYDD

CABINET MEETING: April 2023

DELIVERING A PERMANENT IMPROVEMENT IN AIR QUALITY ON CASTLE STREET IN THE CONTEXT OF CITYWIDE SUSTAINABLE TRANSPORT PROPOSALS

PLANNING, TRANSPORT & HIGHWAYS (CLLR DAN DE'ATH) AGENDA ITEM:

Reason for this Report

1. To report back and assess the implications of the most recent air quality and traffic modelling results for Castle Street and the wider city sustainable transport network.
2. To respond to the Welsh Government Air Quality Direction on Air Quality Compliance issued to Cardiff Council, which includes a formal decision to implement a permanent transport scheme.
3. To seek delegated authority to proceed with design, tender and delivery of Option 1 (All Traffic, Bus Lane and Cycle Lane) as the preferred permanent scheme.

Background

4. Castle Street is one of the most significant and focal streets in Cardiff City Centre, it is also an integral part of the wider transport and highway network. Due to its central position, Castle Street has suffered high levels of traffic usage resulting in a degraded environment and noncompliant air quality levels.
5. As a result, in 2018 the Council received a legal direction from the Welsh Government to ensure that air pollution levels were below the EU limit value, specifically levels of nitrogen dioxide (NO₂). In response, the Council undertook a detailed analysis of air pollution levels across the city, which identified Castle Street as the sole non-compliant street.
6. In June 2019, the Cabinet approved a Clean Air Plan which set out the steps required to improve air quality in the city centre, and on Castle Street specifically. This included three major city centre schemes:

- **City Centre West:** Central Square and Westgate Street
 - **City Centre North:** Boulevard de Nantes, Kingsway and Castle Street
 - **City Centre East:** Dumfries Place, Station Terrace, Churchill Way / including the Canal reopening, and Bute Terrace
6. In addition, the following supporting projects were included within the Clean Air Plan:
- **City Centre Enabling Works Package:** A series of supporting network enhancement that will improve connections to and from the city centre area
 - **SMART Corridors:** Three improvement corridors (North, East and West) aimed at monitoring clean air and traffic levels, improving bus journey time reliability into the city centre and alleviating congestion problems on key routes.
7. Following the approval of the Clean Air Plan, £15.2m was secured from Welsh Government to progress these schemes, representing a significant contribution towards the total project cost.
8. Successful implementation would significantly improve air quality and ensure compliance with legal limits. It would also install high quality active travel infrastructure for the city, ensure policy compliant drainage, and improve connectivity between key developments by strategically aligning bus routes and enhancing links with the new Transport Interchange. An overview of city centre project areas is included in Appendix 1 of this report.

Covid-19 Pandemic – Temporary Transport Interventions:

9. During the COVID19 Pandemic a series of transport measures were implemented in the city centre. The aim of these measures was to ensure safe public access to the city centre and support the recovery of the business and public transport sectors. The measures for Castle Street included:
- Summer 2020: Castle Street was closed to all traffic to accommodate an outdoor dining area, with Station Terrace restricted to bus, taxi and limited access only.
 - Autumn 2020: The pavement was extended on Castle Street south, outdoor dining areas were removed and buses, taxis & access vehicles were allowed in. Station Terrace was opened to all traffic.
 - Autumn 2020 – Present: A series of Pop up Cycleway were installed in the city centre to replicate those included in the permanent programme, extensions to these cycleways continue to be on site today and have seen over 2.5 miles of additional cycleways installed.
 - April 2021: Station Terrace closure to support buses, the future City Centre East Transport Project and the delivery of the Churchill Way event space.

- October 2021: Castle Street reopened to general traffic with an interim scheme which replicated the proposed Option 1 Clean Air Scheme.

Post COVID Position & Recent Developments

10. Following the COVID19 pandemic period, several measures were taken forward to respond and to support the city centre during the recovery process:
11. **Castle Street Reopening:** Following the Cabinet Decision to reopen Castle Street to general traffic in June 2021, the Transport Department proceeded to amend the arrangement of the street to accommodate a temporary version of the 'All Traffic' Option 1 Permanent Transport Scheme. This scheme was implemented in October 2021 and included the following lane arrangement:
 - Lane 1: Westbound Bus Lane
 - Lane 2: Westbound All Traffic Lane
 - Lane 3: East bound All Traffic Lane
 - Lane 4: Two-Way Temporary Segregated Cycleway
12. **The Current Temporary Scheme:** It is important to recognise that the current scheme on street remains a temporary scheme and is non-compliant with wider Cardiff and Welsh Government policy. The Cycleway design, highway arrangement and drainage do not adhere to national guidance. In this regard, the current scheme is likely to require renewal in the short term.
13. **Ongoing Air Quality and Traffic Monitoring:** Air quality monitors installed by the SMART Corridor West scheme, regular traffic surveys and on-site observations have been used since 2021 to define a settled post-COVID network picture.
14. **Re-testing Options:** The data from recent monitoring activity has been used to re-calibrate the South East Wales Model (SEWTM) and re-test both the Option 1 'All Traffic' Scheme and the Option 2 'Bus Gated' Scheme.
15. **Air Quality Compliance:** The current scheme in place on street is a temporary version of the Option 1 All Traffic Scheme. Monitoring undertaken on Castle Street has shown that NO₂ compliance has been achieved with the annual average for 2022 being recorded at 33.8 µg/m³, well within the EU Limit value (compliance target) of 40 µg/m³ as an annual average.
16. **Welsh Government Direction:** The Council is still being directed by Welsh Government to decide (by March 2023) to either implement the permanent version of the Option 1 'All Traffic' scheme previously approved. Or, if the Council is minded to implement an alternative scheme to improve air quality further, that the Council should undertake an assessment of the options, and that a final plan for the option be approved

by the end of March 2023 and then submitted to Welsh Government for approval.

Castle Street Modelling Results

17. As noted above, a number of temporary adaptations were made to Castle Street in responding to the COVID19 Pandemic, and subsequent traffic surveys and air quality monitoring results have been used to re-assess the options. The two options that have been considered are:
 - **Option 1 ‘All Traffic’:** This scheme is the previously approved design included in the Council’s Clean Air Plan. The scheme allows general traffic to access the area under reduced capacity, whilst also providing segregated cycling facilities, bus priority and public realm improvements. The design for this option is included in Appendix 3 of this report.
 - **Option 2 ‘Bus Gate’:** A variation on Option 1 where general traffic is restricted from using the street as a through-route. The scheme provides a segregated cycle lane, bus and taxi access through bus gating, and improved public realm via an extension to the pavement on the south side. The design for this option is included in Appendix 3 of this report.
18. Detailed transportation modelling has been undertaken on both a detailed City Centre VISSIM Model and a wider Strategic Transport Model (SEWTM), with highway flows recalibrated with traffic data collected in central Cardiff during 2022. The highway network was updated to reflect recent schemes or restrictions that have been implemented in the city, since the original modelling work was first undertaken in 2018.
19. The modelling has projected transportation impacts, including demand growth forecasts for a forecast year of 2024, when either Option 1 or Option 2 would be substantially completed and implemented.
20. The traffic model provided vehicle flows for four highway user classes which are: Car, LGV, HGV and Buses. HGVs were further broken down into rigid and articulated and cars were divided into private hire and Hackney taxis subcategories, this was undertaken using Automatic Number Plate Recognition (ANPR) data
21. The results of the transportation model have been extracted to allow detailed air quality dispersion modelling to be undertaken to forecast likely NO₂ concentrations for the forecasted year of 2024.
22. The impacts of the schemes are detailed in

Figure 1 and Figure 2 below, where road networks which are coded in blue show a decrease in traffic flows, and those in red show an increase in traffic flows for 2024. Full Transportation Modelling outputs are included in Appendix 2 and 3.

Figure 1 - Transportation Model Flows for Option 1-2024

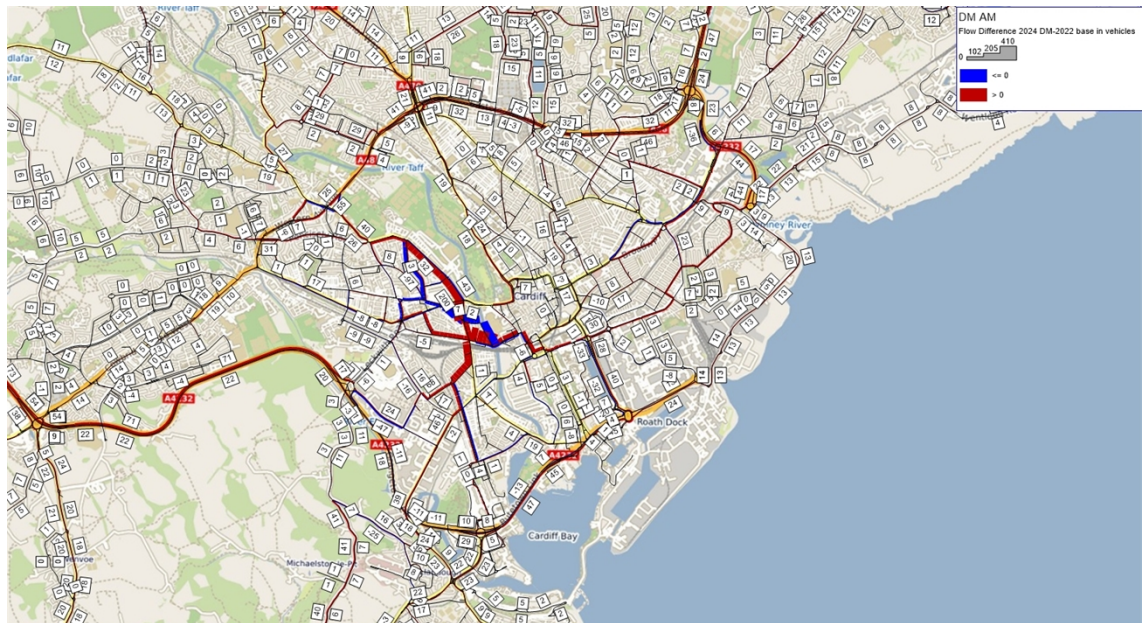
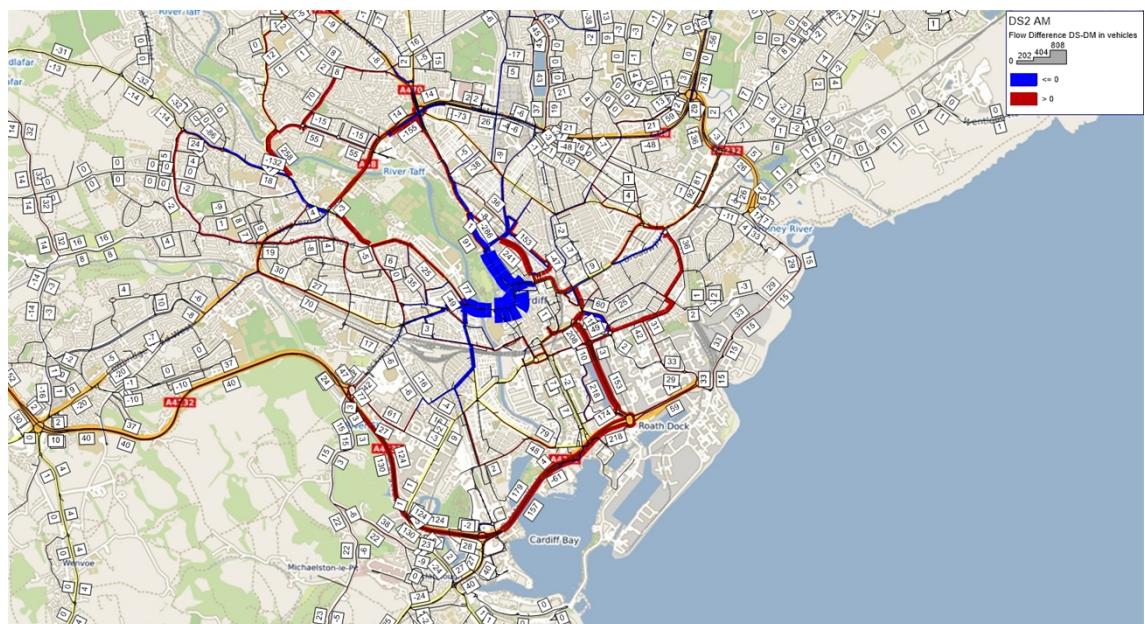


Figure 2 - Transportation Model Flows Option 2-2024



Air Quality Modelling

23. The transportation modelling undertaken, has allowed vehicle emission calculations for each vehicle category based on vehicle fuel type and Euro classification to be made as part of the modelling work. Information on the local fuel type mix and Euro standard distribution has been collected from the ANPR surveys conducted in 2022. The ANPR data were used to calculate the proportions of vehicle types, fuel splits, and Euro classification for the 2022 fleet used in the modelling. The fleet was

projected forward to 2024 using NAEI projections for the future year modelling.

24. The 2022 baseline model does not indicate exceedances of the NO₂ annual average 40 µg/m³ threshold limit on any PCM links. The maximum concentration on the link representing Castle Street predicted a concentration of 38.1 µg/m³. As the model is known to over-predict concentrations in this location (see Appendix 1), exceedances on Castle Street are not likely, and this was reflected in the actual measured data for 2022 recording a concentration of 33.8 µg/m³.
25. The 2024 modelled data for Option 1 predicts that annual average NO₂ concentrations are likely to reduce on most road links, and there are no exceedances of the NO₂ annual average 40 µg/m³ threshold limit. On Castle Street the maximum NO₂ concentration reduces to 33.9 µg/m³ which is well within the compliance value.
26. The 2024 modelled data for Option 2 also predicts that annual averaged NO₂ concentrations are likely to fall compared to both the 2022 baseline and 2024 Option 1 on Castle Street, where the peak concentration is forecasted to be 26.4µg/m³. There are no exceedances of the NO₂ annual average 40 µg/m³ threshold limit on any other road links within the City.
27. Differences in NO₂ concentrations between the 2024 Option 1 and Option 2 are lower at most locations than between the 2022 baseline. In some locations, the maximum concentrations of the 2024 Option 2 are slightly higher than the maximum Option 1; this is expected to be caused by traffic from vehicles other than buses and taxis that are diverted from Castle Street to surrounding roads. However, the diverted traffic is not predicted to cause exceedances of the NO₂ annual average 40 µg/m³ limit, even when model uncertainty is considered.
28. The projected modelled results for 2024 for both schemes are summarised in Table 1 below, and the modelled road links detailed in Figure 3 and Figure 4 , The full air quality modelling report is presented in Appendix 4.

Table 1 - Modelled NO₂ Concentrations µg/m³ of Option 1 and 2

Road	Option 1 2022	Option 1 2024	Option 2 2024	Difference Option 2/Option 1
A48	30.4	24.9	24.8	-0.1
A4119	35.8	22.6	22.8	0.2
A4160	37.2	28.4	29.6	1.2
A48	29.4	25.9	27.1	1.2
A4054	21	18.6	19.4	0.8

A4119	27.1	23.9	25.0	1.1
A4160	29	25.2	25.0	-0.2
A4161	34.7	29.1	29.3	0.2
A4161	20.7	18.0	17.5	-0.5
A48	39.2	33.4	33.3	-0.1
A470	26.2	23.5	20.2	-3.3
A4119	21.4	19.0	19.4	0.4
A4119	38	31.1	32.2	1.1
A4161 (Castle Street)	38.1	33.9	26.4	-7.5
A470	29.5	25.7	26.3	0.6
A469	32.9	28.9	28.8	-0.1
A4160	20.6	18.9	18.9	0
A4161	30.9	27.2	27.4	0.2
A48	34.8	31.0	32.8	1.8
A470	37.2	32.4	32.4	0
A469	28.8	26.1	25.7	-0.4
A4119	28.8	27.2	26.7	-0.5
A4119	28.6	24.9	28.0	3.1
A4161	21.8	19.4	19.4	0
A4161	28.2	25.3	19.8	-5.5
A4161	39	34.0	34.1	0.1
A4232	27.2	22.1	22.4	0.3
A470	26.4	23.4	24.3	0.9
A470	30.3	30.4	31.2	0.8
A470	28.8	23.8	24.1	0.3
A4232	32.7	27.4	27.8	0.4
A469	25.4	23.0	22.9	-0.1
A4160	35.4	32.3	33.5	1.2
A4234	29.8	26.4	27.5	1.1
A4055	27.4	23.3	23.3	0

A48	32.9	27.5	27.3	-0.2
-----	------	------	------	------

Figure 3 - Modelled NO₂ Concentrations Option 1- 2024

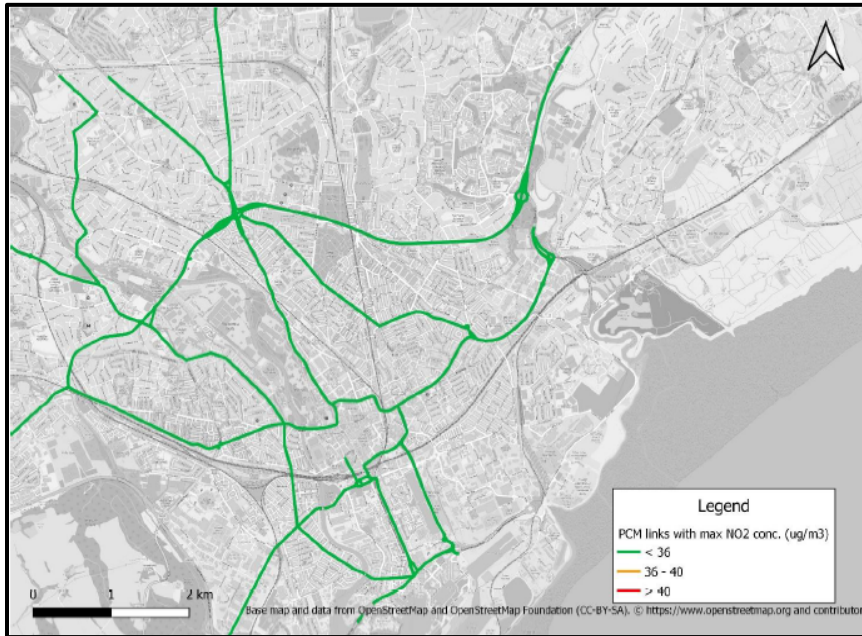
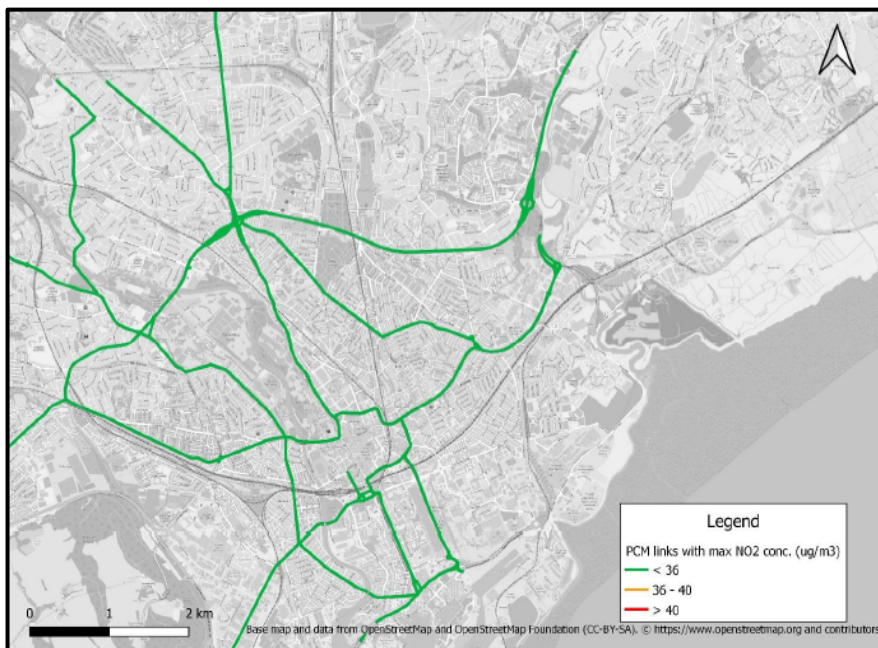


Figure 4 - Modelled NO₂ Concentrations Option 2-2024



Air Quality Modelling Conclusion

29. There are three key conclusions from the modelling results:
30. **Key Conclusion 1:** Both Option 1 and Option 2 achieve air quality compliance on Castle Street.
31. **Key Conclusion 2:** Whilst neither option cause dangerous levels of NO₂ on the surrounding network, the increased traffic displacement caused by Option 2 causes a net gain of NO₂ Concentrations µg/m³ on the wider network. With notable increases reported on both the A4119 and the A48.
32. **Key Conclusion 3:** The chosen option must provide network resilience and support the enabling of future transport network and city development projects.

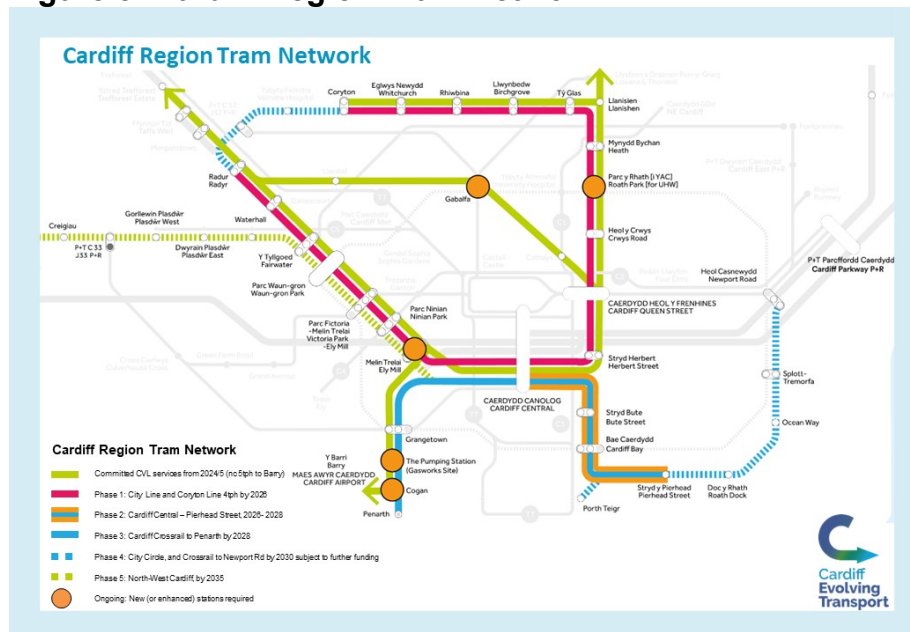
Strategic Network Challenges and Risks

33. Having reviewed air quality and network issues, the overall assessment must also be viewed in the light of current network pressures, the emerging strategic citywide network and future sustainable transport network developments.
34. The A4119 and A48 run through high residential areas, schools and major healthcare locations. There is a risk that any further increases in traffic on these roads could cause further air quality issues.
35. Cardiff's unique geography means that it has limited ability to provide east-west connections across a north-south river that cuts through the middle of the city. It is important that the highway network has an element of resilience and has the ability to cope should an incident happen, such as a broken-down vehicle blocking a traffic lane or a road traffic accident completely blocking a route. The network is extremely sensitive to change, with key arterial routes (A48, A470, A4232 and M4) often experiencing incidents that cause extensive delays on the Cardiff network.
36. The A48 is facing increased pressure as the main distributor road around the north of the city centre area. A bus corridor is also planned for this route, and further pressures could tip the route in to air quality noncompliance. This route is currently at capacity during peak times, especially around the Gabalfa area. There is a clear need to protect the main approaches into the University Hospital of Wales from further congestion and delay.
37. The A4119 is the main route in and out of the Northwest Cardiff, with many more homes planned and a planned Strategic Bus Corridor planned. Further pressures in the future are likely on this route.

Major New Sustainable Transport Schemes

38. In addition to the existing lack of resilience in the highway network, this will need to be carefully managed in the light of wider changes associated with introducing significant sustainable transport measures.
39. **Metro: Crossrail:** The first major step relates to the development of the Crossrail line, and in particular the implications of the recently successful levelling up fund (LUF) bid to deliver the Bay Line Phase of the Cross City Metro Scheme. This scheme will constrain the traffic network on the south side of the city centre. The available road space on Callaghan Square will need to be reduced to accommodate the tram line. Early modelling indications for a tramline in Callaghan Square are showing traffic capacity reductions in the region of 50-70%. This significant reduction in capacity, along with the inevitable construction impact suggests that Castle Street will be required as a traffic route in the medium term. Early modelling results for a tramline option through Callaghan Square are included in Appendix 2 of this report.
40. Furthermore, the Cardiff Bay Arena will be a 15,000-capacity venue attracting people from all over the UK and could form the catalyst for further development in the Bay area. The A4232 and Butetown Tunnel route also requires consideration in this context, this route is currently facing high traffic flows and will face increased pressures because of these developments.

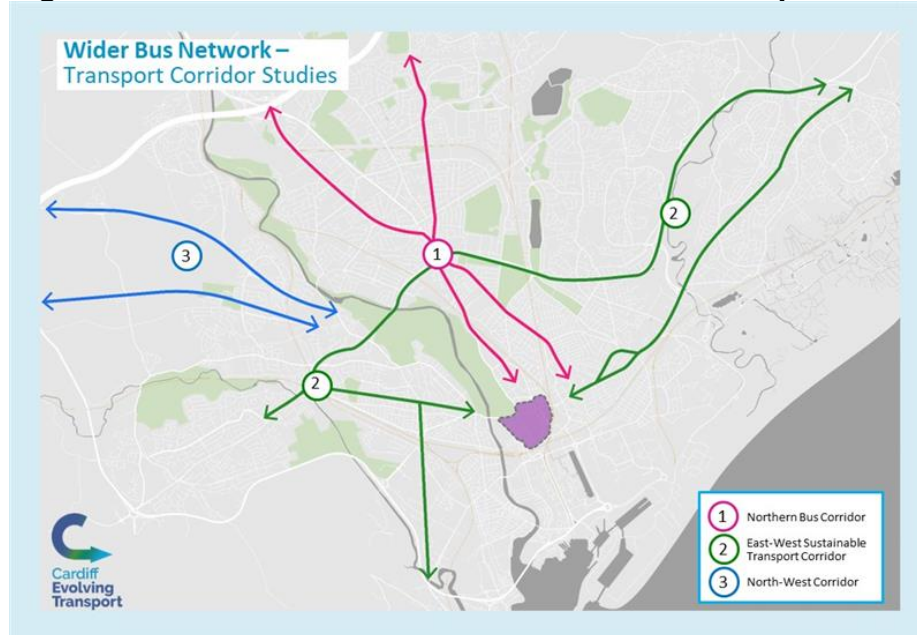
Figure 5: Cardiff Region Tram Network



41. **Strategic Bus Enhancements:** The Bus network and operators have been under particular pressure as a result of the covid period and subsequent funding challenges. Ensuring the sustainability of the bus network and its future development is a key priority for the Council. In view of this, the city has started to work with key stakeholders to understand a longer-term approach to the network that complements the other

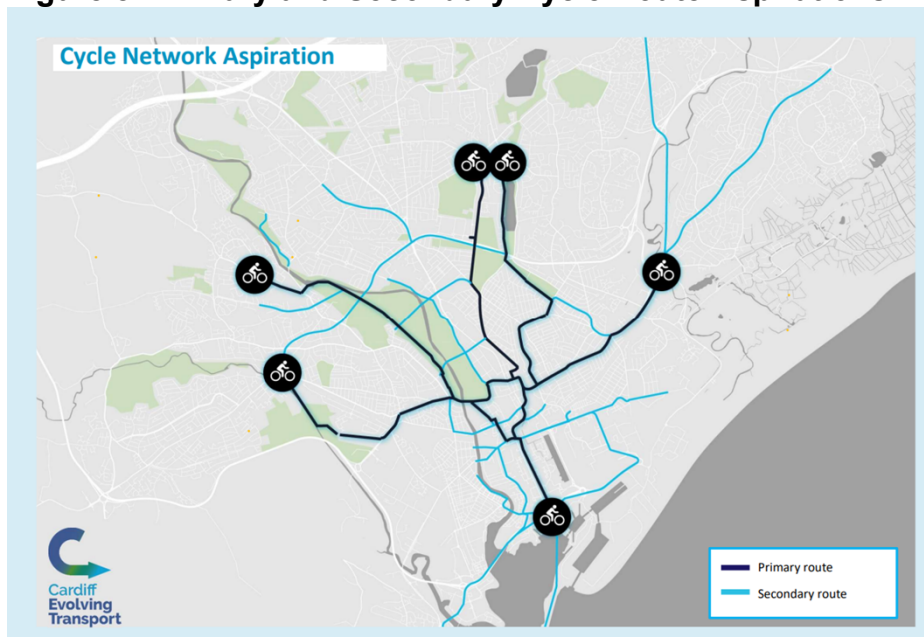
sustainable enhancements in Metro and active travel. In this regard Figure 7 shows the range of bus route reviews currently underway.

Figure 7: Current Bus Corridors in WellTAG Development Stages



42. The main objective of bus priority is to enable the bus to operate in a quick, reliable and safe way with minimum delay. Any aspect of the bus journey should be considered for improvement, with passengers at the heart of bus services. “Priority” needs to consider the passengers end-to-end trip, not just the time on the bus. User focused priority seeks to provide a safe, inclusive, reliable and efficient bus service. – This means bus journey reliability is of paramount of importance and when considering such measures along a key route, such as Castle St, the impact of displaced traffic, and therefore any resultant congestion on adjacent routes needs to be taken into account. Option 1 with all modes using the route provides a more sustainable journey time for buses travelling towards the city centre, particularly from the west, as there is less impact on adjacent routes as a result of re-routed general traffic.
43. **Strategic Cycle Enhancements:** In addition to the Crossrail and bus enhancements, aligned with the transport white paper, the Council is also moving forward with the roll out of a strategic cycle network for the city (see figure 8). This network as yet partially completed will provide a viable and secure network for cyclists across many core areas of the city and is targeted to be implemented in the next 5 years. Nonetheless, this roll out has been challenged both in terms of funding support but also regarding the positional limitation of network space to accommodate all transport modes in limited highway width.

Figure 8: Primary and Secondary Cycle Route Aspirations



44. In summary regarding the strategic transport enhancement programme three key comments can be made. Firstly, that significant progress has been made with regard to effectively planning and delivering new sustainable transport infrastructure, particularly referring to emerging metro and cycle networks. Secondly, funding remains the fundamental issue regarding delivering a comprehensive integrated transport network as opposed to individual enhancements. Thirdly, the highway network, already lacking resilience, requires any further interventions and reductions in capacity to ensure that all the new transport measures are introduced in a manner that allows the overall network to be resilient.
45. In this regard, the decision regarding the removal of further general traffic from Castle St – the most focal area of network on the whole city system – is critical. Importantly, this criticality relates not only to general traffic resilience but also to the wider roll out of sustainable transport measures.
46. In this respect, eliminating a key east-west route (Castle St-Duke Street) will impact on the flexibility and resilience of the transport network. A capital city should have some level of network resilience, there is a risk that closing Castle Street to traffic could increase the impact of incidents on the network and cause gridlock conditions. The impact of these incidents will be not just be felt by residents, visitors, businesses, public transport operators and emergency services but also in terms of the viability of wider sustainable measures such as bus, cycle and tram.

The Case for Protecting and Facilitating Network Development

47. In this context, Options 1 and 2 have substantially distinct outcomes in terms of affording network sustainability and change. It is now more important than ever to provide network resilience and further sustainable transport options for people to consider. Continuing with the ambitious active travel and sustainable transport aspirations outlined in the Council's

White Paper on Transport (2019) will ensure that the right balance is struck between providing options for mode shift, and the network resilience required to facilitate these changes in the short-medium term.

48. The significant level of future development and the network restrictions imposed by Option 2 strongly suggest that the flexibility and resilience afforded by Option 1 will be a key facilitator in enabling the Council's White Paper aspirations. The risk of further air quality issues on the wider network also points towards Option 1 as the favourable option in the short-medium term, especially given that traffic levels are now approaching pre-COVID levels.

Proposed Recommendation and Next Steps

49. In view of the above analysis, it is recommended that Option 1 (All Traffic) is moved forward as the recommended option for the following reasons:
50. **Ensures Air Quality Compliance:** The current interim scheme fully replicates the traffic conditions of Option 1, these conditions (and those modelled for the permanent option) show Castle Street well within air quality compliance levels.
51. **Provides Network Resilience:** A capital city must have a certain level of Network Resilience, it is critical that the impact of incidents, construction on the highway and future developments can be absorbed within the network.
52. **Protecting Residential Areas:** Option 1 offers the most protection from increased traffic levels in residential areas in the wider city area, the distributional impacts from Option 2, appear to increase NO₂ concentrations away from Castle Street in high density residential areas.
53. **Supports wider Sustainable Transport:** Further enhancements will be made to the City Centre Bus Box along with sustainable transport corridors leading in, and out of the city centre area. An all-traffic Castle St Option will still include bus priority and will connect into the wider vision for both the city centre and the wider city area. It will also support the implementation of the city mass transit/tram system, by freeing up capacity in the Callaghan Sq area. This change, along with other key interventions on the network will require a certain level of network resilience to be maintained in the medium-long term.
54. **A Permanent Scheme is Needed:** It is imperative that a permanent scheme is applied to the area of Castle Street in the next twelve months. The temporary infrastructure in place has not been designed to last any longer than the short term.

Next Steps Castle Street:

55. **The Essential need for Welsh Government Funding Commitment:** In terms of next steps it is essential that funding for a permanent scheme is confirmed by the Welsh Government, this will allow Cardiff Council to proceed with upgrading the current temporary layout into a fully permanent scheme. In this regard, the decision to proceed with Option 1 'All Traffic' is based on previous confirmed commitments given by Welsh Government to meet the full cost of the permanent scheme, and as per the approval of the Council's Clean Air Plan. Indeed, it is important to note at every stage of this process, Welsh Government's positive support and commitment to funding a permanent scheme. The decision to proceed with the Option 1 'All Traffic' scheme has been based on this commitment.
56. Furthermore, it is important to stress that the current implemented road layout was only designed for an 18-month temporary period. There are features of the scheme, in terms of cycleway and bus stop design and SUDs integration, that whilst were acceptable as temporary measures at the time of implementation are now currently in urgent need of renewal. The infrastructure in place also needs amending to meet design guidance, required safety levels and the expectations of key stakeholders.
57. In this regard, if funding for the permanent scheme was not forthcoming there would be a major risk that the current arrangement may have to be removed, and a return to the pre-temporary scheme layout is reverted to. Should the scheme be removed there remains a high risk that increased levels of traffic on Castle Street will cause non-compliant air quality levels. Overall, a confirmation of funding for a permanent scheme (circa £8-9m) is required from Welsh Government to move the scheme forward. The decision to proceed with Option 1 'All Traffic' is the bases upon the assumption that the Welsh Government will meet the cost of the permanent scheme.
58. Further steps will include:
- a. **Detailed Design & Tender:** A funding confirmation will allow the chosen scheme to be tendered once more.
 - b. **Construction:** A successful tender period will see the scheme on site early 2024.
59. The Wider Transport Network:
- a. **Ongoing Monitoring:** Air Quality monitoring stations, traffic monitoring stations and bespoke traffic surveys should be used to continually assess the state of the network and to inform future developments.
 - b. **Continued Development of the City Centre Network:** Continuing with schemes such as the City Centre Bus Box, City Centre Cycling Loop and Key Developments such as the Metro Bay Line and the Canal Quarter. Plans are included in Appendix 4 of this report.

- c. **Continued Development of the Wider Transport Network:**
Further sustainable transport interventions are required to support the transport network and achieve the goals set out in the Council's White Paper on Transport. These include but are not limited to: The Metro Cross Rail, The Metro City Circle, a Bus Priority Network, a Fully Segregated Cycle Network and Controlled Parking Zones. Plans are included in Appendix 4 of this report.

Future Public and Stakeholder Engagement

- 60. The Permanent Castle Street has previously been publicly consulted on three times:
 - a. April-May 2019: City Centre Clean Air Plans
 - b. Dec 2019-Jan 2020: Castle Street Option 1
 - c. March-May 2021: Castle Street Option 1 and Option 2
- 61. The chosen option advised in this Cabinet Report will be further consulted on via the Cabinet Approval process and the statutory Traffic Regulation Order Process.

Project Funding

- 62. The Welsh Government's Clean Air funding will be used to cover the cost of construction.
- 63. It is estimated that the fees associated with delivering the project (from April 2023 onwards) will be £250,000.

Future Maintenance Costs

- 64. The construction contract for the project will provide 2 years maintenance cover on hard infrastructure and 5 years cover on soft landscaping maintenance.
- 65. Following on from the construction period and the above maintenance periods, it is acknowledged that new infrastructure will cause future maintenance costs. The Project Team are working with all the relevant departments to identify costs and formulate plans for future maintenance and cleansing. This is to ensure that the level of investment proposed across the City Centre can be sustained and maintained. This will need to be a consideration in developing the future Medium Term Financial Plan, along with other Council priorities.

Local Member consultation (where appropriate)

- 66. Local Members have been able to comment on the proposals for the city centre as part of the Clean Air Consultation that ran from April-May 2019.

Then again during the scheme consultations for Castle Street in December 2019-January 2020, and again in March–May 2021

67. Local Members will also be consulted with as part of the Traffic Regulation (TRO) process associated with the delivery of the final scheme.

Reason for Recommendations

68. To comply with the Welsh Government direction placed on the Council to ensure continued air quality compliance is achieved on Castle Street.
69. To ensure that the temporary scheme currently in place is upgraded to a level that satisfies design guidance, road safety and future maintenance.
70. The delivery of these highway works are critical to achieving continued air quality compliance on Castle Street.
71. This transport project will deliver key commitments in the Transport White Paper and will greatly assist with meeting targets in that paper, and also the One Planet Strategy.
72. To maintain network resilience and support the future development of the transport network.

Financial Implications

73. The report seeks delegated authority to proceed with design, tender and delivery of the Option 1 (All Traffic, Bus Lane and Cycle Lane) permanent scheme and identifies that funding will be made available from the Welsh Government towards the capital construction costs of the proposed upgrade to the temporary scheme.
74. The extent and source of the grant funding available has still to be confirmed and the Council will need to continue to work collaboratively with Welsh Government officers to maximise any financial contribution.
75. Until funding is confirmed, the risk remains that the scheme proposed may not be deliverable and may need to be reduced or removed to match the available funding.
76. It should also be noted that the provision of capital support to schemes is conditional upon local authorities' commitment to meet future revenue and maintenance costs.
77. As part of the development of the scheme options, the incremental revenue costs of maintaining any infrastructure to required maintenance standards and to preserve its useful life would need to be identified. Where such identified costs cannot be managed at the expense of existing maintenance obligations and minimum condition standards set for existing assets, this would need to be considered along with other pressures as

part of future medium term budget planning, consistent with an approved asset management plan.

Legal Implications

78. Legal Implications are included in Appendix 5 'Exempt Legal Implications'.

HR Implications

79. There are no HR Implications for this report.

Property Implications

80. There are no specific property implications in respect of this Castle Street report. Where there are any resultant land transactions, negotiations or valuations required to deliver any proposals, they should be done so in accordance with the Council's Asset Management process and in consultation with Strategic Estates and relevant service areas.

RECOMMENDATIONS

Cabinet is recommended to:

1. Note the modelling work carried out on the future of Castle St provides confirmation that the legal limit for Air Quality is achieved.
2. Subject to confirmation of Welsh Government Funding approve Option 1 (Do Minimum – All Traffic) to be delivered as a permanent scheme.
3. Delegate authority to the Director of Planning, Transport & Environment in consultation with the Corporate Director of Resources to deal with all aspects of the procurement process (including approving the evaluation criteria to be used and authorising the award of the proposed contract).
4. If Welsh Government funding is not forthcoming, delegate authority to the Director of Planning, Transport & Environment to review future arrangements on Castle Street and report back to Cabinet.
5. Note and support the aspirations to improve the wider transport network in line with the decision to leave Castle Street open to traffic.

SENIOR RESPONSIBLE OFFICER	Andrew Gregory Director of Planning, Transport & Environment
	13 th April 2023

The following appendices are attached:

Appendix 1 Project Area Map

Appendix 2 City Centre West and South Option Modelling (VISSIM)

Appendix 3 Castle Street Option Design

Appendix 4 Traffic Modelling and Air Quality Technical Information (SEWTM)

Appendix 5 Exempt Legal Implications

Tudalen 49

Boulevard de Nantes, Stuttgarter Strasse, Dumfries Place

Castle Street

Station Terrace, Churchill Way

Westgate Street

Central Square

South Interchange

Lower St Mary Street, Penarth Road, Mill Lane, Canal Street

Bute Street, Bute Terrace, Adam Street

Callaghan Square

Key

- City Centre South
- City Centre North
- City Centre West
- City Centre East



Mae'r dudalen hon yn wag yn fwriadol

Cardiff West Option Modelling Report

Castle Street Option Modelling Summary Note

Project number: 60678234

21 February 2023

Quality information

Prepared by	Checked by	Verified by	Approved by
Kyle Hance Senior Consultant	Ellena Caudwell Principal Consultant	James Gait Associate Director	Ellena Caudwell Principal Consultant

Revision History

Revision	Revision date	Details	Authorized	Name	Position
V1	21/02/2023	DRAFT	Y	EC	PC
V2	21/03/2023	Final	Y	EC	PC

Prepared for:

Cardiff Council

Prepared by:

AECOM Limited
3rd Floor, Portwall Place
Portwall Lane
Bristol BS1 6NA
United Kingdom

T: +44 117 901 7000
aecom.com

© 2022 AECOM Limited. All Rights Reserved.

This document has been prepared by AECOM Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

1. Introduction.....	4
Study Area.....	4
SEWTM / Ricardo Context	4
Scenarios / Schemes	5
Base Description.....	5
Reference Case Description.....	5
Option 1 Description	5
Option 2 Description	6
2. High-level Results.....	6
Reference Case.....	6
Option 1	7
Option 2	7
3. Wider Network Considerations	8
Callaghan Square	8
4. Summary	8
Appendix A – Limitations & Methodology	10
Appendix B – Bus Journey Time Graphs.....	11

Figures

Figure 1-1 – Cardiff City Centre West Network Extent	4
--	---

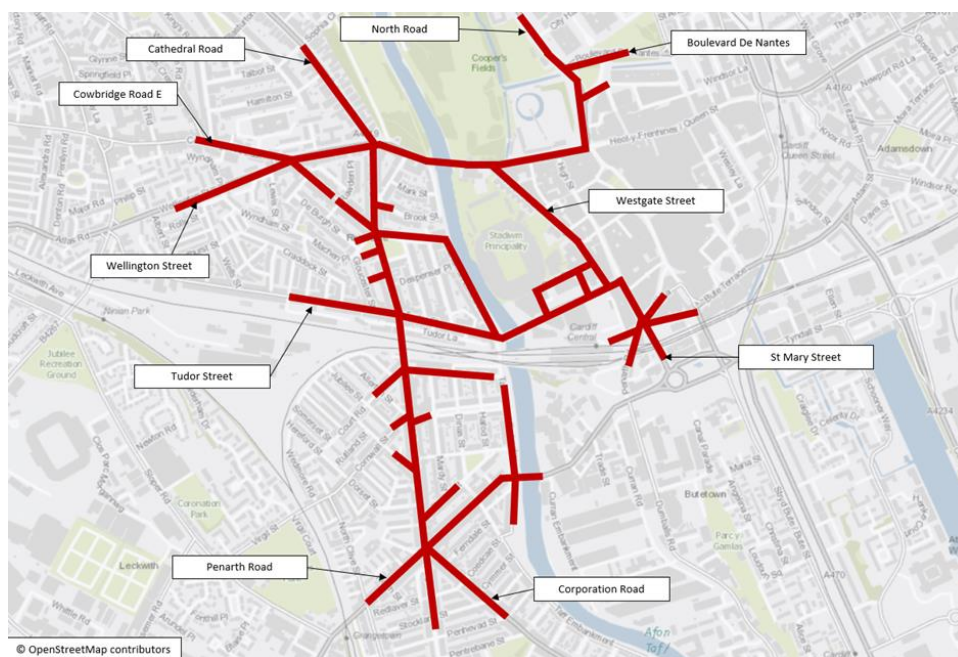
1. Introduction

Purpose of Modelling

- 1.1 Cardiff Council are considering two options for the future layout of Castle Street: a permanent version of the existing pop-up cycle scheme which maintains access for all traffic, or a permanent version of the existing pop-up cycle scheme which introduces a bus gate on Castle Street, limiting motorised access to buses and taxis.
- 1.2 This report summarises the Vissim modelling undertaken to assess the options, with consideration to the impact on, or of, further schemes in the wider network.
- 1.3 Vissim is a multimodal traffic simulation software which allows the local impact of a proposed scheme to be assessed, providing detailed visualisation and statistical outputs for individual modes of transport.
- 1.4 In the context of the Castle Street scheme, Vissim was particularly required to obtain the local impacts on buses using the city centre.

Study Area

Figure 1-1 – Cardiff City Centre West Network Extent



- 1.5 The Vissim model covers the extent shown in red in **Figure 1-1**. The results obtained from the model show the impacts of the scheme within this extent and cannot show further impacts on the wider network.

SEWTM / Ricardo Context

- 1.6 Cardiff Council (CC) separately commissioned Ricardo to undertake an Air Quality (AQ) Assessment of the Castle Street scheme, where AQ is the driver for the scheme due to the Air Quality Management Area (AQMA) covering Castle Street.
- 1.7 The AQ assessment uses traffic data from the South East Wales Transport Model (SEWTM). The SEWTM model is a strategic model covering the whole of Cardiff and beyond, and re-routes traffic under the proposed scheme.
- 1.8 Data was fed between the Vissim model and SEWTM model to ensure as much consistency as possible, and to provide the Vissim model with an estimate for volumes of traffic in the scenario where Castle Street is closed to general motorised traffic (Option 2).

Scenarios / Schemes

- 1.9 Descriptions of each modelled scenario are provided below. Further information about the methodology, particularly in relation to the traffic changes and relationship to the SEWTM model, is held in **Appendix A**.

Base Description

- 1.10 A Base Vissim model was developed to replicate the on-street conditions during the traffic surveys conducted on 3rd and 5th March 2022.
- 1.11 As detailed in the Existing Conditions Report (ECR), the modelled period based on analysis of traffic data (flows, queue lengths, and journey times) is as follows:
- AM: 07:30-09:30 with a peak hour of 08:00-09:00
 - PM: 16:00-18:00 with a peak hour of 16:30-17:30
 - SAT: 13:00-15:00 with a peak hour of 13:30-14:30
- 1.12 The model period allows for a half hour warm-up and cool-down period either side of the peak hour. The warm-up allows for pre-load of vehicles, so the peak hour network conditions are representative of on-street conditions. The cool-down allows all vehicles to complete their desired journey.
- 1.13 The highway network was coded using OS Mapping to define the length, width, and number of lanes for each modelled link. On site observations during the survey period and Google Maps were used to assist in checking the highway, lane allocation, and to check that link distances were accurate. Along Castle Street a new bidirectional cycle lane was implemented on-street. The designs from these schemes were also used in the development of this model.
- 1.14 The Base model aims to replicate current on-street conditions. However, Cardiff City Centre is constantly evolving, therefore, it was decided that a Reference Case model should be developed to capture recent developments.

Reference Case Description

- 1.15 The Cardiff City Centre road network is currently undergoing a number of changes. It was necessary to code some of these changes into a Reference Case model so that the Option modelling could be compared to the network with committed schemes in place. The committed schemes are:
- Tudor Street and Wood Street / Central Square cycle scheme, includes rerouting of traffic using Dispenser Street in the Base model – including all bus routes;
 - Castle Street westbound bus lane extension;
 - Cathedral Road / Cowbridge Road E signal changes; and,
 - Opening of Cardiff Bus Interchange (and associated bus rerouting).

Option 1 Description

- 1.16 The Option 1 model was built upon the Reference Case model and is a permanent version of the existing popup cycle scheme. A design drawing was provided to aid in the coding of the Option 1 model. This design involves the following changes from the Reference Case:
- Castle Street popup cycle scheme made permanent;
 - Castle Street / Westgate Street design alterations to accommodate cycle movements between Westgate Street and Castle Street, and associated signal changes;
 - North Road / Boulevard de Nantes scheme including pedestrian crossings & associated signal changes; and,
 - Signal timing changes to accommodate new scheme.

Option 2 Description

1.17 Option 2 built upon the Option 1 model. A design drawing was provided to aid in the coding of the Option 2 model. This design involves the following changes from the Option 1 model:

- Bus gate on Castle Street, east of Westgate Street – reduces westbound to one lane;
- Castle Street / Westgate Street signal timing changes;
- New pedestrian crossing on Castle Street;
- North Road / Boulevard de Nantes signal timing changes;
- Traffic demand changes; and,
- Signal timing changes to accommodate new traffic patterns (Cowbridge Rd E / Cathedral Road, Tudor St/Clare St).

2. High-level Results

2.1 Graphs depicting the bus journey time impacts are in **Appendix B**.

Reference Case

Bus Travel Times

2.2 Generally, bus journey times in the Reference Case are similar to those in the Base model, however, there are two routes with changes.

- Bus journey times decrease northbound on Clare Road. This is caused by the completion of the Clare Road / Tudor Street junction roadworks in the Reference Case, and reopening Tudor Street to eastbound traffic. Buses are no longer required to divert north onto Clare Street and along Despenser Street. A shorter journey results in a decrease in journey time. The completed junction also results in shorter queues on the Clare Road northbound arm, further improving bus journey times.
- Bus journey times decrease on the West Loop route, on which buses enter on Neville St, Despenser Street, and Fitzhamon Embankment; and then exit northbound along Westgate Street, Castle Street and Cowbridge Road E in a westbound direction. Journey times increase on the inbound section of this route as buses are diverted from Despenser Street onto Clare Street and Tudor Street with increased queuing southbound into the Clare Road / Tudor Street junction. However, the journey time of exiting buses decreases along Castle Street and Cowbridge Road E due to the new westbound bus lane on Castle Street and signal improvements at the Cathedral Road / Cowbridge Road E junction. The combination of these two impacts results in an overall improvement to bus journey times on the West Loop.

General Traffic Travel Times

2.3 Compared to the Base model, general traffic journey times decrease westbound between Boulevard de Nantes and Cowbridge Road E. This is a direct result of signal improvements at the Cathedral Road / Cowbridge Road E junction.

2.4 General traffic journey times northbound between Corporation Road and Cathedral Road decrease. This is in part, due to the completion of the Clare Road / Tudor Street junction roadworks, and signal improvements at the Cathedral Road / Cowbridge Road E junction.

Option 1

Bus Travel Times

- 2.5 Option 1 bus journey times are similar to the Reference Case, except for an increase in northbound bus travel times on Westgate Street, eastbound on Castle Street and northbound on North Road. The increases in journey time of up to 3 minutes is caused by:
- Changes made to the Castle Street / Westgate Street junction to incorporate the new cycle crossing causing a slight increase in queueing on Westgate Street.
 - Changes to the North Road / Boulevard De Nantes junction to incorporate new pedestrian crossings, increasing northbound queueing and impacting buses where general traffic queues exceeded the length of the bus lane.
- 2.6 Whilst no results have been extracted for buses entering the network southbound on North Road, this reverse route would experience delays for the same reasons.
- 2.7 Elsewhere in the network, Option 1 results in bus journey times similar to the Reference Case, which are either similar to or improved over the Base journey times.

General Traffic Travel Times

- 2.8 General traffic journey times increase on all approaches to the North Road / Boulevard De Nantes junction due to the implementation of pedestrian crossings reducing the available 'green time' for traffic stages at the traffic signals.

Option 2

Bus Travel Times

- 2.9 Westbound bus journey times on Tudor Street increase by 5 minutes in the AM peak and 2 minutes in the Saturday peak. The reassignment of traffic under Option 2 results in a significant increase in congestion on the westbound approach to the Clare Road / Tudor Street junction.
- 2.10 In the AM peak, the northbound ahead and right-turn from Corporation Road experiences an increase in demand which leads to an increase in queue lengths on Corporation Road. This causes bus journey times to increase by 1 minute compared to the Reference Case; the journey time is nevertheless 1 minute shorter than the Base model result. However, in the PM, demand and queueing reduces resulting in reductions in bus journey times of 4 minutes.
- 2.11 Elsewhere in the network, Option 2 results in bus journey times similar to the Reference Case, which are either similar to or improved over the Base journey times. The congestion seen in Option 1 at the North Road / Boulevard de Nantes junction is not present due to the reduction in traffic volume due to the bus gate.

General Traffic Travel Times

- 2.12 Overall, the Option 2 model experiences increased congestion southbound on Clare Street and westbound on Tudor Street.
- 2.13 The Clare Street queue regularly stretched from the Clare Road / Tudor Street junction to Lower Cathedral Road and Neville Street in the AM and Saturday peaks – in the AM peak the queue occasionally reaches the Cathedral Road / Cowbridge Road E junction.
- 2.14 The westbound Tudor Street queue stretched back to Fitzhamon Embankment in both the AM and Saturday peaks.

3. Wider Network Considerations

Callaghan Square

- 3.1 The Option 2 Castle Street bus gate scheme would have wider implications for the routing of general motorised traffic in Cardiff City Centre, and likely displace traffic onto nearby routes. This section considers the Callaghan Square scheme currently under development, to review the Castle Street scheme in the context of the capacity and accessibility of the city centre network.
- 3.2 AECOM recently undertook a Vissim modelling exercise for the proposed scheme to introduce a Metro Rail link between Cardiff Central and Cardiff Bay, which has secured Levelling Up Funding from UK Government. The rail link route would pass through Callaghan Square, which is the nearest available east-west route, south of Castle Street, and the only other through the city centre.
- 3.3 The concept design for Callaghan Square is currently in early stages of development and the first round of modelling will be used to further develop the scheme, which may include increasing the network capacity from that provided in the concept scheme.
- 3.4 Nevertheless, the initial indication is that weekday peak hour motorised traffic volumes would need to decrease through the Callaghan Square area by approximately 50%. The result therefore would be an increased stress on alternative east-west routes through Cardiff city centre.
- 3.5 Castle Street Option 1 allows general motorised traffic on Castle Street, maintaining the existing east-west corridor access and providing resilience to the city centre road network should the Callaghan Square scheme come forward.
- 3.6 The Callaghan Square Vissim modelling exercise does not consider mode shift or traffic re-routing. However, as the Castle Street corridor is the nearest available east-west corridor and the only other route within the city centre, it is reasonable to assume a proportion of the displaced traffic may wish to travel through the Castle Street corridor. There is a risk therefore that should the Callaghan Square scheme come forward, there would be increased demand on Castle Street, which could impact on the AQ in the area. This would need to be managed through wider network management strategies considered alongside the Callaghan Square proposals.
- 3.7 It is expected that should motorised traffic demand on Castle Street increase, a wider network management plan be implemented to control the volume of motorised traffic accessing Castle Street. For example, a traffic signal network management plan.

4. Summary

- 4.1 Option 1 modelling indicates the scheme would result in increased congestion at the North Road / Boulevard De Nantes junction. This could impact on northbound and southbound buses in addition to the general motorised traffic. Further design considerations, such as extending the southbound bus lane on North Road, would ensure bus priority is provided. Furthermore, if the design was refined, for example to retain the underpass instead of providing pedestrian crossings, this may help relieve the congestion issues shown in the model.
- 4.2 Elsewhere in the network, Option 1 results in bus journey times similar to the Reference Case, which are either similar to or improved over the Base journey times.
- 4.3 Option 2 shows increased congestion on the network around Clare Street / Tudor Street. Buses travelling southbound on Clare Street could be protected by continuing to use Despenser Street, however the models indicate buses travelling westbound on Tudor Street would have longer journey times under Option 2.
- 4.4 Elsewhere in the network, Option 2 results in bus journey times similar to the Reference Case, which are either similar to or improved over the Base journey times.
- 4.5 General traffic experiences delays in similar locations to the buses.

- 4.6 Either Option 1 or Option 2 could be implemented. Each have different locations where delay is predicted under the scheme, but further design or network considerations could help ease the delay to buses.
- 4.7 However, when considering the east-west cross city movements and the proposed scheme at Callaghan Square, Option 1 would provide greater resilience in the city centre network.
- 4.8 There is a risk the Callaghan Square scheme could increase traffic demand on the Castle Street corridor; this would require management through a wider network management plan.

Appendix A – Limitations & Methodology

Modelled Options

– 2022 Base Model corresponding to SEWTM 2022 Base

- Based on traffic surveys undertaken on Thursday 3rd & Saturday 5th March 2022

– Reference Case corresponding to SEWTM Do Minimum

- Introduction of Westbound bus lane on Castle Street, west of Westgate Street
- Signal changes at Cowbridge Rd E / Cathedral Rd junction
- Completion of Tudor Street / Wood St roadworks and opening of permanent scheme

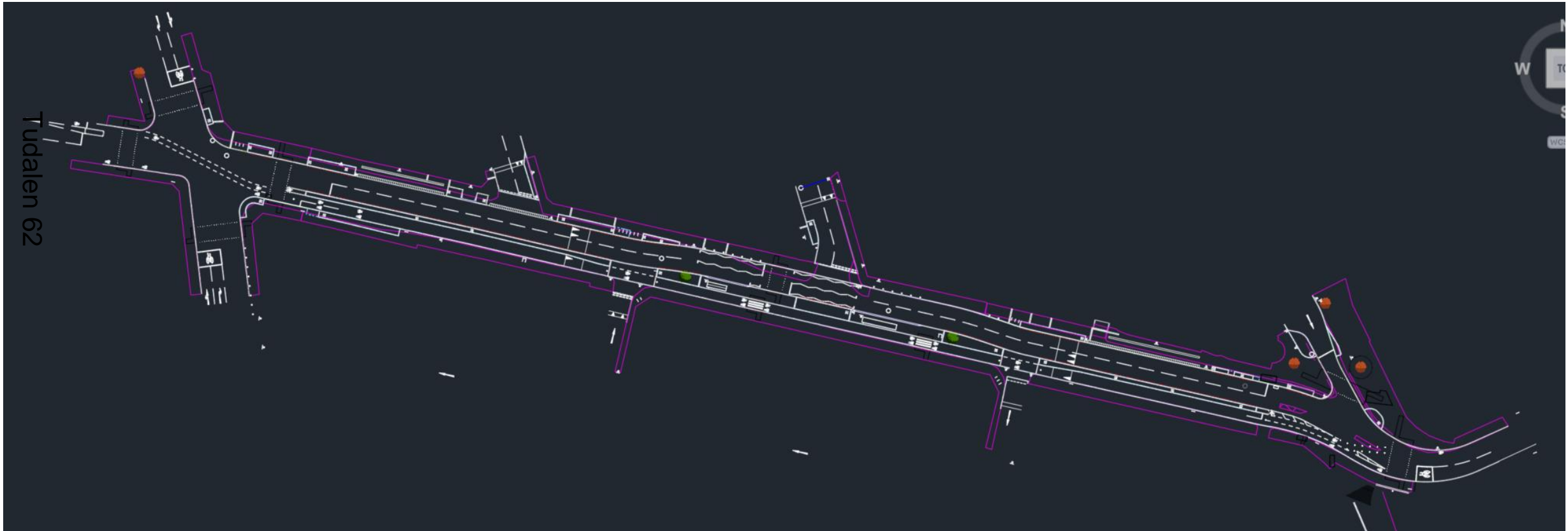
– Option 1 does not correspond to a SEWTM model

- Popup cycle scheme made permanent
- Signal changes at North Rd / Boulevard de Nantes junction
 - Introduction of pedestrian crossings

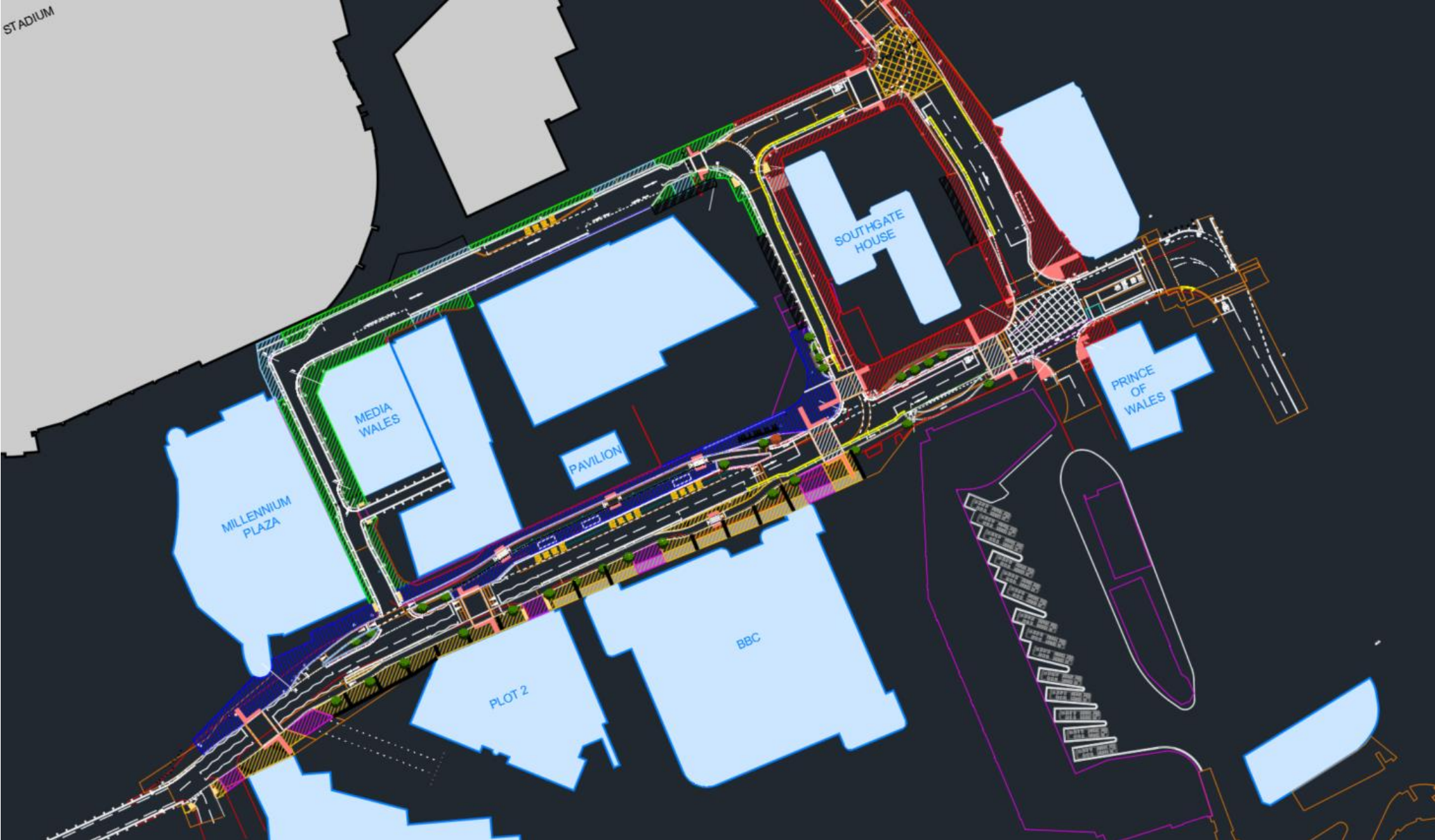
– Option 2 corresponding to SEWTM Do Something 1

- Option 1 changes, plus:
- Bus gate on Castle Street between Westgate St and Queen St – all general traffic (excluding taxis) removed / reassigned

Modelled Options – Reference Case Design (Tudor Street)



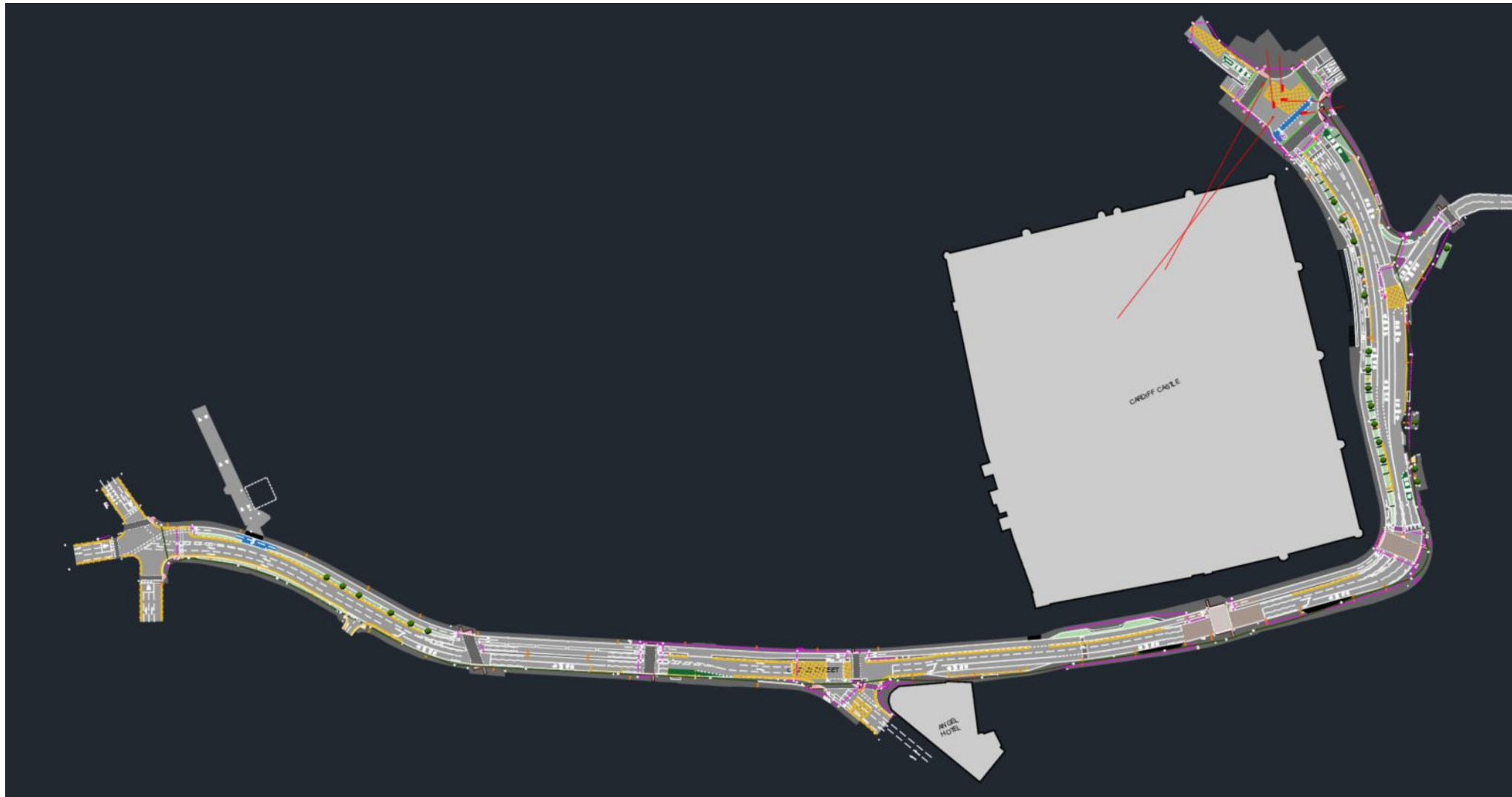
Modelled Options – Reference Case Design (Wood Street)



Tudalen 63

Modelled Options – Option 1 Design

Tudalen 64

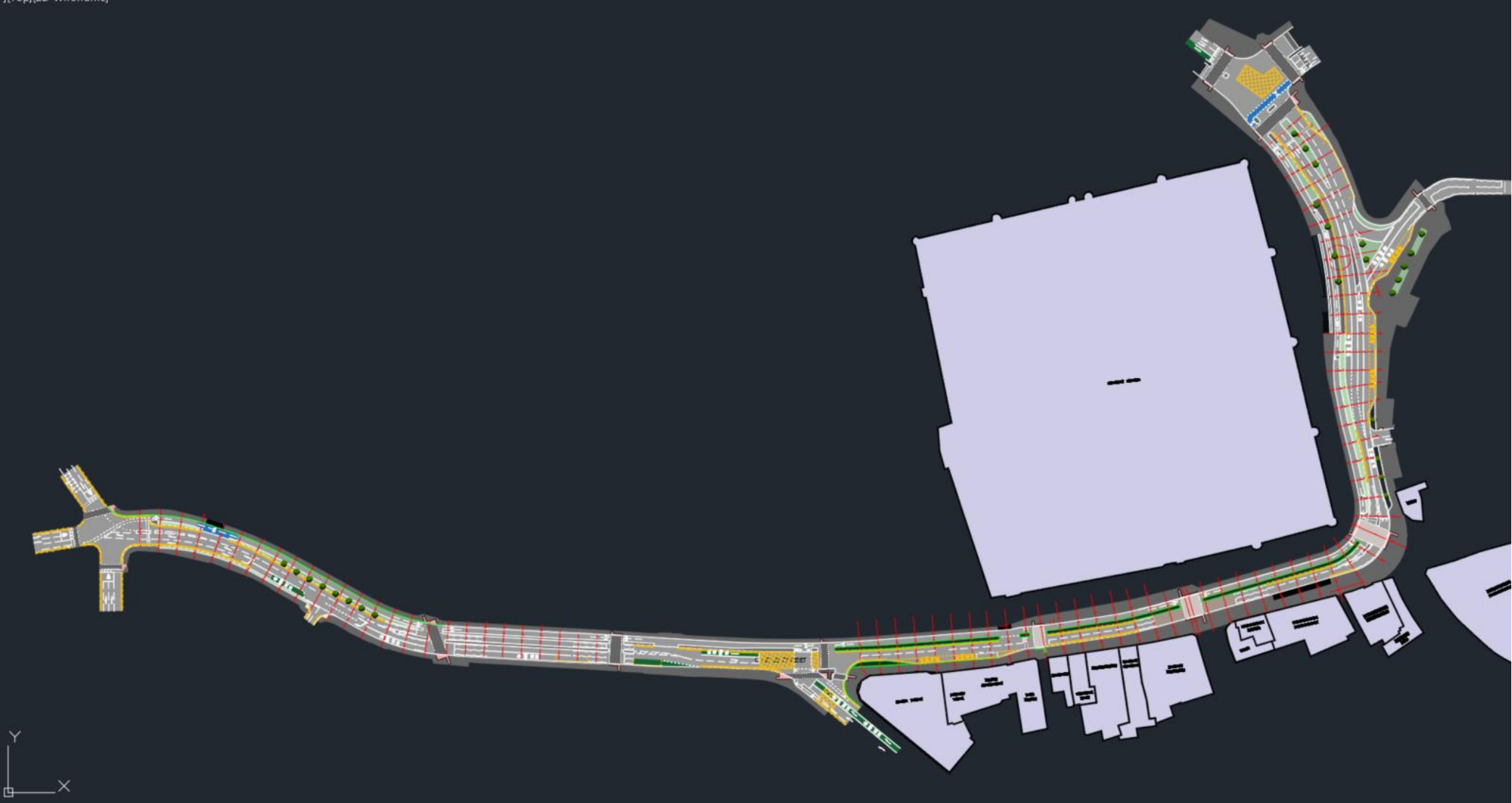


Modelled Options – Option 1 Design

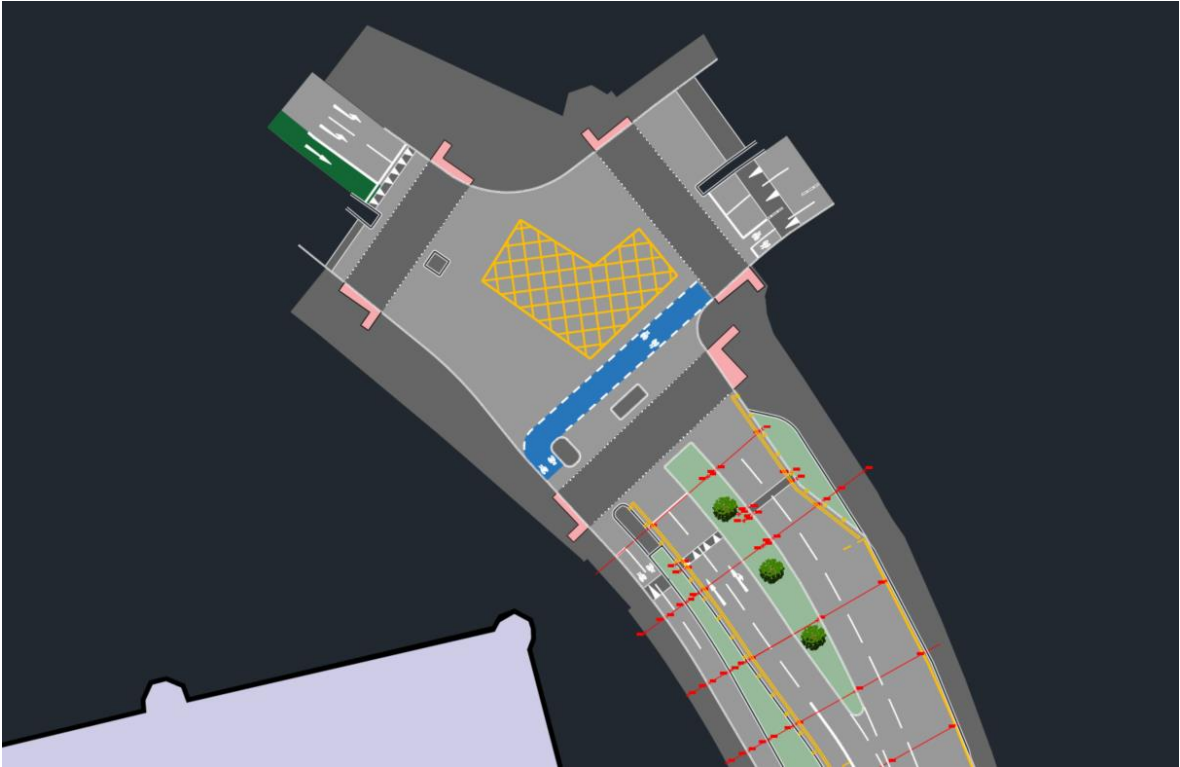
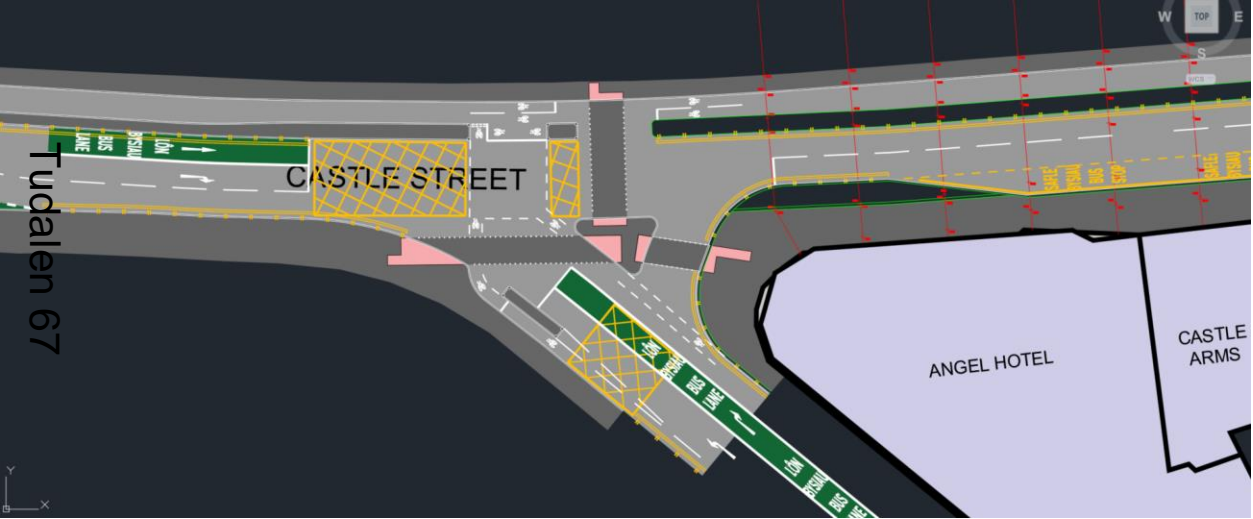


Modelled Options – Option 2 Design

Tudalen 66



Modelled Options – Option 2 Design



Changes in Traffic Volumes

– Base to Reference Case

- Tudor St eastbound reopened with vehicles rerouted from Despenser St / Fitzhamon Embankment
 - 68 vehicles in the AM peak
 - 46 vehicles in the PM peak
 - 41 vehicles in the SAT peak

Tudalen 68

Reference Case to Option 1

- *No changes in demand*

– Reference Case to Option 2

- Bus gate on Castle St between Westgate St and Queen St
- Significant decrease in Castle St motorised traffic
 - adjacent tables indicate a 60-70% reduction in traffic
- Re-routing informed by option SEWTM models (AM & PM peak only)

Castle Street Traffic Volumes

		Ref Case	Option 2	Difference	% Difference
Eastbound	AM	647	297	-350	-54%
	PM	584	235	-349	-60%
	SAT	499	209	-290	-58%

		Ref Case	Option 2	Difference	% Difference
Westbound	AM	568	127	-441	-78%
	PM	599	244	-355	-59%
	SAT	475	116	-359	-76%

		Ref Case	Option 2	Difference	% Difference
Two-way Combined	AM	1215	424	-791	-65%
	PM	1183	479	-704	-60%
	SAT	974	325	-649	-67%

Limitations – Option 2 Traffic Re-routing Methodology

SEWTM (*strategic model*) traffic volume changes were analysed to create the Option 2 AM & PM weekday Vissim matrices. SEWTM does not have a Saturday scenario and therefore the Option 2 Saturday methodology differs.

Reference Case traffic flows were applied within the Vissim model directly, and does not consider changes predicted between the SEWTM Base and Reference case scenarios

- For example, SEWTM predicts an increase in northbound demand on Clare Street between the Base and Ref Case in both the AM and PM peaks. This is at-least in part due to SEWTM representing an increase in capacity at the Cathedral Road / Cowbridge Road E junction. However, Vissim models showed the Tudor Street / Clare Road junction did not have the capacity to accept this increase in demand. Therefore, the Vissim model maintained the Base demands in the Ref Case modelling.
- SEWTM also predicts an increase in demand on Castle Street EB between the Base and Do Min (Ref Case) which is not represented in Vissim.

SEWTM Do Min -
Base Flow Plots



Limitations – Option 2 Traffic Re-routing Methodology (cont.)

SEWTM traffic flow matrices were used to create difference matrices showing how demands changed between the Do Min (Ref Case) and Option 2.

This difference matrix was applied directly to the Vissim Ref Case matrices. The resulting matrices were then furnished to 15-minute matrices to create the Vissim Option 2 matrices.

Due to differences in demand between the Strategic and Vissim models, some Origin-Destination trips could not be removed (where the strategic modelling suggested a reduction in flow greater than the initial Vissim demand).

In general, the patterns of demand increases/decreases is consistent between the Strategic and Vissim models.

- One exception is Clare Road: SEWTM suggests a overall reduction in demand on Clare Road Northbound and Southbound (AM & PM).
- The Vissim model has an increase in demand Southbound in the AM peak hour. Due to SEWTM removing more trips from some movements than existed in the Vissim model matrices.

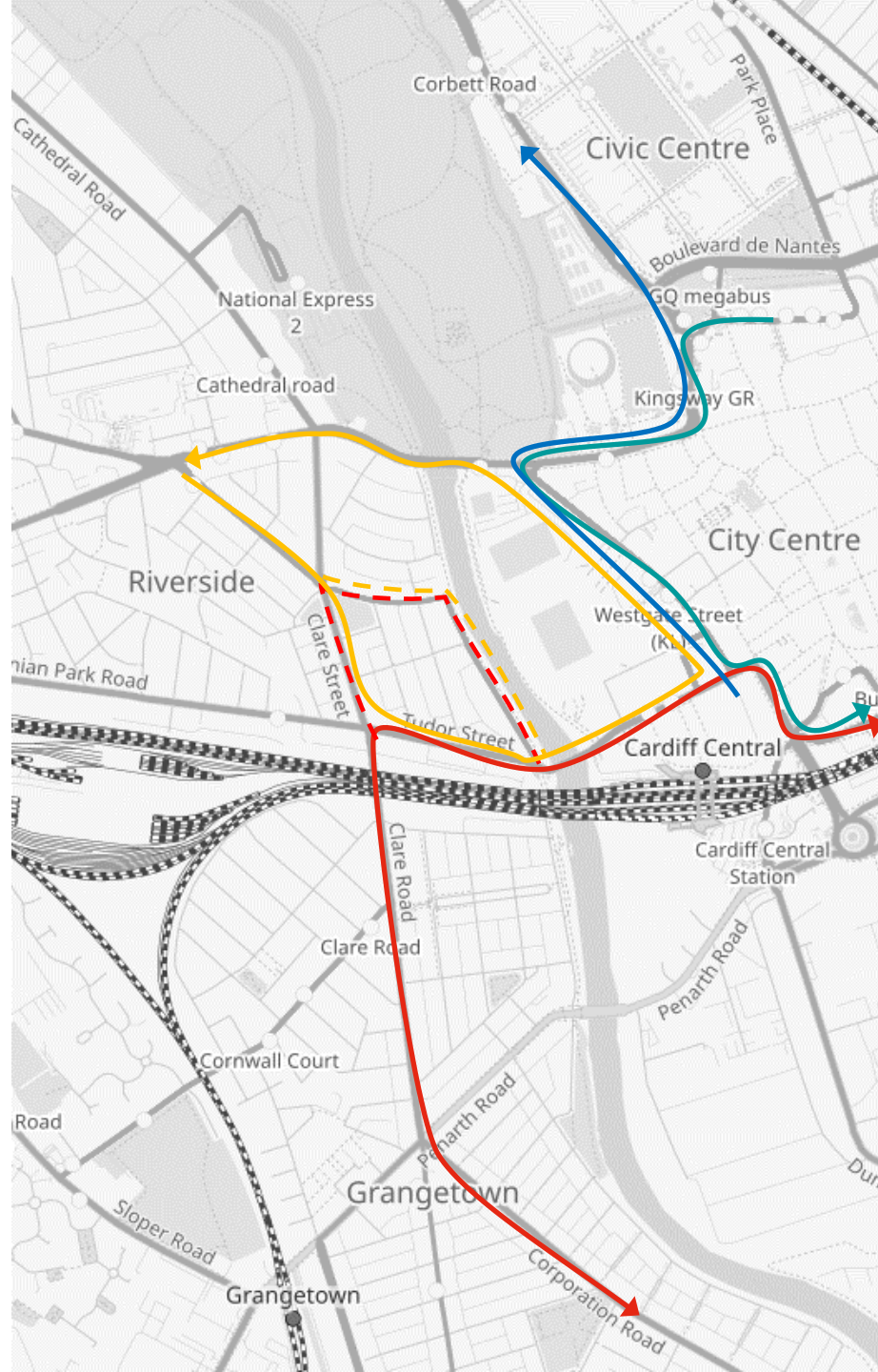
Limitations – Option 2 Traffic Re-routing Methodology (cont.)

There is not a strategic model for the Saturday peak. Therefore, the Option 2 Saturday matrices were generated using a set of assumptions which allows for traffic using Castle St to be diverted:

- Eastbound
 - Trips from south of the railway line (south of Tudor Street) will use Penarth Road
 - Trips from Tudor Street will use Wood Street
 - Trips from Clare Street side turnings will use Wood Street
 - Trips from Wellington St, Cowbridge Road E, and Cathedral Road will be split, 50% using Wood Street and 50% being removed from the matrices (assuming they would reroute outside of our network)
- Westbound
 - Trips to south of the railway line (south of Tudor Street) will enter from Penarth Road
 - Trips to Tudor Street will enter from Wood Street
 - Trips to Clare Street side turnings will enter from Wood Street
 - Trips to Wellington St, Cowbridge Road E, and Cathedral Road will be split, 50% using Wood Street and 50% being removed from the matrices (assuming they would reroute outside of our network)

A difference matrix (Option 2 - Ref Case) was calculated for each peak hour. With these, the Saturday matrices were checked against the AM and PM. Overall, the shift of traffic showed a similar pattern.

Appendix B – Bus Journey Time Graphs



Bus Journey Time Routes

Clare Road NB/SB

Bus Box

West Loop

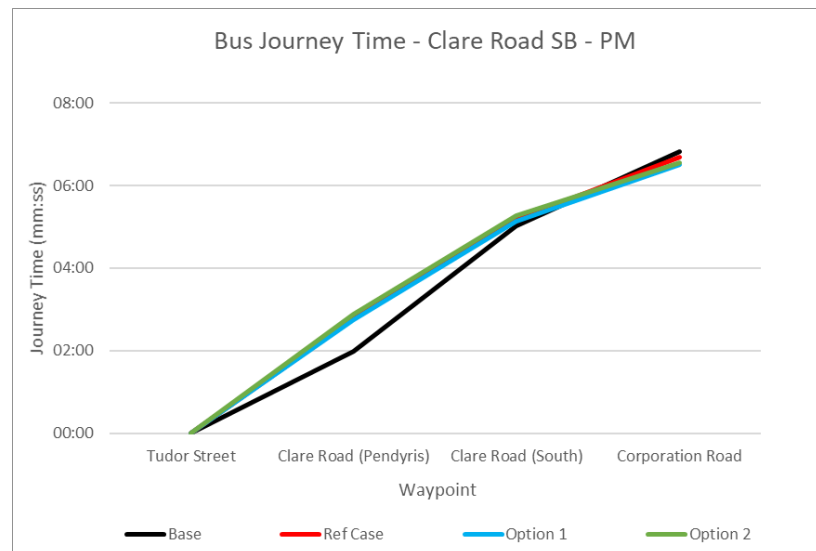
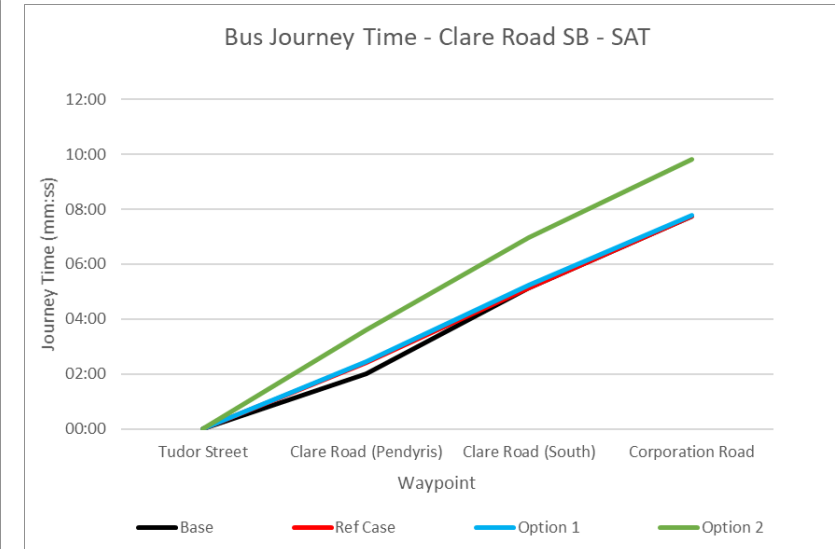
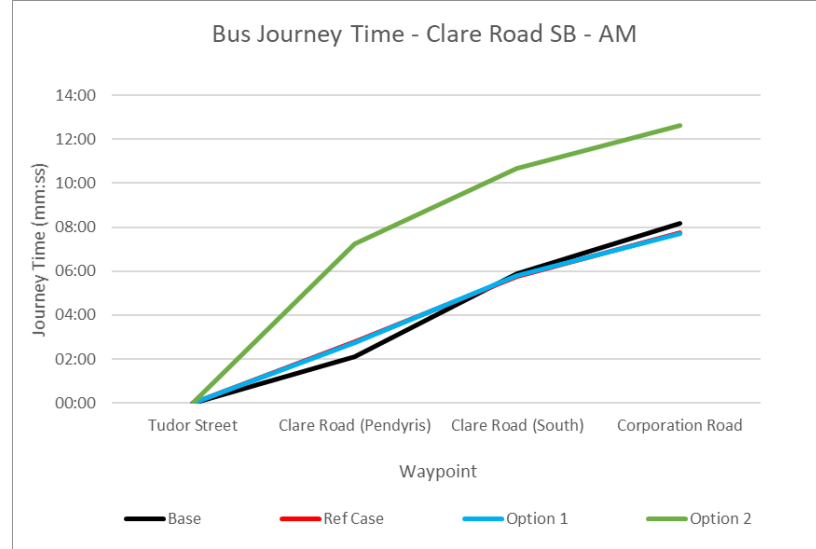
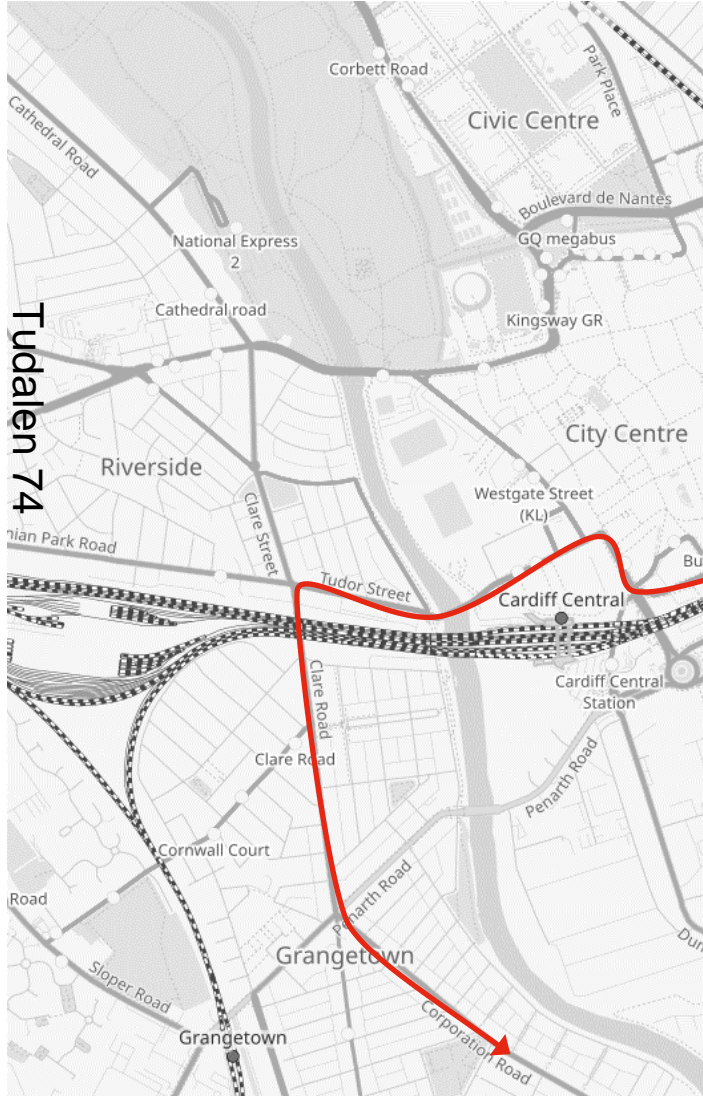
Castle St EB

Note – dashed lines signify the base model eastbound route using Despensers St due to Tudor St roadworks

Bus Journey Times – Clare Road SB

Clare Rd SB	Base	Ref Case	Option 1	Option 2
AM	08:10	07:44	07:42 (-00:02)	12:39 (+04:55)
PM	06:50	06:41	06:31 (-00:10)	06:33 (-00:08)
SAT	07:45	07:46	07:47 (+00:01)	09:48 (+02:02)

Option 1 & 2 journey time compared to Ref Case



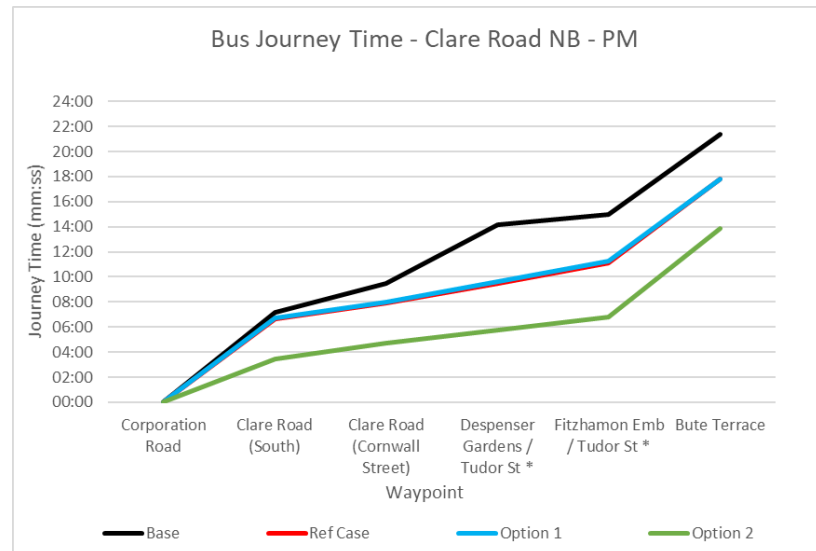
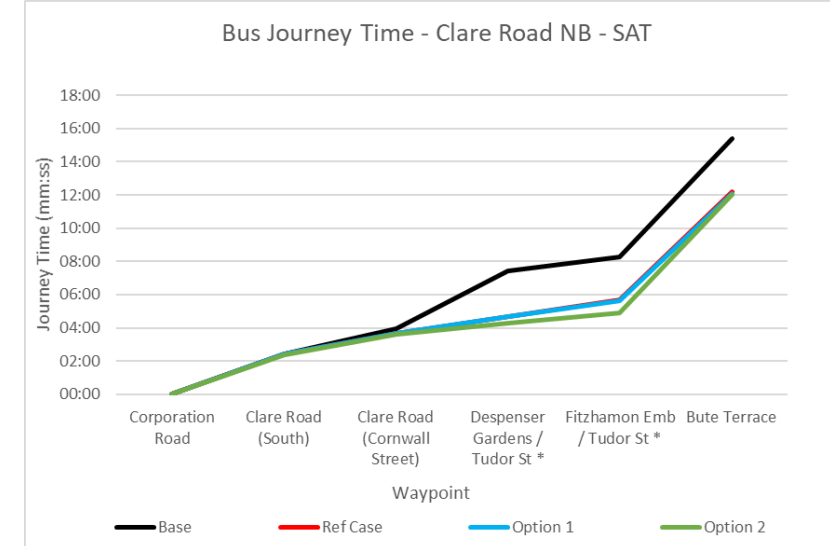
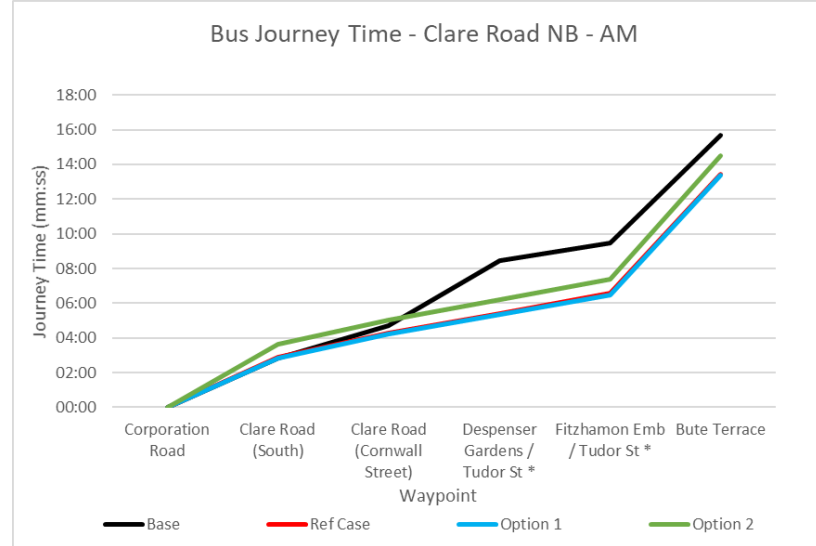
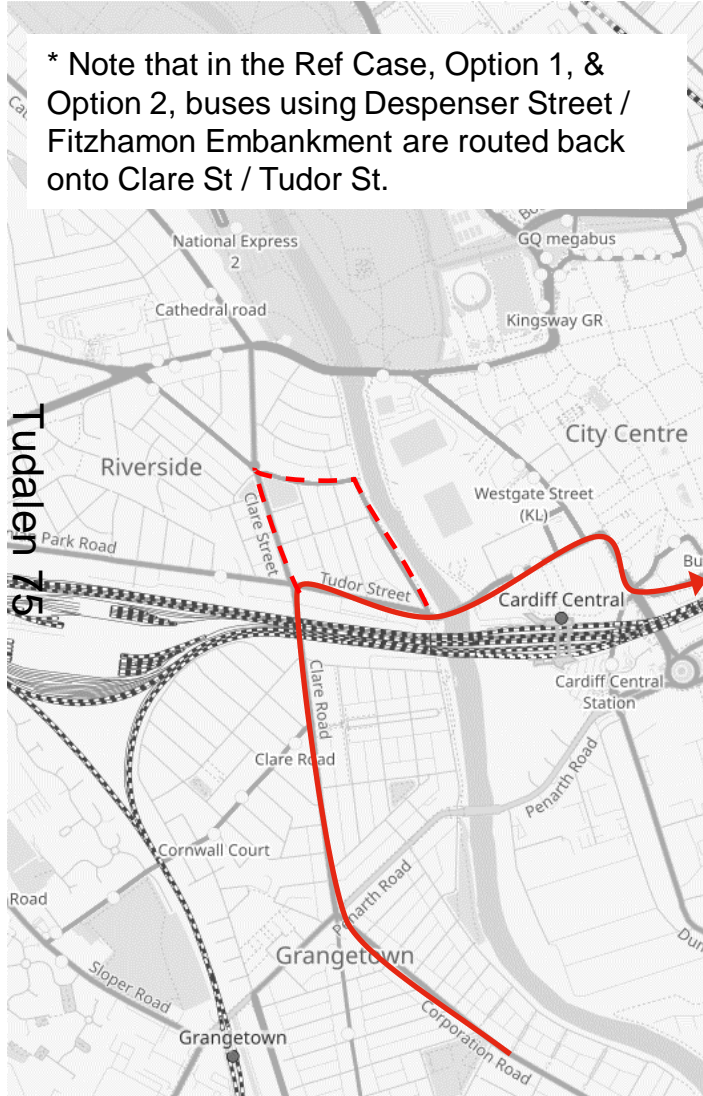
- Westbound delay on Tudor Street in Option 2 AM peak: Caused by reallocation of green times at the Tudor St signalised junction to account for increased southbound traffic on Clare Street
- Increased delay on Tudor St in Option 2 Saturday peak: due to increased traffic volumes on Tudor Street

Bus Journey Times – Clare Road NB

Clare Rd NB	Base	Ref Case	Option 1	Option 2
AM	15:40	13:25	13:24 (-00:01)	14:29 (+01:04)
PM	21:22	17:49	17:47 (-00:02)	13:51 (-03:58)
SAT	15:25	12:12	12:07 (-00:05)	12:01 (-00:11)

Option 1 & 2 journey time compared to Ref Case

* Note that in the Ref Case, Option 1, & Option 2, buses using Despenser Street / Fitzhamon Embankment are routed back onto Clare St / Tudor St.

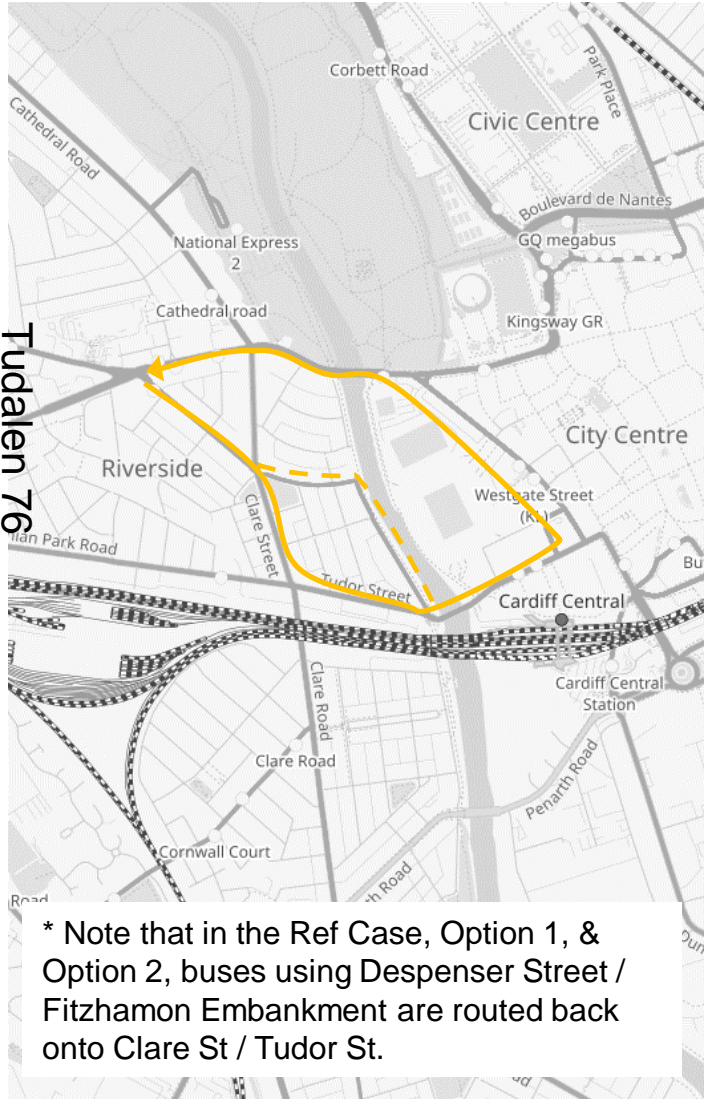


- **Faster eastbound travel times in the Ref Case & Option models:** mainly due to the reopening of Tudor Street Eastbound and reduced distance travelled.

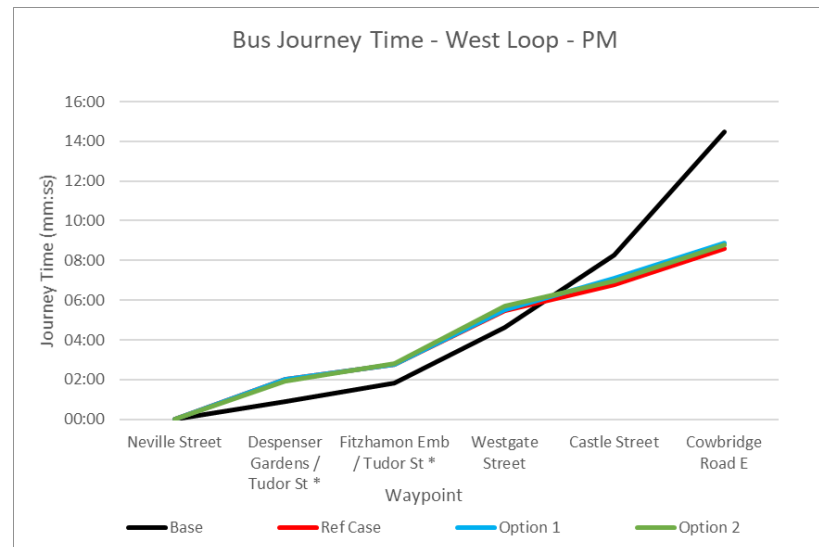
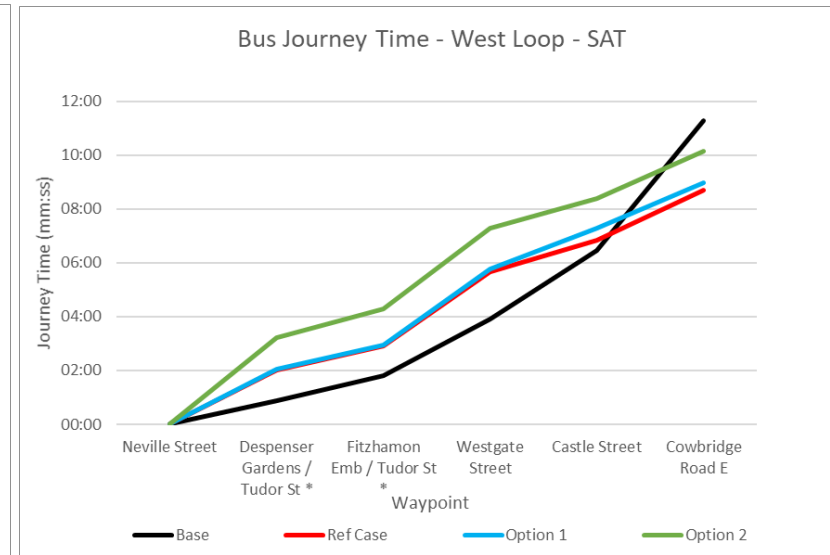
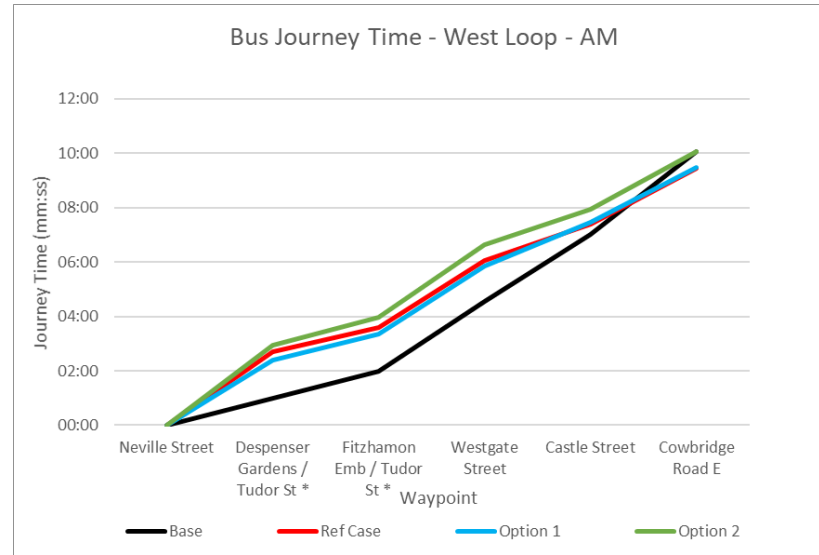
Bus Journey Times – West Loop

West Loop	Base	Ref Case	Option 1	Option 2
AM	10:04	09:27	09:28 (+00:01)	10:04 (+00:36)
PM	14:29	08:36	08:54 (+00:18)	08:48 (+00:13)
SAT	11:16	08:42	08:58 (+00:16)	10:09 (+01:26)

Option 1 & 2 journey time compared to Ref Case



* Note that in the Ref Case, Option 1, & Option 2, buses using Despenser Street / Fitzhamon Embankment are routed back onto Clare St / Tudor St.

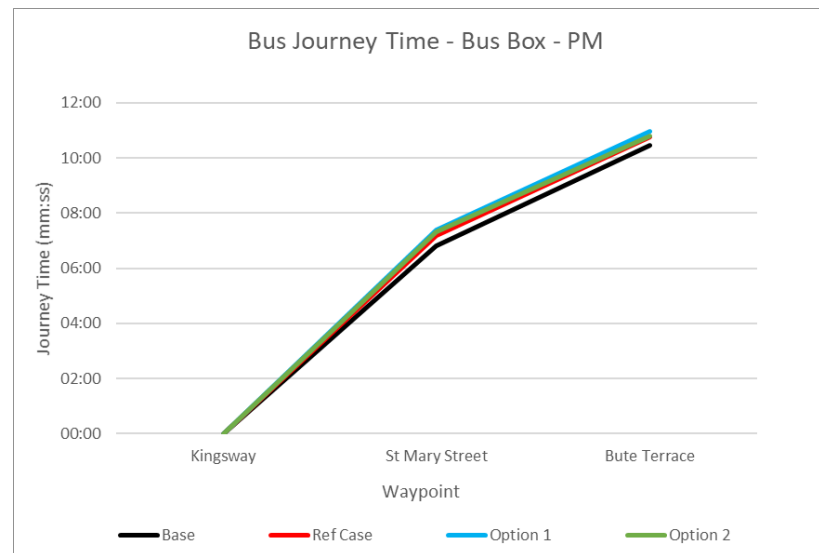
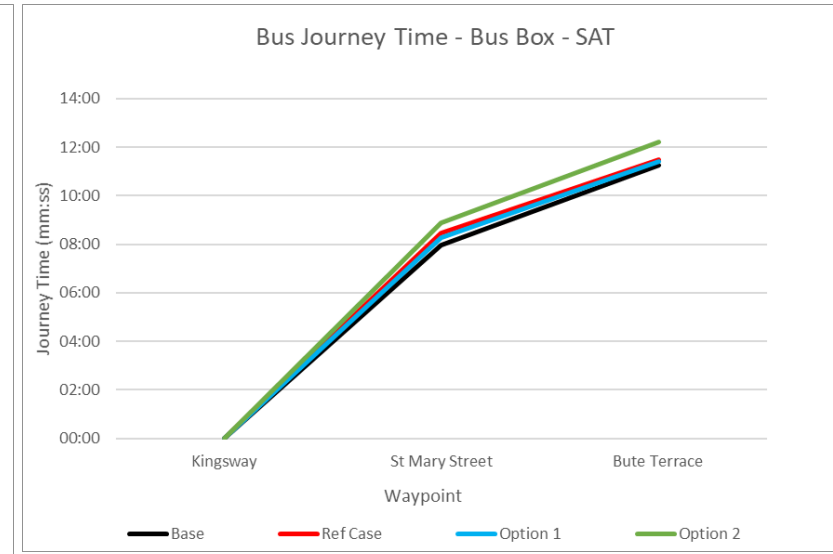
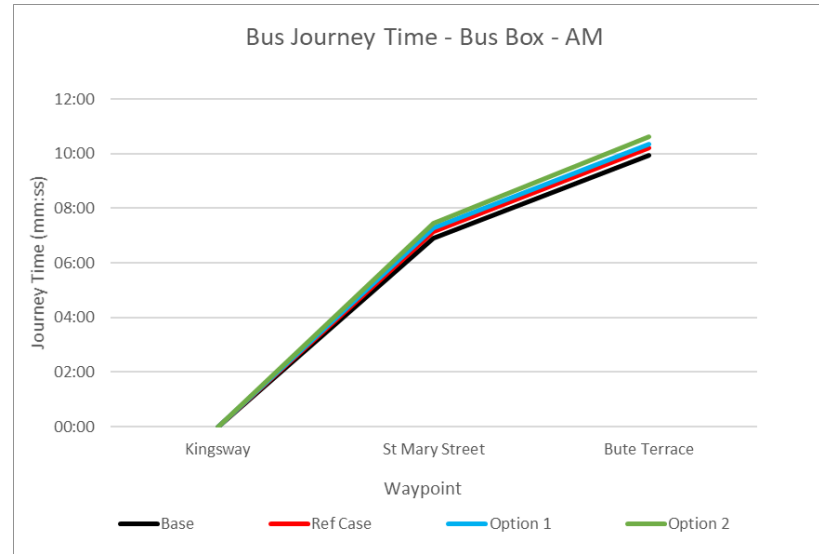
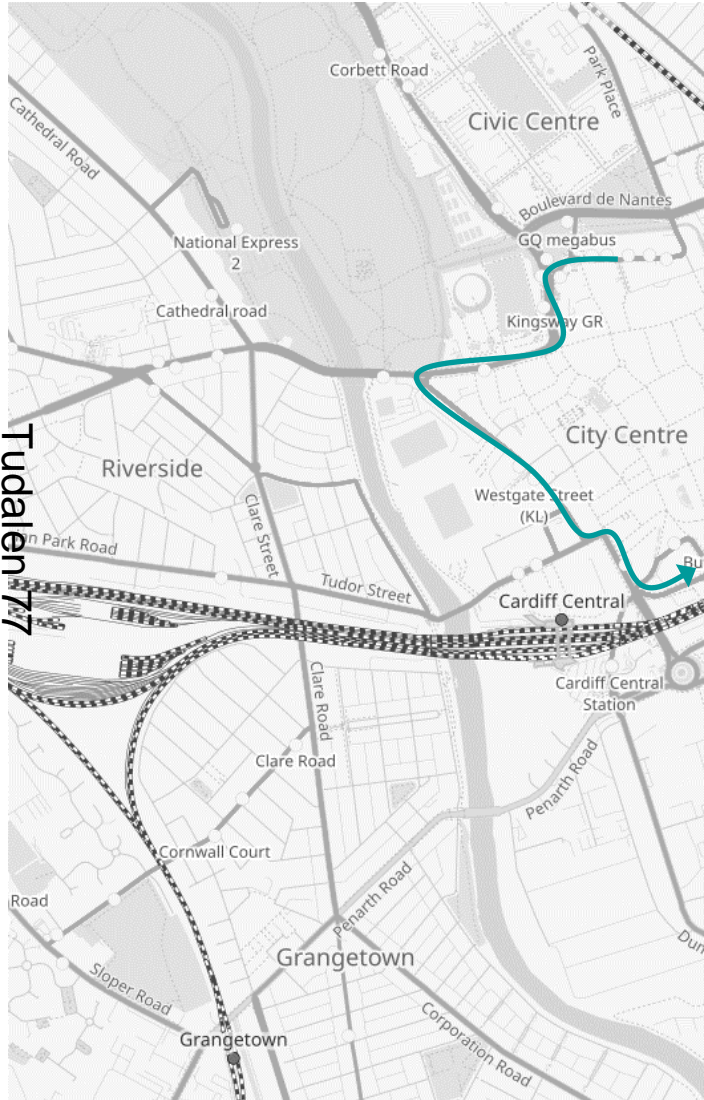


- Additional southbound delay on Clare Road: due to re-routing of buses through Clare St / Tudor St junction – option to maintain bus routes on Despenser Street?
- Improved/comparable westbound travel time on Castle Street in Ref Case & Options: due to provision of westbound bus lane on Castle Street & adjusted signal staging at Cathedral Road junction.

Bus Journey Times – Bus Box

Bus Box	Base	Ref Case	Option 1	Option 2
AM	09:57	10:12	10:21 (+00:09)	10:37 (+00:25)
PM	10:27	10:46	10:57 (+00:11)	10:47 (+00:01)
SAT	11:14	11:30	11:25 (-00:05)	12:13 (+00:43)

Option 1 & 2 journey time compared to Ref Case

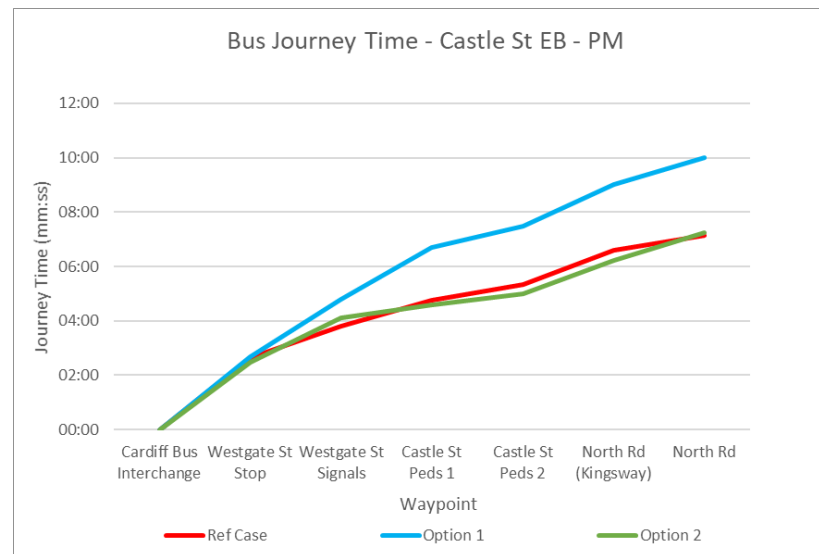
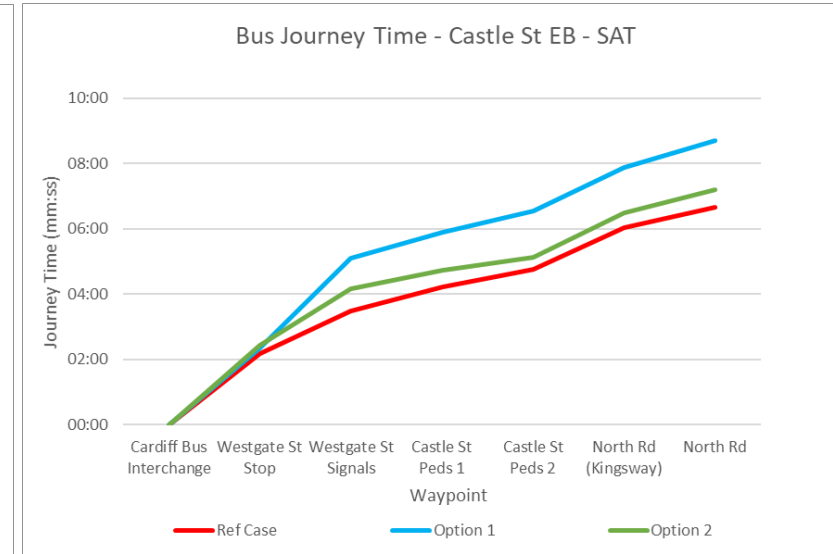
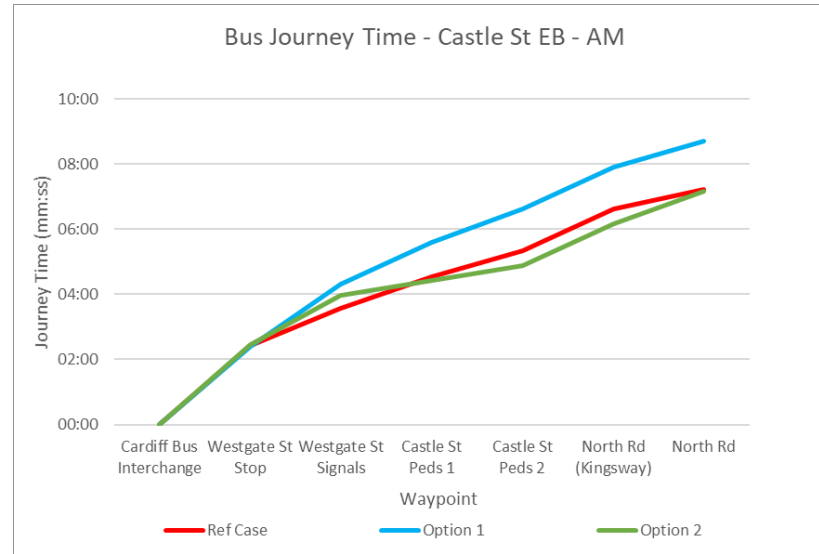
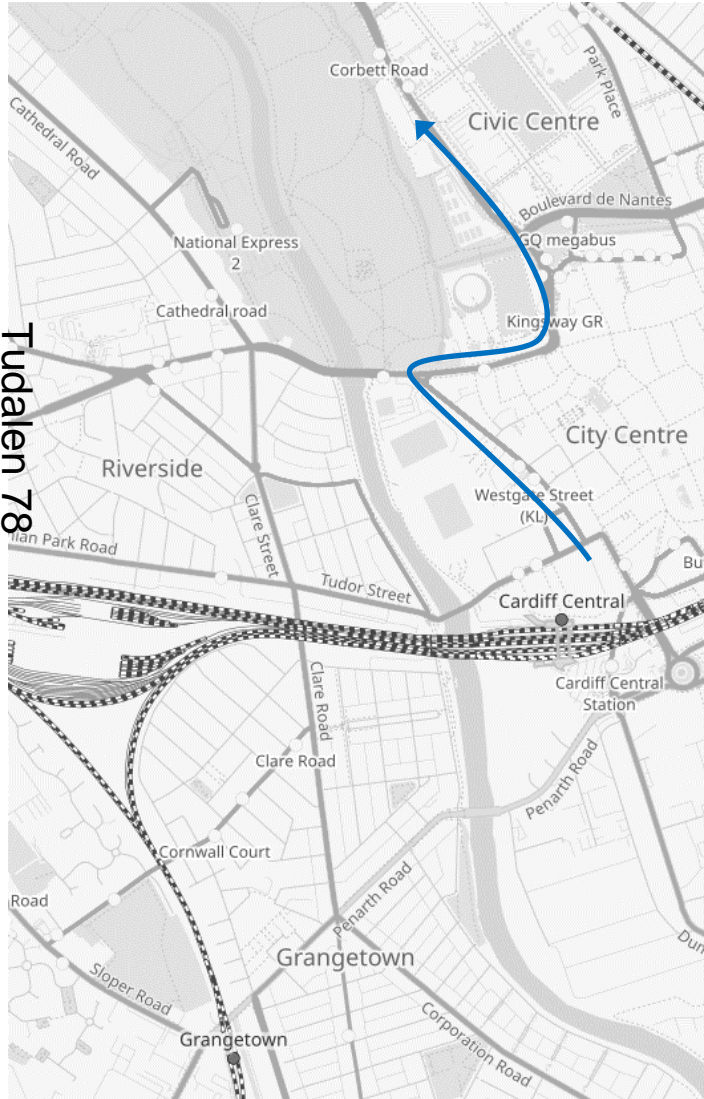


- Consistent travel times in all options: buses are protected on this route through bus lanes and/or bus gate

Bus Journey Times – Castle St EB

Castle St EB	Base	Ref Case	Option 1	Option 2
AM	-	07:14	08:43 (+01:29)	07:10 (-00:04)
PM	-	07:09	10:00 (+02:51)	07:15 (+00:07)
SAT	-	06:40	08:42 (+02:02)	07:12 (+00:32)

Option 1 & 2 journey time compared to Ref Case



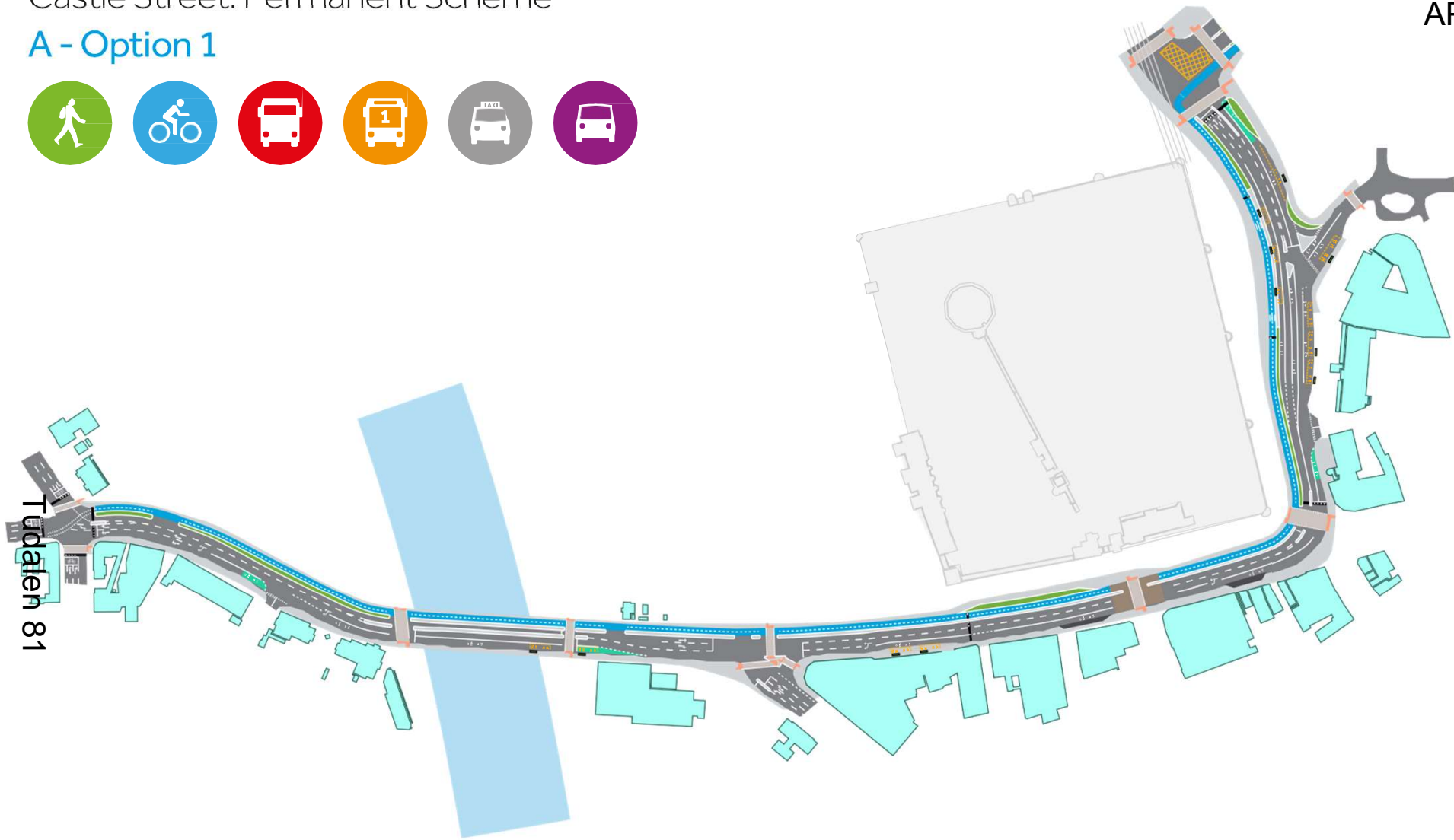
- No Base model results as Bus Interchange not in operation.
- Increased travel times in Option 1: due to impacts of proposed design at North Road / Boulevard De Nantes junction.
- No delays in Option 2: as the bus gate on Castle Street, and lower traffic volumes, mitigate the impact to the North Road junction.

aecom.com

Mae'r dudalen hon yn wag yn fwriadol

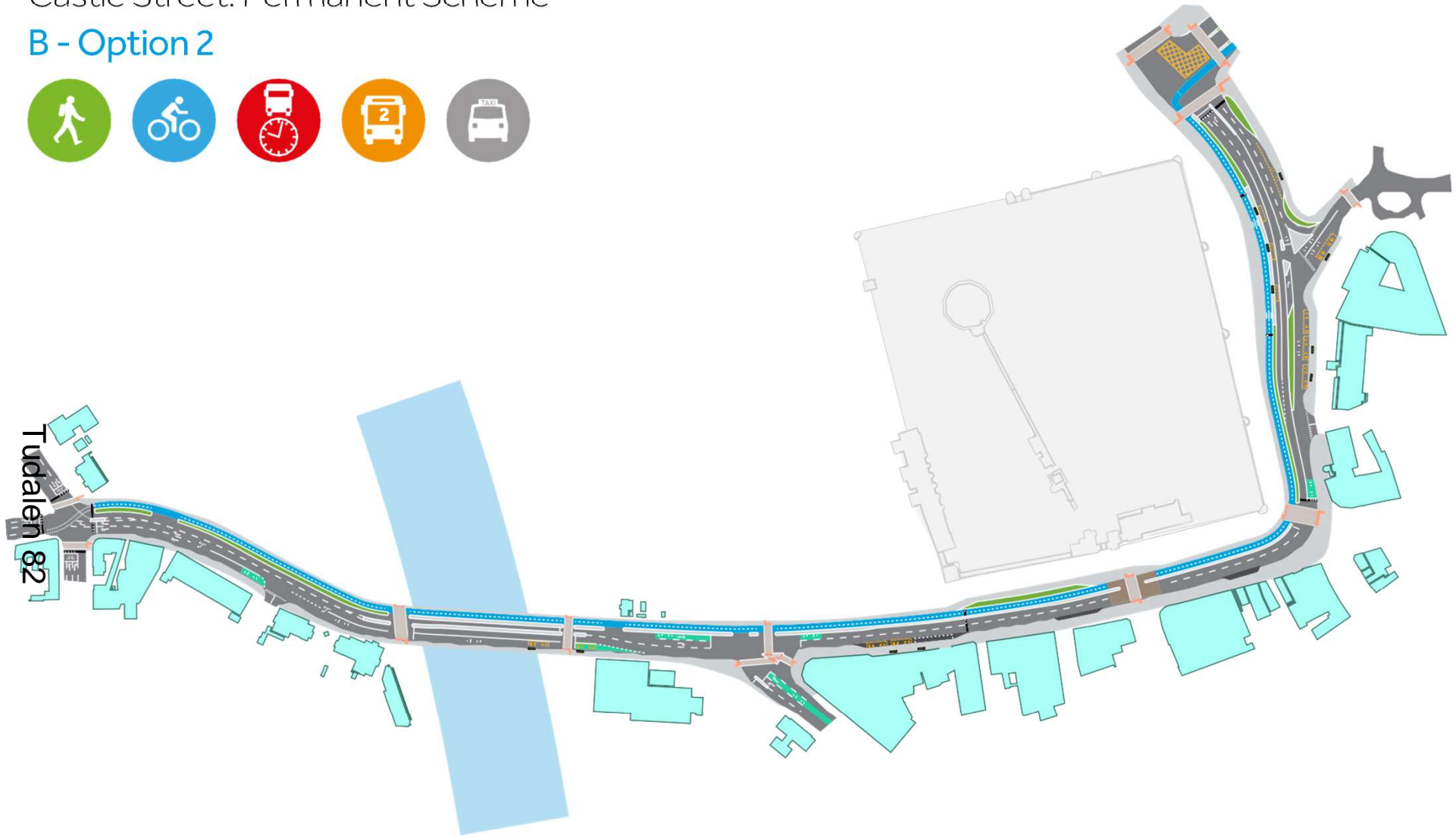
Castle Street: Permanent Scheme

A - Option 1



Castle Street: Permanent Scheme

B - Option 2





Cardiff Air Quality Management Castle Street Scheme

March 2023

This page left intentionally blank for pagination.

Mott MacDonald
35 Newhall Street
Birmingham B3 3PU
United Kingdom

T +44 (0)121 234 1500
mottmac.com

Cardiff Council.
County Hall,
Atlantic Wharf,
Cardiff,
CF10 4UW

Cardiff Air Quality Management Castle Street Scheme

March 2023

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	09/03/23	GB	ND	PO	Final Report

Document reference: 100106938 | 01 | A |

Information class: Standard

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

Executive summary	1
1 Base Year Cordon Model Development	2
1.1 Coding Recent Highway Network Updates	2
1.2 Variable Demand Model Run to Generate Baseline Demand	2
1.3 Cordoning Process	2
1.4 Application of Splits to Car Demand Matrices	3
1.5 Adjustment of Traffic Flows to Count Data	4
2 Do-Minimum Forecast	6
2.1 Coding Do-Minimum Schemes	6
2.2 Highway Assignment Parameters	6
2.3 Forecast Demand Changes	6
2.4 Do-Something Scheme Coding	7
2.5 Signal Updates	7
3 Model Results	8
3.1 Option 1 Flow Difference Plots	8
3.2 Option 2 Flow Difference Plots	10
3.3 Flows on Key Links	12
4 Economic Assessment Using TUBA	15
4.1 Software and Economic File Versions	15
4.2 Other Parameters	15
4.3 Treatment of Taxis and Non-Taxis	15
4.4 TUBA Results	16
4.4.1 Disbenefit Totals	16
4.4.2 Sectorised Results	16
Tables	
Table 1-1: Link Flow Comparison Following Matrix Estimation	5
Table 2-1: Applied Car Growth Rates 2022-24	6
Table 2-2: Goods Vehicle Growth	7
Table 3-1: Key Link Flow Changes DM vs DS1	13
Table 3-2: Key Link Flow Changes DM vs DS2	14
Table 4-1: Castle Street Scheme TUBA Results by Benefit Type, 2024 Values in 2010 Prices, Discounted to 2010	16

Table 4-2: Sectorised Time Disbenefits - Option 1	17
Table 4-3: Sectorised Time Disbenefits - Option 2	18

Figures

Figure 1.1: Cordon Model Area	3
Figure 1.2: Model Link Counts Used in Calibration Process	4
Figure 3.1: Castle Street Option 1, Flow Difference vs DM, AM Peak View 1	8
Figure 3.2: Castle Street Option 1, Flow Difference vs DM, AM Peak View 2	9
Figure 3.3: Castle Street Option 1, Flow Difference vs DM, PM Peak View 1	9
Figure 3.4: Castle Street Option 1, Flow Difference vs DM, PM Peak View 2	10
Figure 3.5: Castle Street Option 2, Flow Difference vs DM, AM Peak View 1	10
Figure 3.6: Castle Street Option 2, Flow Difference vs DM, AM Peak View 2	11
Figure 3.7: Castle Street Option 2, Flow Difference vs DM, PM Peak View 1	11
Figure 3.8: Castle Street Option 2, Flow Difference vs DM, PM Peak View 2	12
Figure 4.1: Sector Definitions	17

Executive summary

A Clean Air Feasibility Study was undertaken on behalf of Cardiff Council between 2018 and 2019. Arising from this several schemes were implemented in the city to improve air quality. Following on from schemes and network changes undertaken during the global pandemic, the Council are considering alterations to the road network in the vicinity of the original air quality schemes (in particular on Castle Street) and are therefore required by Welsh Government to undertake further modelling to understand the likely impact on pollutant concentrations.

Using traffic count data collected by the Council, Mott MacDonald has developed an updated 2022 base year cordon model of the city in PTV Visum software using the wider South East Wales Transport Model (SEWTM) as a basis. Since the scheme options distinguish between taxis and general traffic, and by taxi engine type, the model's car demand segments were disaggregated to general car, taxi compliant engine and taxi non-compliant engine (compliance with reference to EURO standards) before calibrating traffic flows to count data collected by the Council in 2022. The DfT's National Trip End Model (NTEM) has been used to grow highway demand to 2024 as part of a Do-Minimum (DM) forecast, incorporating schemes which will be implemented by the Council in the intervening period. The Castle Street scheme options have been coded into these networks to develop Do-Something (DS) forecasts.

Outputs from the 2022 base year model have been supplied to Ricardo Energy and Environment to facilitate the development of an updated air dispersion model. Subsequently, 2024 DM and DS outputs have been provided so the air dispersion model can be used to understand likely concentrations of pollutants in a forecast scenario, and the impact of the proposed Castle Street scheme options on these concentrations.

An economic assessment of the schemes has been undertaken using the DfT's Transport User Benefit Analysis (TUBA) software.

This report has been prepared to detail the modelling undertaken in the cordon model and the results of the scheme testing. The remainder of this report is structured as follows:

- Section 1 outlines the process undertaken to develop the base year (2022) cordon model;
- Section 2 details the forecasting process used to develop the 2024 forecasts;
- Section 3 provides a brief overview of the modelling results; and
- Section 4 provides details of the economic assessment using TUBA.

1 Base Year Cordon Model Development

The SEWTM model used as a basis for this study has a base year of 2015. Owing to significant changes to travel patterns due to the global COVID pandemic and recent alterations to the Cardiff highway network, it was necessary to develop a cordon model of the city so that travel patterns could be modelled sufficiently accurately for the calibration of the updated air dispersion model. This section outlines the development and calibration of the 2022 base year cordon model.

1.1 Coding Recent Highway Network Updates

A series of schemes were coded into the SEWTM highway networks to bring the model up to date in the vicinity of the Castle Street scheme. These were:

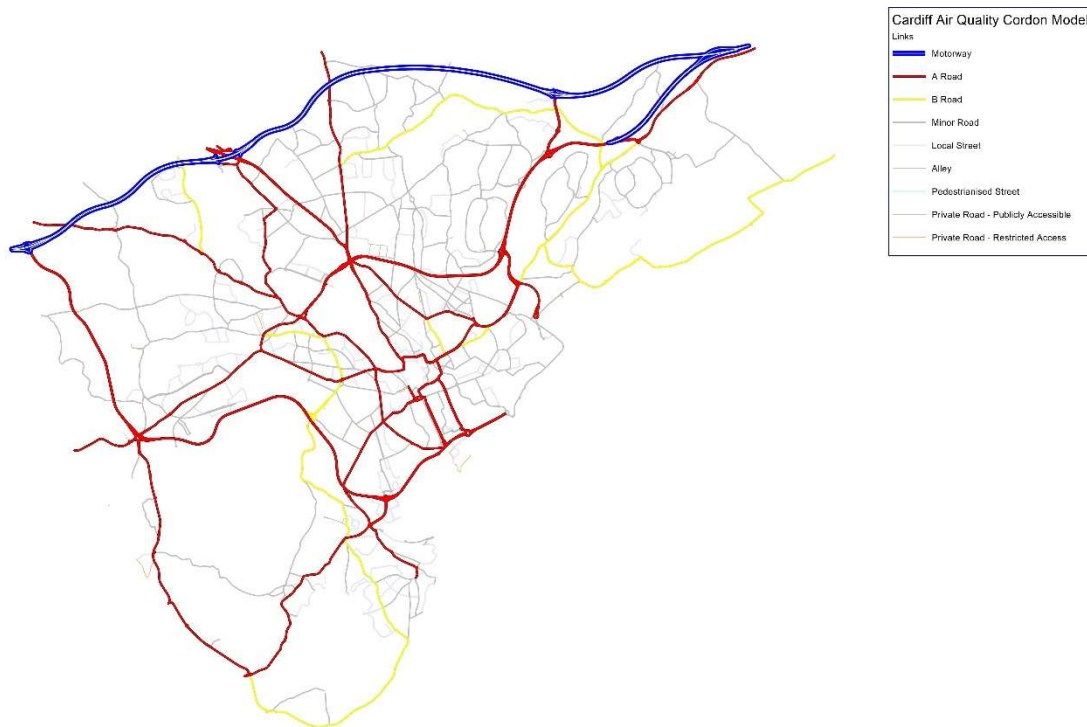
- Purple cycleway, reassigning road space from general traffic to cyclists along Tyndall Street;
- Gold cycleway, reassigning road space from general traffic to cyclists along Newport Road, Boulevard de Nantes, Castle Street and Wellington Street;
- City Centre East scheme incorporating bus gate on Station Terrace;
- Westgate Street bus and taxi gate;
- Closure of Tudor Street eastbound owing to roadworks during the period of count data collection; and
- Extensive updates to signal timings throughout the city, using observed data for 3rd March 2022 supplied by the council.

1.2 Variable Demand Model Run to Generate Baseline Demand

Demand and highway model parameters were generated for 2022 using the May 22 release of the TAG databook. Exogenous factors for changes (2015-22) in external link speeds, goods vehicles and external-external trips were generated using the DfT's Road Traffic Forecast (RTF) 2018. Population and employment inputs for 2022 were generated by interpolating values for 2015 and 2026 model years, whilst respecting development site profiling data, where such information was available. The Variable Demand Model (VDM) was then run to generate baseline 2022 demand matrices which could more easily be adjusted to match the count data provided by the Council.

1.3 Cordoning Process

Following the generation of the 2022 baseline demand the model was cordoned using Visum's inbuilt subnetwork generator to improve the manageability of the subsequent tasks. The cordon area is shown below in Figure 1.1

Figure 1.1: Cordon Model Area

1.4 Application of Splits to Car Demand Matrices

The SEWTM demand matrices for cars are split into three demand segments, representing the following trip purposes:

- Employer's business;
- Commute; and
- Other.

The Castle Street scheme options ban general traffic from Castle Street, allowing passage for only the following vehicles (as well as buses):

- Option 1 – taxis; and
- Option 2 – electric taxis.

Therefore, it was necessary to subdivide each of the car demand segments into the following categories:

- Electric-only taxi (not including hybrids);
- Other taxi; and
- Other vehicles.

ANPR data collected by the Council during on 3rd March 2022 was considered as a source for splitting the model into taxi/non-taxi in a geographically disaggregate manner. However, it was found that this data only identified Hackney Carriages in the taxi data, which was not in line with the distinctions being made in terms of the scheme. Further, manually classified count data collected during the period 2nd March-14th March 2022 was found to significantly underestimate the proportion of taxis compared to previous data used in the 2018-19 study. It is assumed that this is due to enumerators not being able to accurately identify such vehicles. Since these data sources were found to be unsuitable, an assumption of 9% of vehicles being taxis was applied, based on ANPR data collected during the previous study, which matched registration plates to the Council's data base of licensed taxis directly. Taxis were split into electric only and other

types using information supplied by Ricardo Energy and Environment based on their analysis of the taxi database – 2.3% of taxis were modelled as electric only. The model's demand matrices were split consistently, with no distinction made between different trip purposes or origin-destination pairs, in the absence of suitable information to facilitate this. It should be noted, however, that in the assigned model the proportion of taxis on links is higher in the vicinity of the scheme than elsewhere, owing to existing taxi-only restrictions included in the model (Westgate Street and Eastside Scheme) as described in 2.1. Noting the issues with these sources, this approximately reflects the patterns in the 2022 ANPR and manual count data, if not the actual proportions. The same 2022 Value of Time (VoT) and Vehicle Operating Cost (VOC) parameters were applied to the split matrices as used for the parent classes. Following the split of the assignment matrices, the highway networks were reassigned.

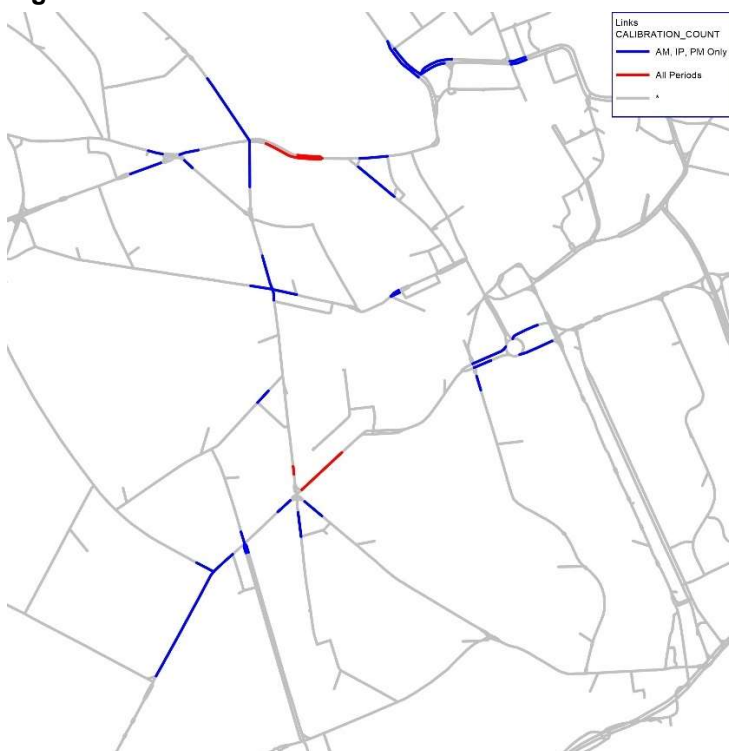
1.5 Adjustment of Traffic Flows to Count Data

A significant amount of count data was collected by Cardiff Council in the city centre in March 2022, covering:

- ANPR counts (as described above);
- Two-week Automatic Traffic counts (ATCs) (collected 28th February-20th March 2022);
- Single day (12 hour) manually classified link counts (as described above); and
- Single day (12 hour) manually classified turning counts (collected on 3rd March 2022).

Various movements were covered more than once in the dataset, for example some ATC locations also had a single day manually classified count, and some manually classified link counts occurred on junctions with individual arms that also had a single day count. A subset of the data was used to calibrate the model, with preference given to longer term ATCs over manually classified counts, and manually classified turning counts amalgamated to link counts where appropriate (turning movements were not specifically calibrated). The data was processed to modelled time periods and comparisons made between observed and modelled car and total flows. The location of the links with calibration counts is shown below in Figure 1.2.

Figure 1.2: Model Link Counts Used in Calibration Process



The adjustment process was complicated by the increased number of demand segments used in the assignments. The dataset also represents a much denser set of counts than would usually be applied to a strategic model, with significant variations owing to a high proportion of single day counts, therefore significant effort was required in getting the matrix estimation process to run. As a result, a lower proportion of passing links was considered acceptable than would usually be applied. In some cases, a lower overall pass rate was accepted to improve the fit to counts on Castle Street and Westgate Street. Comparisons were made on the basis of the GEH criterion only, for cars and all vehicles. The proportion of counts with a GEH statistic of less than 5, post matrix-estimation, is shown below in Table 1-1.

Table 1-1: Link Flow Comparison Following Matrix Estimation

Time Period	Cars			All Vehicles	
	Total Sites	Number GEH < 5	Proportion GEH <5	Number GEH < 5	Proportion GEH <5
AM	60	52	86.7%	50	83.3%
IP	60	50	83.3%	49	81.7%
PM	60	43	71.7%	44	73.3%
OP	6	6	100.0%	6	100.0%

Due to the importance of matching flows accurately for the air dispersion model, and the layout of the counts not allowing parallel screenlines to be formed, no counts were kept back for independent validation. TAG guidance usually specifies that matrix estimation should only be carried out on an unadjusted prior matrix, however given the need to adjust a cordon matrix which had been forecast from the model's base year of 2015, this was not possible in this instance.

Following the adjustment of the flows to the count data, base year link flows and speeds were supplied to Ricardo Energy and Environment to facilitate development and calibration of the base year air dispersion model.

2 Do-Minimum Forecast

The DfT's National Trip End Model (NTEM) was used to apply growth to the base year model to develop a 2024 DM forecast. That process is described in this section.

2.1 Coding Do-Minimum Schemes

The following schemes were coded into the highway networks:

- Extension of the westbound bus lane on Cowbridge Road East to within 60m of the Cowbridge Road East/Cathedral Road junction; and
- Updates to the signal timings at the above junction.

2.2 Highway Assignment Parameters

Highway assignment parameters (VoT and VOC) were generated using the same (May '22) version of the TAG databook as for the base model.

2.3 Forecast Demand Changes

Origin/destination trip end information was extracted from NTEM 8 as follows:

- NTEM 8 core scenario only;
- Car driver only;
- Covering trips with an origin/destination in the Cardiff Local Authority;
- By trip purpose (15 NTEM trip purposes);
- Data for 2022 and 2024; and
- By time period (NTEM definitions).

Trip end forecasts for the 15 NTEM purposes were amalgamated to the highway assignment model's three trip purposes. It was assumed that:

- Calculated growth factors were suitable for application to all matrices of a given purpose (taxi electric, taxi non-electric and other cars); and
- Factors for the NTEM time periods could be applied directly to the equivalent model time periods (though the time period definitions are not identical).

Separate origin and destination trip growth factors were calculated, as well as an origin/destination average, as shown below in Table 2-1.

Table 2-1: Applied Car Growth Rates 2022-24

Purpose	AM			IP			PM			OP		
	Origin	Dest	O/D	Origin	Dest	O/D	Origin	Dest	O/D	Origin	Dest	O/D
Commuter	2.3%	1.8%	2.0%	1.9%	2.0%	2.0%	1.8%	2.3%	2.0%	1.6%	1.7%	1.7%
Business	2.3%	1.9%	2.1%	1.9%	1.9%	1.9%	1.9%	2.2%	2.0%	1.9%	2.2%	2.1%
Other	2.4%	2.0%	2.2%	2.3%	2.3%	2.3%	2.1%	2.2%	2.2%	2.1%	2.2%	2.2%

The factors were applied as follows:

- Trips with an origin within the cordon and a destination at the cordon boundary – origin factor;

- Trips with an origin at the cordon boundary and a destination within the cordon – destination factor; and
- Other trips – average origin/destination factor.

Growth for goods vehicles was generated using RTF 2018 and applied at a whole matrix level as shown below in Table 2-2.

Table 2-2: Goods Vehicle Growth

Vehicle Type	LGV	HGV
Growth 2022-24	1.6%	-0.2%

The networks were subsequently reassigned, and the outputs provided to Ricardo Energy and Environment as the 2024 DM for an initial air quality assessment.

2.4 Do-Something Scheme Coding

The two do-something schemes were subsequently coded into the networks:

- Option 1 – Castle Street closed to general traffic, taxis (and buses) allowed only; and
- Option 2 – Castle Street closed to general traffic, fully electric taxis (and buses) allowed only.

Signal timings were also updated at the following junctions, based on initial outputs from a microsimulation model of the area developed by AECOM:

- Boulevard des Nantes / North Road junction; and
- Castle Street / Westgate Street Junction.

The networks were subsequently reassigned, and the outputs provided to Ricardo Energy and Environment as the 2024 DS for an initial air quality assessment.

2.5 Signal Updates

Cordon matrices for the microsim model were then extracted from the initial DM and DS forecasts and supplied to AECOM, who then provided updated signal timings for the following junctions, which were coded into the model:

- Tudor Street / Clare Road;
- Cowbridge Road East / Cathedral Road;
- Castle Street / Westgate Street; and
- North Road / Boulevard de Nantes.

Concurrently, Mott MacDonald were made aware of recent changes implemented to the layout of the Tudor Street/Clare Road junction, which were also coded into both the DM and the DS.

Both the DM and DS models were then reassigned, and flow/speed outputs provided to Ricardo Energy and Environment to undertake a full air quality assessment using the final networks.

3 Model Results

This section briefly outlines the impact of the Castle Street scheme options.

3.1 Option 1 Flow Difference Plots

The forecast changes in traffic flow, flow differences, (compared to the DM) for Option 1 for the AM peak are shown below in Figure 3.1 and Figure 3.2. As would be expected there is a significant reduction in Castle Street in both directions, extending northwards along North Road. The decrease in traffic is more significant east of Westgate Street, since this is the section which the closure is specifically applied to. East of Westgate Street there is a reduction in flow of around 800 vehicles in each direction, west of Westgate Street the reduction is approximately 500 vehicles per direction. The model forecasts only a slight change in flow on Westgate Street, since in both scenarios there is already a bus and taxi gate in operation. As this is a fixed trip assignment test, there are corresponding decreases in flow on alternative routes. In particular, the largest increases are along the A4232 and A4234, and along the A48. These routes are now facilitating the east-west movements across the city centre rather than Castle Street.

Figure 3.1: Castle Street Option 1, Flow Difference vs DM, AM Peak View 1

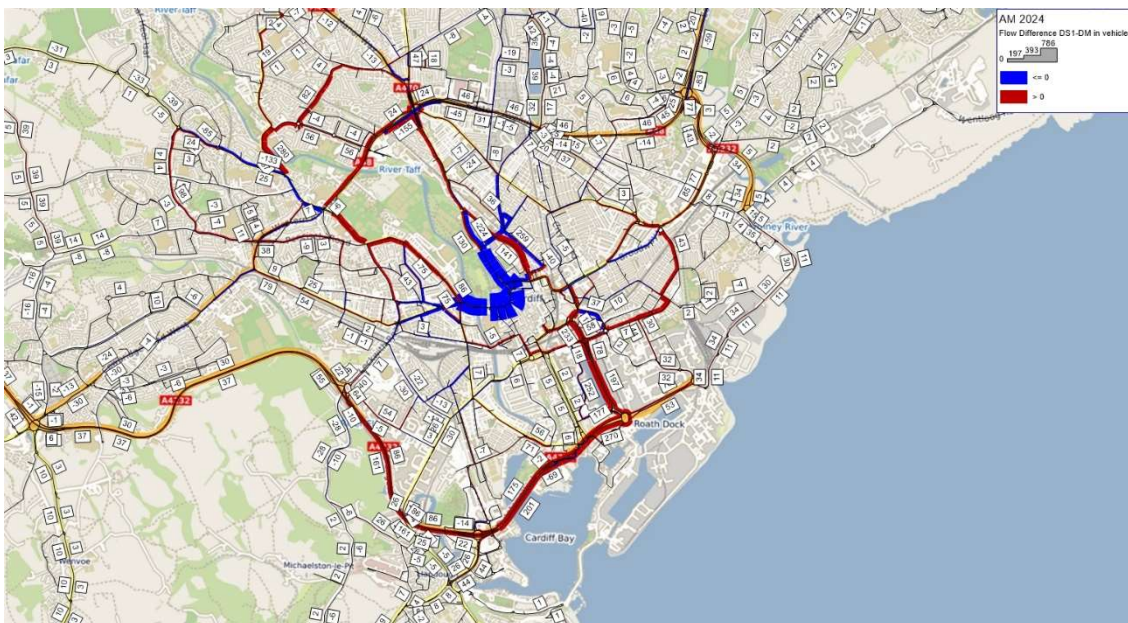
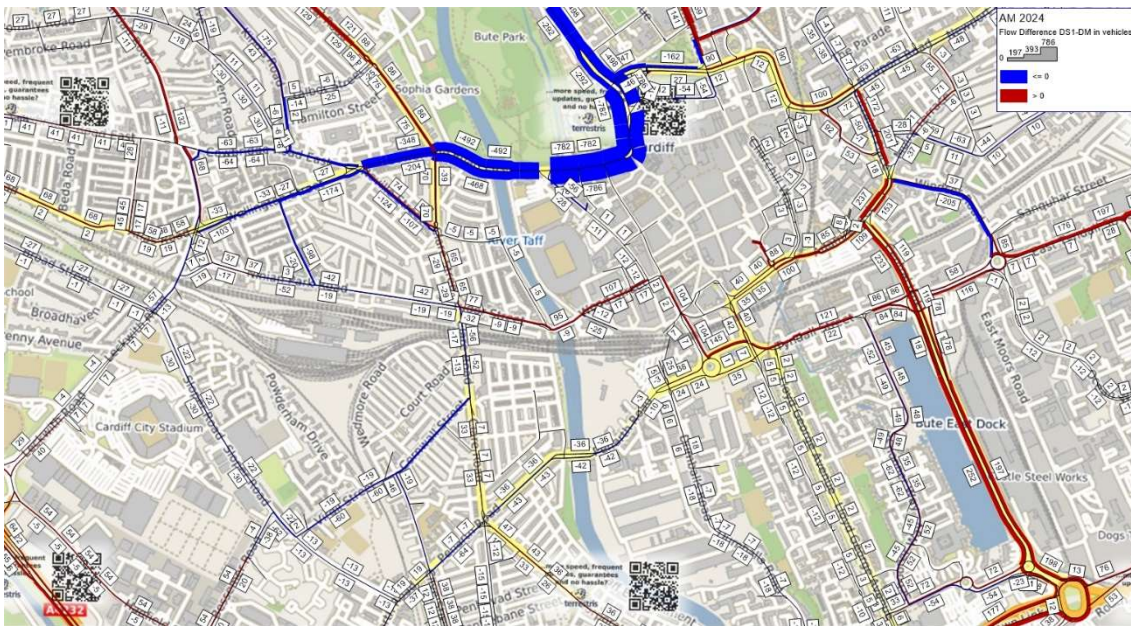


Figure 3.2: Castle Street Option 1, Flow Difference vs DM, AM Peak View 2



The flow differences (compared to the DM) for Option 1 for the PM peak are shown below in Figure 3.3 and Figure 3.4. Similar patterns to the AM peak are reflected in the PM peak, with traffic flow reductions on Castle Street being offset by increases on the A4232, A4234 and A48. The flow reduction on Castle Street is again greater on the section east of Westgate Street than the section to the west, though the eastbound decrease is more pronounced compared to westbound; in the AM peak the flow reduction is closely matched across directions. The flow reduction eastbound is approximately 600 vehicles west of Westgate Street and approximately 1,000 vehicles east of Westgate Street. Eastbound, these figures are approximately 250 and 550 vehicles, respectively.

Figure 3.3: Castle Street Option 1, Flow Difference vs DM, PM Peak View 1

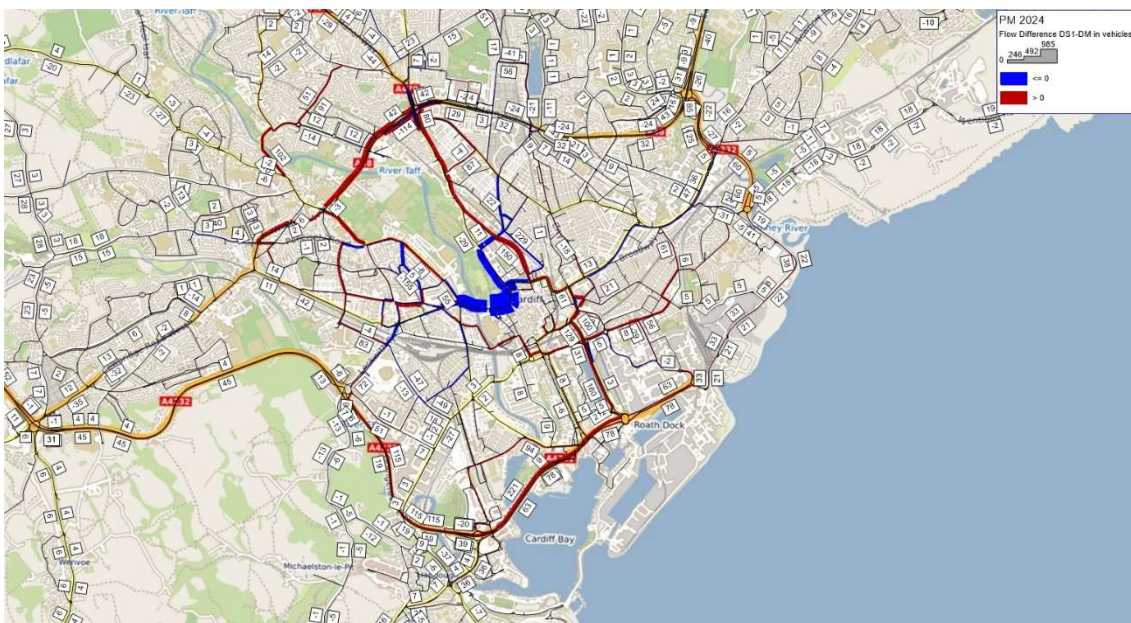
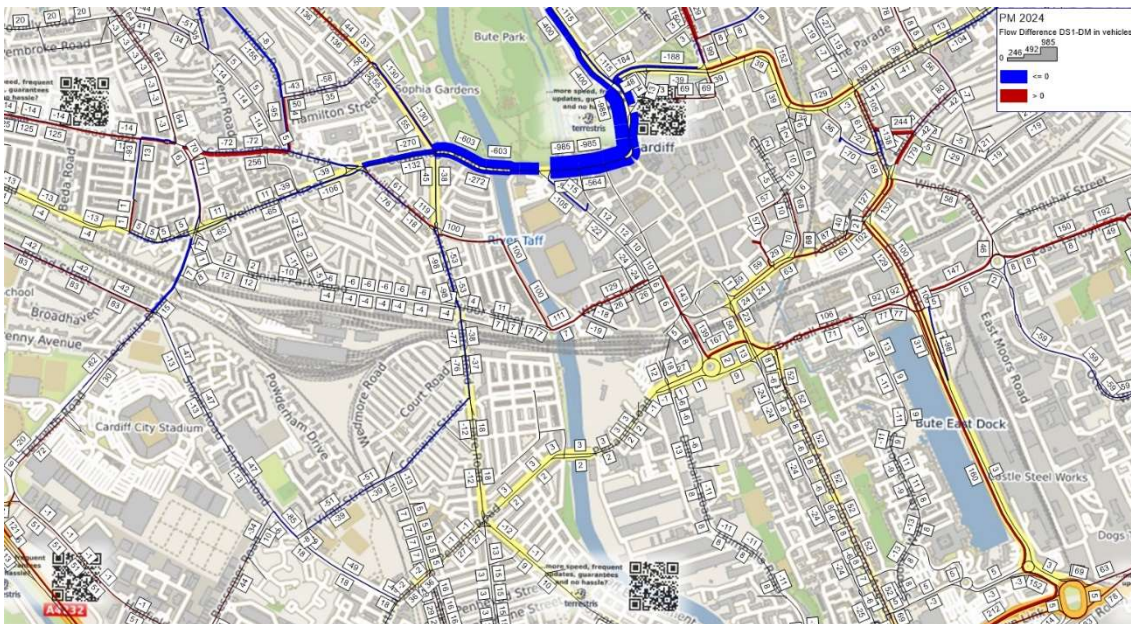


Figure 3.4: Castle Street Option 1, Flow Difference vs DM, PM Peak View 2



3.2 Option 2 Flow Difference Plots

Flow difference plots (compared to the DM) for Option 2 for the AM peak are shown below in Figure 3.5 and Figure 3.6. The patterns shown are almost identical to those for Option 1. This is to be expected, since there is only a marginal difference between the schemes, with non-electric taxis (representing just less than 9% of the car demand) now being banned from Castle Street in addition to non-taxi cars. West of Westgate Street there are around 550 fewer vehicles eastbound and around 500 fewer vehicles westbound (for Option 1 this was approximately 500 vehicles in each direction). East of Westgate Street flows reduce by around 850 vehicles in each direction, compared to the value of 800 for Option 1.

Figure 3.5: Castle Street Option 2, Flow Difference vs DM, AM Peak View 1

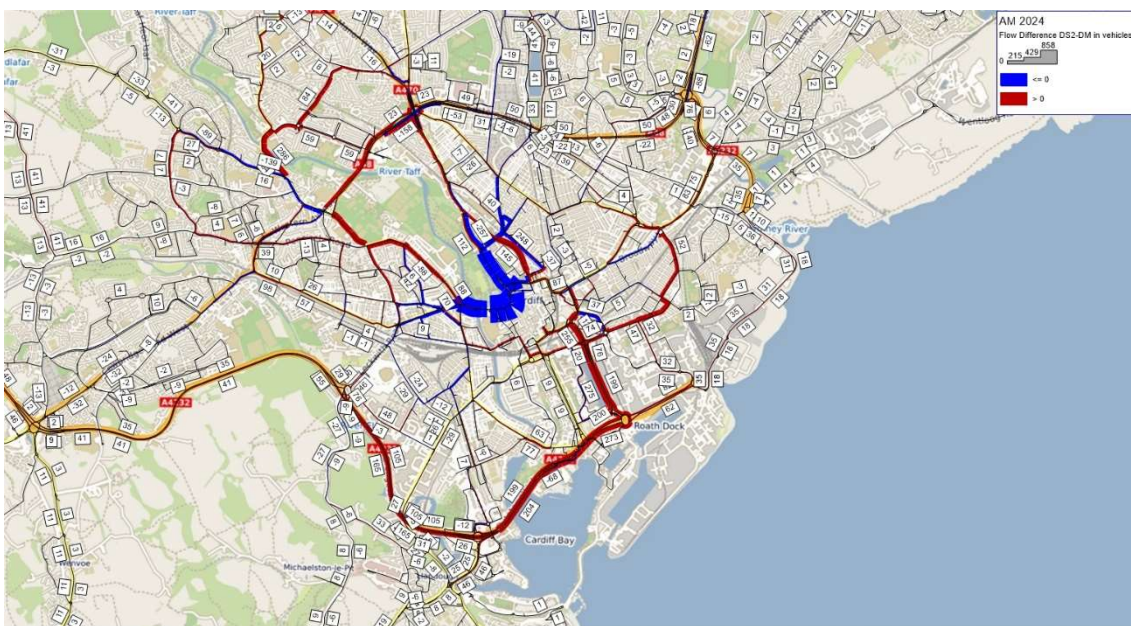


Figure 3.6: Castle Street Option 2, Flow Difference vs DM, AM Peak View 2

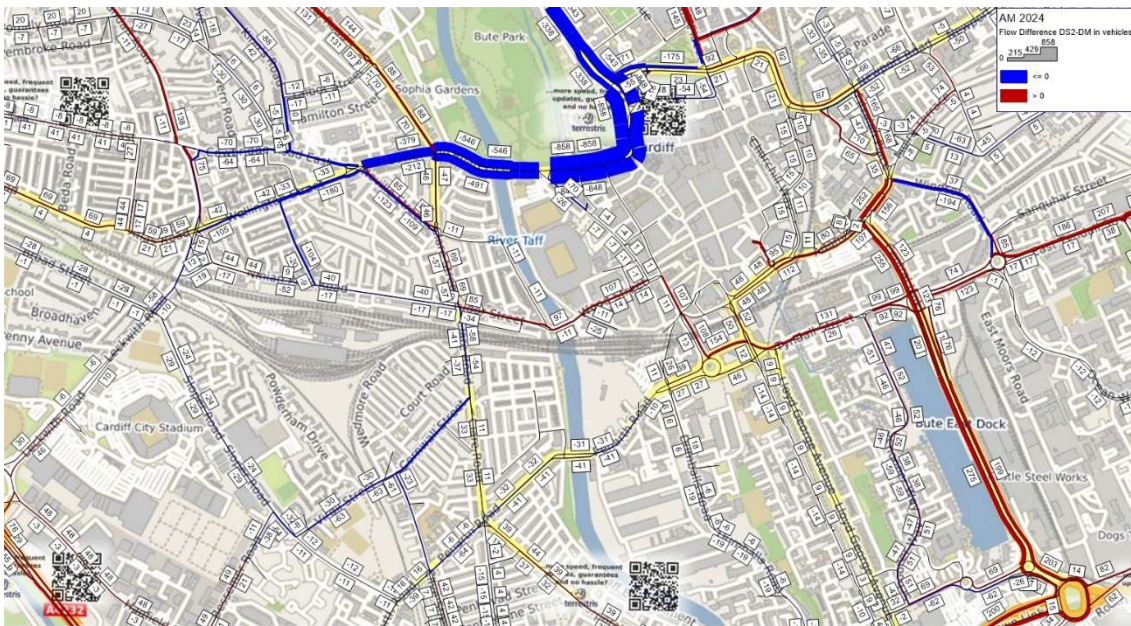


Figure 3.7 and Figure 3.8 below illustrate the flow differences arising from Castle Street Option 2 in the PM peak. Similar patterns are seen again when compared with the changes brought about by Option 2, with small increases in the size of flow reductions on Castle Street and nearby links, commensurate with the further changes in Option 2.

Figure 3.7: Castle Street Option 2, Flow Difference vs DM, PM Peak View 1

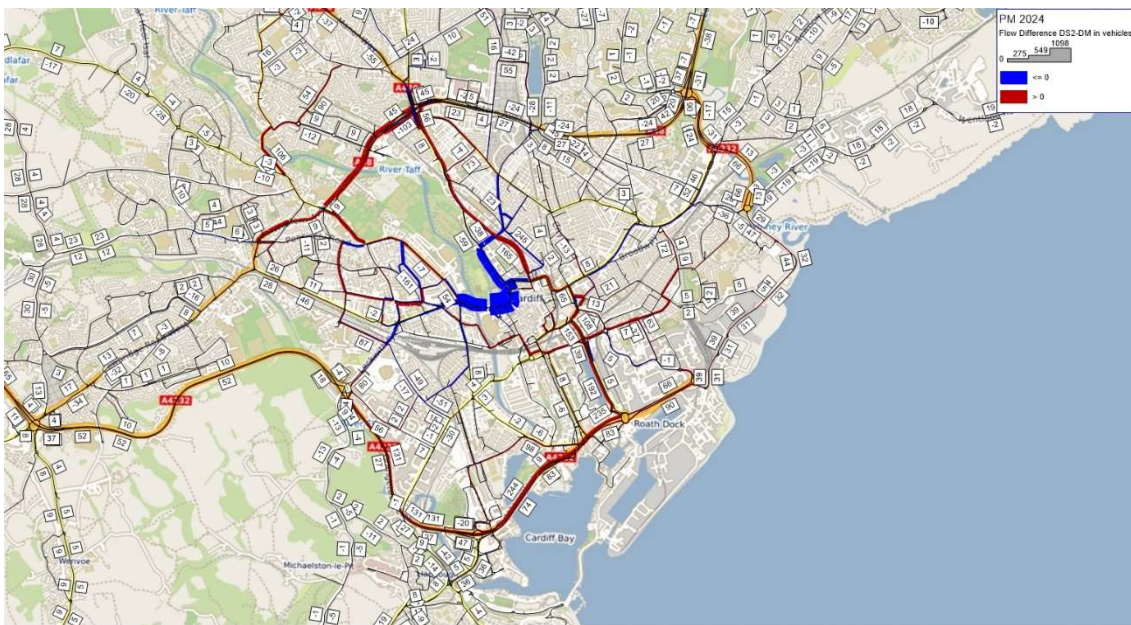
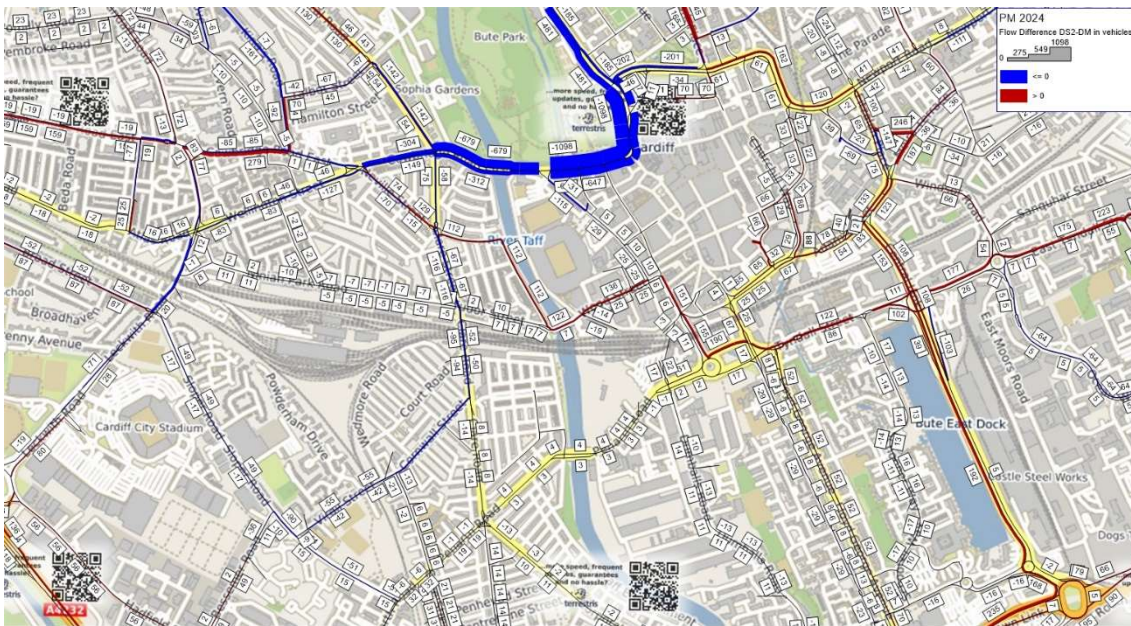


Figure 3.8: Castle Street Option 2, Flow Difference vs DM, PM Peak View 2



3.3 Flows on Key Links

Table 3-1 below illustrates the forecast changes in traffic flow on Castle Street and other key links for Option 1, corresponding to the flow differences show in Figure 3.1 - Figure 3.4. The most significant changes, both in percentage and absolute terms, are the decreases in flow on Castle Street east of Westgate Street. Whilst greater changes are forecast on other links in absolute terms, the second most affected location with respect to percentage change is Cowbridge Road East. At a 24-hour level there are increases on Cathedral Road, though there are decreases for some directions and time periods. Table 3-2 displays the same information for Option 2, with similar patterns observed.

Table 3-1: Key Link Flow Changes DM vs DS1

Link	Direction	DM Flow (Demand)			DS1 Flow (Demand)			Change (Absolute)			Change (%)		
		AM	PM	AAWT	AM	PM	AAWT	AM	PM	AAWT	AM	PM	AAWT
Castle St (east of Westgate St)	EB	870	1110	9770	90	120	1050	-780	-990	-8720	-90%	-89%	-89%
	WB	860	660	9630	70	90	1070	-790	-560	-8560	-92%	-86%	-89%
Castle St (west of Westgate St)	EB	910	880	9060	420	280	4640	-490	-600	-4420	-54%	-68%	-49%
	WB	640	530	8680	170	260	4250	-470	-270	-4430	-73%	-51%	-51%
Westgate St (north of bus gate)	NB	170	340	4810	140	230	3980	-30	-110	-830	-16%	-31%	-17%
	SB	430	230	5030	380	210	4370	-60	-20	-660	-13%	-7%	-13%
Boulevard De Nantes	EB	770	400	6990	520	220	4190	-250	-180	-2800	-32%	-46%	-40%
	WB	320	630	6620	270	580	4850	-50	-50	-1770	-14%	-8%	-27%
North Road (north of Blvd de Nantes)	NB	610	1070	8990	320	670	5350	-290	-400	-3640	-48%	-37%	-40%
	SB	1040	390	9220	540	280	4710	-500	-120	-4520	-48%	-29%	-49%
Cathedral Road (north of Castle St)	NB	430	400	5710	500	460	6730	80	60	1020	18%	14%	18%
	SB	520	540	5240	600	410	6070	90	-130	840	17%	-24%	16%
Cowbridge Rd E (west of Cathedral Rd)	EB	440	340	3860	90	70	1190	-350	-270	-2660	-80%	-80%	-69%
	WB	270	190	3290	70	60	1130	-200	-130	-2160	-76%	-68%	-66%

Tudalen 101

Table 3-2: Key Link Flow Changes DM vs DS2

Link	Direction	DM Flow (Demand)			DS2 Flow (Demand)			Change (Absolute)			Change (%)		
		AM	PM	AAWT	AM	PM	AAWT	AM	PM	AAWT	AM	PM	AAWT
Castle St (east of Westgate St)	EB	870	1110	9770	10	10	130	-860	-1100	-9640	-99%	-99%	-99%
	WB	860	660	9630	10	10	170	-850	-650	-9470	-99%	-99%	-98%
Castle St (west of Westgate St)	EB	910	880	9060	370	200	4180	-550	-680	-4880	-60%	-77%	-54%
	WB	640	530	8680	150	220	3920	-490	-310	-4760	-77%	-58%	-55%
Westgate St (north of bus gate)	NB	170	340	4810	140	220	3850	-30	-110	-960	-15%	-34%	-20%
	SB	430	230	5030	360	200	4130	-70	-30	-900	-16%	-14%	-18%
Boulevard De Nantes	EB	770	400	6990	490	200	3940	-270	-200	-3050	-35%	-50%	-44%
	WB	320	630	6620	260	580	4740	-60	-50	-1880	-17%	-7%	-28%
North Road (north of Blvd de Nantes)	NB	610	1070	8990	270	590	4820	-340	-480	-4170	-56%	-45%	-46%
	SB	1040	390	9220	500	210	4070	-540	-190	-5160	-52%	-47%	-56%
Cathedral Road (north of Castle St)	NB	430	400	5710	500	450	6750	70	50	1040	16%	14%	18%
	SB	520	540	5240	600	400	6110	90	-140	870	17%	-26%	17%
Cowbridge Rd E (west of Cathedral Rd)	EB	440	340	3860	60	40	940	-380	-300	-2920	-87%	-90%	-76%
	WB	270	190	3290	60	40	990	-210	-150	-2290	-79%	-77%	-70%

Tudalen 102

4 Economic Assessment Using TUBA

An economic assessment of the schemes has been undertaken using the fixed trip assignments with DfT's TUBA software. This section outlines the process and results for this analysis, based on a single year assessment.

4.1 Software and Economic File Versions

The economic assessment was undertaken using v1.9.17 of the TUBA software (the most up to date available). The economics inputs were based on the standard v1.9.19.0 release of the economics file, derived from the May '22 version of the TAG databook (designed to work with v1.9.17 of the software). Modifications were made to the economics file to combine the OGV1 and OGV2 goods vehicle classes into a single HGV class. Since the economic assessments were run, an updated version of the economics file has become available.

4.2 Other Parameters

The following assumptions were made as part of this assessment:

- First year: 2024;
- Horizon year: 2024;
- Modelled year: 2024; and
- Current year: 2023.

Given that a single forecast year has been modelled, TUBA requires both the first year and horizon year to be the same as the modelled year. The (dis)benefits discussed in this section are therefore only applicable to the single modelled year and would need to be profiled to cover the full appraisal period. This would require, amongst other things, an understanding of the changes to the proportion of taxis which are fully electric.

Annualisation factors have been applied representing the SEWTM hour to time-period factors multiplied by the usual number of weekdays in a year (253) – (dis)benefits covered in this section therefore only account for weekdays. These factors are:

- AM peak: 556;
- Inter-peak: 1518;
- PM peak: 601; and
- Off peak: 3289.

4.3 Treatment of Taxis and Non-Taxis

For ease of running the TUBAs, the two sets of taxi demand segments (electric and non-electric, by purpose) have been run through separate TUBAs assuming the same parameters as general cars. Parameters may differ between taxis and general cars in reality (and also between electric and non-electric taxis, particularly with respect to greenhouse gas emissions), however this approach is considered to be proportionate. Further, a full set of parameters specific to these types of vehicles is not presently available. General cars have been assessed using the same TUBA run as for HGVs and LGVs.

4.4 TUBA Results

4.4.1 Disbenefit Totals

The total disbenefits of the two scheme options across all time periods and user classes are shown below in Table 4-1. These values represent single year disbenefits and are (as standard) presented in 2010 prices, discounted to 2010. Modelling has been undertaken on a highway-basis only, therefore PT fare benefits are not shown in this table. For a frame of reference, the single year (2021) disbenefit for the CASAP package of schemes submitted during the final business case for the previous study was -£3.2m across all benefit types.

Table 4-1: Castle Street Scheme TUBA Results by Benefit Type, 2024 Values in 2010 Prices, Discounted to 2010

Scenario	Time benefit	Fuel VOC benefit	Non-fuel VOC benefit	Change in indirect tax revenue	Green House Gases	Total
DS1	-£6,949,000	-£1,223,000	-£858,000	£680,000	-£550,000	-£8,900,000
DS2	-£7,813,000	-£1,322,000	-£924,000	£735,000	-£594,000	-£9,918,000

As would be expected, the largest component of the disbenefit arises from user time in both scenarios. The disbenefit arises as travellers must take more circuitous routes as travel via Castle Street is now disallowed for most user classes. The disbenefit for Option 2 is greater than for Option 1 since in this scenario non-electric taxis, as well as non-taxi cars, LGVs and HGVs are subject to the restrictions. The additional user time disbenefit is in line with expectations, given the proportion of cars which are non-electric taxis.

There are VOC disbenefits in both options, owing to the increased network vehicle-km. Correspondingly, there are disbenefits in terms of greenhouse gas emissions, and benefits in terms of indirect tax revenue.

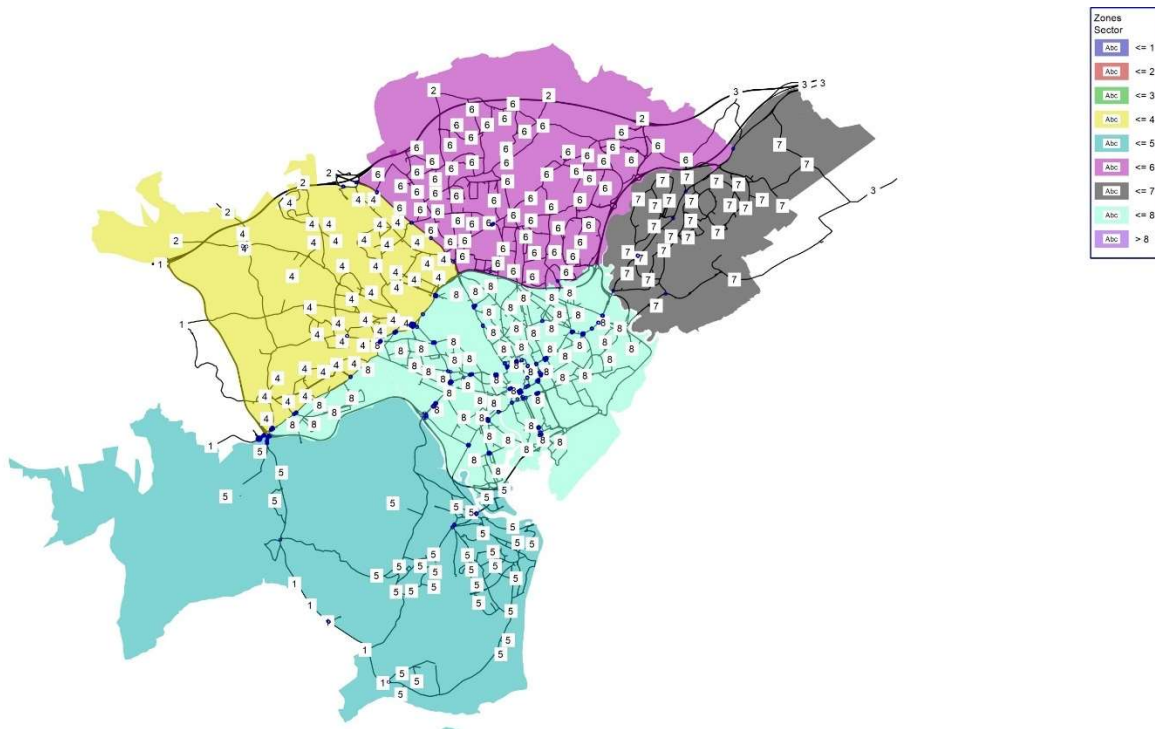
Were the Castle Street options assessed using a variable demand model run, it is likely that the disbenefits presented above in Table 4-1 would be lower. Likewise, the model operates on fixed timings for signals, which have not been altered for the DS scenarios except for a small area in the vicinity of the scheme; as there are significant traffic flow changes over a much larger area, disbenefits could be alleviated by optimising signal timings, as might naturally be expected to occur where traffic signals are demand actuated.

4.4.2 Sectorised Results

A sector system has been defined as follows, and as shown below in Figure 4.1:

- Sector 1: External West;
- Sector 2: External North;
- Sector 3: External East;
- Sector 4: Internal North West;
- Sector 5: Internal SW Of A4232;
- Sector 6: Internal North;
- Sector 7: Internal East: and
- Sector 8: Internal Central.

Figure 4.1: Sector Definitions



For the purposes of brevity, only sectorised values for time benefit and across all time periods and demand segments are shown in this report. A spreadsheet has been supplied containing pivot tables to enable the user to interrogate these results in greater detail.

4.4.2.1 Option 1 Sectorized Results

Table 4-2 below shows the sectorised time disbenefits for Option 1. Sector 8, where Castle Street is situated, shows the most significant disbenefits, with around a third of the total time disbenefit deriving from intra-sector trips within this area. Approximately 80% of the total time disbenefit arises for movements with at least one trip end in this sector. Whilst disbenefits are significant, this illustrates that they are predominantly limited to an area within the vicinity of the scheme itself. Other than sector 8, the most significant disbenefits are between Sector 4 (internal North West) and Sector 6 (internal North). These arise because of reassignment to the A48 and other parallel routes, which are used heavily to facilitate movements between these two sectors.

There are small levels of benefits between some sectors, arising from second order effects of reassignment, for example between sectors 5 and 2. These are small, around 1% of the total disbenefit.

Table 4-2: Sectorised Time Disbenefits - Option 1

	1	2	3	4	5	6	7	8	Grand Total
1	-17,487	-36,021	-73,397	-13,541	-9,128	-78,780	-24,707	-63,720	-316,782
2	-15,108	74	-10,225	-23,659	-9,627	-13,745	-3,008	-71,459	-146,756
3	-29,301	341	4	-44,896	-23,862	6,413	802	-217,760	-308,260
4	-5,032	-10,108	-95,662	-96,452	-3,018	-260,802	-19,060	-281,411	-771,545
5	-36,573	36,045	-56,673	-19,220	-12,970	-73,863	-40,348	-91,426	-295,030
6	-24,822	9,197	14,102	-129,997	-28,804	11,288	9,707	-337,796	-477,125

	1	2	3	4	5	6	7	8	Grand Total
7	-11,748	-497	-16	-17,705	-33,031	-9,219	-3,873	-100,922	-177,012
8	-174,973	-198,600	-355,196	-434,780	-87,580	-702,729	-149,679	-2,352,932	-4,456,469
Grand Total	-315,044	-199,570	-577,064	-780,250	-208,020	-1,121,438	-230,166	-3,517,426	-6,948,980

4.4.2.2 Option 2 Sectorised Results

Table 4-3 below shows the sectorised time disbenefits for Option 2. The sectorised time disbenefits for Option 2 replicate those for Option 1; again, around a third of the disbenefit arises for trips entirely within Sector 8, with around 80% of the disbenefit occurring for movements with at least one trip end in this sector. Otherwise, the largest disbenefits again occur between sectors 4 and 6. Again, the positive benefit totals are around 1% of the total disbenefit.

Table 4-3: Sectorised Time Disbenefits - Option 2

	1	2	3	4	5	6	7	8	Grand Total
1	-20726	-42110	-84398	-15743	-12635	-89194	-28725	-73006	-366538
2	-17503	75	-11740	-26702	4177	-13459	-3856	-88914	-157924
3	-34754	1053	4	-49335	-29436	6960	583	-237542	-342466
4	-6552	-11362	-105840	-109099	-4955	-279701	-21515	-319005	-858028
5	-41399	31404	-63065	-21555	-13824	-85482	-44602	-99093	-337614
6	-31339	10862	16333	-143967	-37076	13654	9321	-410218	-572430
7	-14041	-53	-142	-19146	-38593	-10023	-4250	-117018	-203265
8	-198591	-225377	-392128	-484970	-98997	-780831	-169961	-2624134	-4974989
Grand Total	-364906	-235507	-640976	-870517	-231338	-1238075	-263004	-3968930	-7813253





CARDIFF CASTLE STREET UPDATED AQ ASSESSMENT REPORT

Report for: Cardiff City Council

Ref. PO 4501784228

Ricardo ref. ED16675

Issue: 3

20/02/23

Customer:
Cardiff City Council

Customer reference:
PO 4501784228

Confidentiality, copyright and reproduction:

This report is the Copyright of Cardiff City Council and has been prepared by Ricardo Energy & Environment, a trading name of Ricardo-AEA Ltd under contract Castle Street 2023 Updated AQ report dated 18th Oct 2022. The contents of this report may not be reproduced, in whole or in part, nor passed to any organisation or person without the specific prior written permission of [Client name]. Ricardo Energy & Environment accepts no liability whatsoever to any third party for any loss or damage arising from any interpretation or use of the information contained in this report, or reliance on any views expressed therein, other than the liability that is agreed in the said contract

Ricardo reference:
ED16675

Contact:
Guy Hitchcock Gemini Building, Fermi Avenue,
Harwell, Didcot, OX11 0QR, UK

T: +44 (0) 1235 753 327
E: guy.hitchcock@ricardo.com

Author:
Rob Benney, Rohan Patel, James Southgate, Jamie Bost, Victoria Thomson

Approved by:
Guy Hitchcock

Signed



Date:
20/02/23

Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001.

Ricardo, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to as the 'Ricardo Group'. The Ricardo Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Ricardo Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

EXECUTIVE SUMMARY

Ricardo Energy and Environment have undertaken an air pollutant dispersion study at the request by Cardiff City Council to support their understanding of the potential impacts on air quality by a proposed alteration to the current road network scheme for Cardiff Castle Street. Cardiff City Council have requested that only the impacts of the proposed changes on annual averaged concentrations of Nitrogen Dioxide (NO₂) were considered.

Cardiff City Council have requested that two scenarios were modelled for the year 2024 as part of this study:

- Do minimum – No alterations are made to the current Castle Street road scheme
- Do something - Restricting the use of Castle Street to bus and taxis services only

A third model which predicted concentrations across Cardiff for the year 2022 was also run. This model was used to assess the model’s performance at locations where real concentrations were captured by the local NO₂ monitoring network.

Additionally, Cardiff City Council are considering a third scenario where access to the Castle Street is restricted to the use of electric buses and taxis only. This scenario was only modelled in an indicative way and not with a full dispersion model run.

This report details the approach undertaken to complete this assessment and the results from the air dispersion modelling.

The results from this study found that:

- The 2022 baseline scenario indicates that there were no exceedances of the NO₂ annual average concentration above the 40µg/m³ target threshold. There were six locations likely to have been above the 90% compliance threshold i.e. above 36 µg/m³, and one of these PCM links is on Castle Street. It is noted that only small stretches of these road links were above these thresholds whilst the majority of PCM receptors along these road links are expected to be below 36 µg/m³.
- The 2024 do minimum model suggests that the maximum concentration on all road links will be below 36 µg/m³, including on Castle Street.
- The 2024 do something model suggests that the maximum concentration on all road links will be below 36 µg/m³.

The results from the study therefore show that:

- Annual average NO₂ across Cardiff will be reduced naturally should the assumptions made in the do minimum scenario occur. This will bring the highest NO₂ concentration at PCM receptors to below 36 µg/m³.
- The 2024 do something model suggests that implementing further action targeting the reduction of annual averaged NO₂ concentration along Castle Street would further reduce concentrations on Castle Street.

CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	1
1.1 BACKGROUND	1
1.2 MODELLING DOMAIN AND YEARS	2
2. MODEL AND RECEPTOR LOCATION SELECTION	4
2.1 DISPERSION MODEL	4
2.1.1 Meteorology	4
2.1.2 Canyon modelling	4
2.1.3 Gradient, tunnels and flyovers	6
2.2 RECEPTOR LOCATIONS	7
3. BASE YEAR MODELLING	9
3.1 BASE YEAR AND METEOROLOGICAL DATASET	9
3.2 ROAD TRAFFIC MODELLING	9
3.2.1 Average daily vehicle flow and speeds	9
3.2.2 Vehicle fleet composition	10
3.2.3 NOx/NO2 emissions assumptions	13
3.3 NON-ROAD TRANSPORT MODELLING AND BACKGROUND CONCENTRATIONS	14
3.4 MEASUREMENT DATA FOR MODEL CALIBRATION	14
4. PROJECTED FUTURE YEAR SCENARIO MODELLING	15
4.1 ROAD TRANSPORT FUTURE YEAR BASELINE	15
5. RESULTS	16
5.1 PCM RESULTS	16
6. SUMMARY	22
APPENDIX 1 MODEL VERIFICATION	23

1. INTRODUCTION

City of Cardiff Council (CCC) has previously carried out a Nitrogen Dioxide (NO₂) Feasibility Study directed by Welsh Government for non-compliance with the NO₂ limit values. The study assessed a number of options to improve air quality and a preferred package, the Clean Air Strategy Action Plan (CASAP), was agreed with Welsh Government to be taken forward. CASAP measures included the removal of one vehicle lane on Castle Street and a replacement cycle way, along with other traffic management measures in the centre, zero emission buses, retrofit existing buses, taxi licensing scheme, and a cycle superhighway.

During lockdown Castle Street was fully closed resulting in improvements in air quality but has since re-opened and is currently operating in line with the CASAP scheme agreed with WG. CCC have requested Ricardo to provide an updated assessment of the current Castle Street scheme with the latest available traffic and air quality data and compare this with an alternative which would see Castle Street closed to all traffic except taxis and buses. This report provides the draft results of this analysis covering:

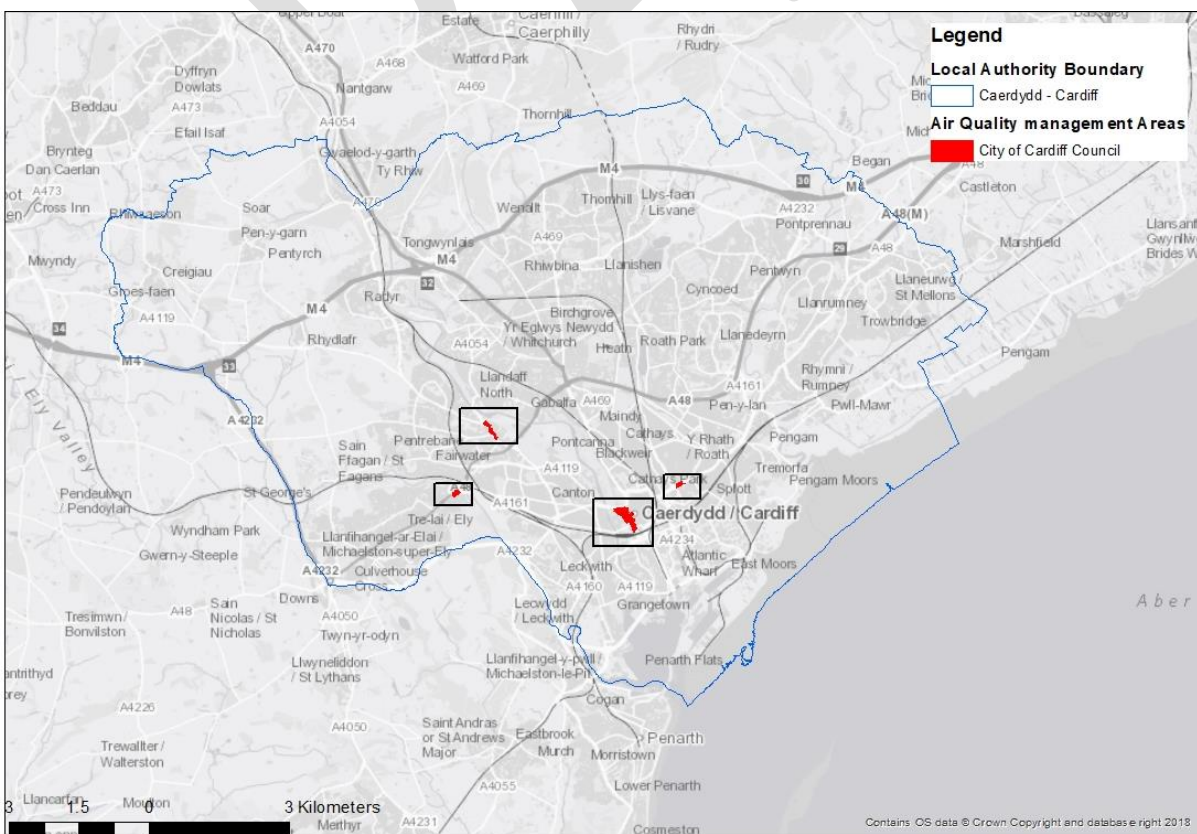
- An updated 2022 base year assessment with the current CASAP scheme in place
- A future 2024 forecast year with the current CASAP scheme in place (the do minimum scenario, DM)
- A future 2024 forecast year with the bus and taxi only scheme option in place (the do something scenario, DS)

An enhancement of the bus and taxi scheme, where only electric buses and taxis are given access, was also consider but has only been assessed in an indicative way as set out in the results.

1.1 BACKGROUND

Cardiff like many other urban areas, has elevated levels of NO₂ due mainly to road transport emissions. As such CCC has designated four Air Quality Management Areas (AQMA) across the city where concentrations of NO₂ breach Government, health-based air quality objectives as shown in Figure 1-1.

Figure 1-1 Cardiff Air Quality Management Areas (AQMA)



AQMAs cover the city centre, Ely bridge, Stephenson Court, and Llandaff. Cardiff have been proactive in managing air quality prior to the NO₂ feasibility study and proposed measures to improve air quality in these areas, and more widely across the city in the Form of a Clean Air Strategy. Cardiff have also bid for funding for Ultra low emission buses/zero emission buses which will introduce electric buses within Cardiff's AQMAs, and those areas identified within the Welsh Government Interim Supplemental Plan (WGSP), such as the city centre AQMA, Stephenson Court AQMA and the A470 corridor.

Subsequent work by Department for Environment Food and Rural Affairs (Defra) updated its air quality plan using more recent information on the expected real-world emission performance of vehicles. This latest analysis is suggesting that emissions from vehicles will be higher than previously estimated and so breaches of the air quality limits are likely to persist for longer, and over a wider area.

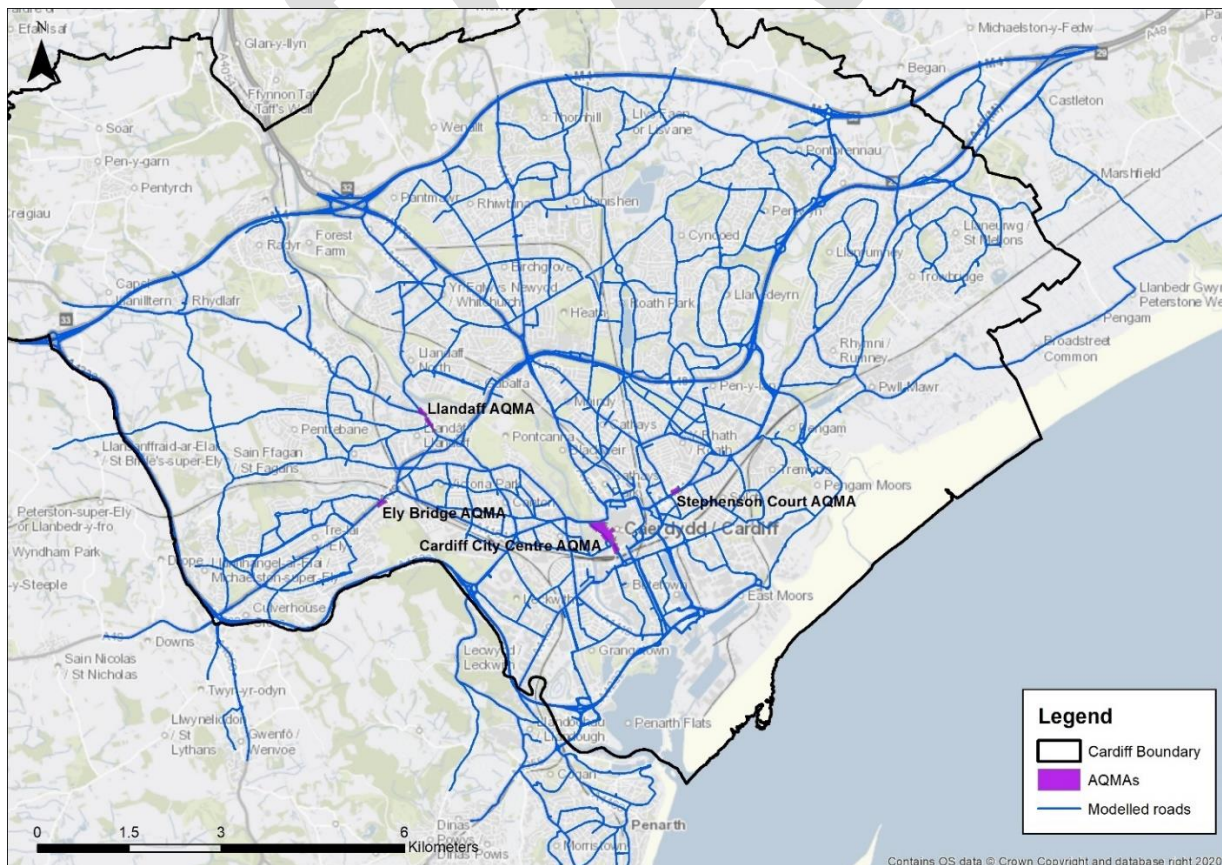
The latest study has carried out a fully updated assessment of air quality in and around Cardiff in relation to European limit values for NO₂ using the latest data on emission factors and traffic activity. This assessment has been used to establish the current extent of any air quality compliance with the existing CASAP scheme, and how this would compare with the bus and taxi only option going forward. This study will focus in particular on Castle Street area where previous exceedance issues were identified.

1.2 MODELLING DOMAIN AND YEARS

Modelling measure options and associated air quality impacts requires a model domain that covers the scheme options, relevant AQMAs and potential diversion routes. Therefore, the model domain shown in Figure 1-2 has been used to cover the following:

- All the AQMAs in Cardiff including the main areas of concern from the national modelling assessment along the A470 and A48;
- The wider transport network out to and including the M4 which will cover all the likely key diversion routes to avoid Castle Street;

Figure 1-2 Model domain



Two key model years are used in the modelling work: a 2022 base year and a 2024 future year (Table 1-1). The base year is taken as 2022 as this is the base year for the most recently validated transport model covering the area. To compliment this, the 2022 air quality data has been used to validate the air quality model.

Table 1-1 Model years

Scenario	Measure
2022	Base year – using latest available data on air quality and traffic.
2024	Future year – latest date when scheme is due to be in place.

DRAFT

2. MODEL AND RECEPTOR LOCATION SELECTION

2.1 DISPERSION MODEL

We have used the RapidAir modelling system for the study. This is Ricardo Energy & Environment's proprietary modelling system developed for urban air pollution assessment and the model that was used in other Clean Air Zone feasibility studies such as Derby, London and Southampton.

The model is based on convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD¹ model. The physical parameterisation (release height, initial plume depth and area source configuration) closely follows guidance provided by the USEPA in their statutory road transport dispersion modelling guidance². AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies (it is one of only two mandated models in the US and is widely used overseas for this application). The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir demonstrably fit for purpose for this study.

The USEPA have very strict guidelines on use of dispersion models and in fact the use of AERMOD is written into federal law in 'Appendix W' of the Guideline on Air Quality Models³. The RapidAir model uses AERMOD at its core and is evidently therefore based on sound principles given the pedigree of the core model.

The model produces high resolution concentration fields at the city scale (1 to 3m scale) so is ideal for spatially detailed compliance modelling. A validation study has been conducted in London using the same datasets as the 2011 Defra inter-comparison study⁴. Using the LAEI 2008 data and the measurements for the same time period the model performance is consistent (and across some metrics performs better) than other modelling solutions currently in use in the UK. The results of this study have been published in Environmental Modelling and Software⁵.

2.1.1 Meteorology

Modelling was conducted using the 2022 annual surface meteorological dataset measured at Cardiff City Centre measurement station. The dataset was processed in house using our own meteorological data gathering and processing system. We use freely available overseas meteorological databases which hold the same observations as supplied by UK meteorological data vendors. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; this was obtained from the closest radiosonde site and process with the surface data in the USEPA AERMET model. We have utilised data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). AERMET processing was conducted following the USEPA guidance. To account for difference between the meteorological site and the dispersion site, surface parameters at the met site were included as recommended in the guidance and the urban option specified for the dispersion site.; land use parameters were accessed from the CORINE land cover datasets⁶.

A uniform surface roughness value of 1.0 m was modelled to represent a typical city/urban environment.

2.1.2 Canyon modelling

The platform includes two very well-known street canyon algorithms with significant pedigree in the UK and overseas. The first replicates the functionality of the USEPA 'STREET' model. The code was developed by the Office of Mobile Source Air Pollution Control at the USEPA and published in a series of technical articles

¹ https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod

² <https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses>

³ 40 CFR Part 51 Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, Environmental Protection Agency, 2005

⁴ <https://uk-air.defra.gov.uk/research/air-quality-modelling?view=intercomparison>

⁵ Masey, Nicola, Scott Hamilton, and Iain J. Beverland. "Development and evaluation of the RapidAir® dispersion model, including the use of geospatial surrogates to represent street canyon effects." *Environmental Modelling & Software* (2018). DOI: <https://doi.org/10.1016/j.envsoft.2018.05.014>

⁶ EEA (2018) <https://www.eea.europa.eu/publications/COR0-landcover>

aimed at operational dispersion modellers in the regulatory community^{7,8}. The STREET model has been used for many years and has been adopted in dispersion modelling software such as AirViro. The USEPA canyon model algorithms are essentially the same as those recommended by the European Environment Agency for modelling canyons in compliance assessment⁹.

The RapidAir model also includes the AEOLIUS model which was developed by the UK Met Office in the 1990s. The AEOLIUS model was originally developed as a nomogram procedure¹⁰. The scientific basis for the model is presented in a series of papers by the Met Office^{11,12,13,14,15}. The model formulation shares a high level of commonality with the Operational Street Pollution Model^{16,17} (OSPM) which in turn forms the basis of the basic street canyon model included in the ADMS-Roads software. Therefore, the AEOLIUS based canyon suite in RapidAir aligns well with industry standards for modelling dispersion of air pollutants in street canyons.

Using available information on building heights and road widths, candidate locations for street canyons were identified. These locations were then checked using Google Street View to confirm the presence of a street canyon. For roads assigned as street canyons, the required information for the AEOLIUS street canyon model was populated – this includes building height, emissions and number of vehicles per hour. The canyon model is only turned on if the wind is blowing parallel across the canyon (± 5 degrees) i.e. the wind must be between 40 and 50 degrees from the orientation of the canyon. For each hour in the meteorological data (same as that described in 2.1.1) with wind direction matching the criteria to turn the street canyon on, the leeward, windward and parallel street canyon concentrations were calculated. To provide annual street canyon concentrations, the sum of the data contained within each of leeward, windward and parallel was calculated.

The results from the street canyon module were combined with the concentrations modelled in the dispersion step of RapidAir. The annual leeward and annual windward concentrations were added together, then this was added to the dispersion modelled road NO_x.

Figure 2-1 shows the locations of street canyons included in the modelling.

⁷ Ingalls., M. M., 1981. Estimating mobile source pollutants in microscale exposure situations. US Environmental Protection Agency. EPA-460/3-81-021

⁸ USEPA Office of Air Quality Planning and Standards., 1978. Guidelines for air quality maintenance planning and analysis, Volume 9: Evaluating indirect sources. EPA-450/4-78-001

⁹ <http://www.eea.europa.eu/publications/TEC11a/page014.html>

¹⁰ Buckland AT and Middleton DR, 1999, Nomograms for calculating pollution within street canyons, Atmospheric Environment, 33, 1017-1036.

¹¹ Middleton DR, 1998, Dispersion Modelling: A Guide for Local Authorities (Met Office Turbulence and Diffusion Note no 241: ISBN 0 86180 348 5), (The Meteorological Office, Bracknell, Berks).

¹² Buckland AT, 1998, Validation of a street canyon model in two cities, Environmental Monitoring and Assessment, 52, 255-267.

¹³ Middleton DR, 1998, A new box model to forecast urban air quality, Environmental Monitoring and Assessment, 52, 315-335.

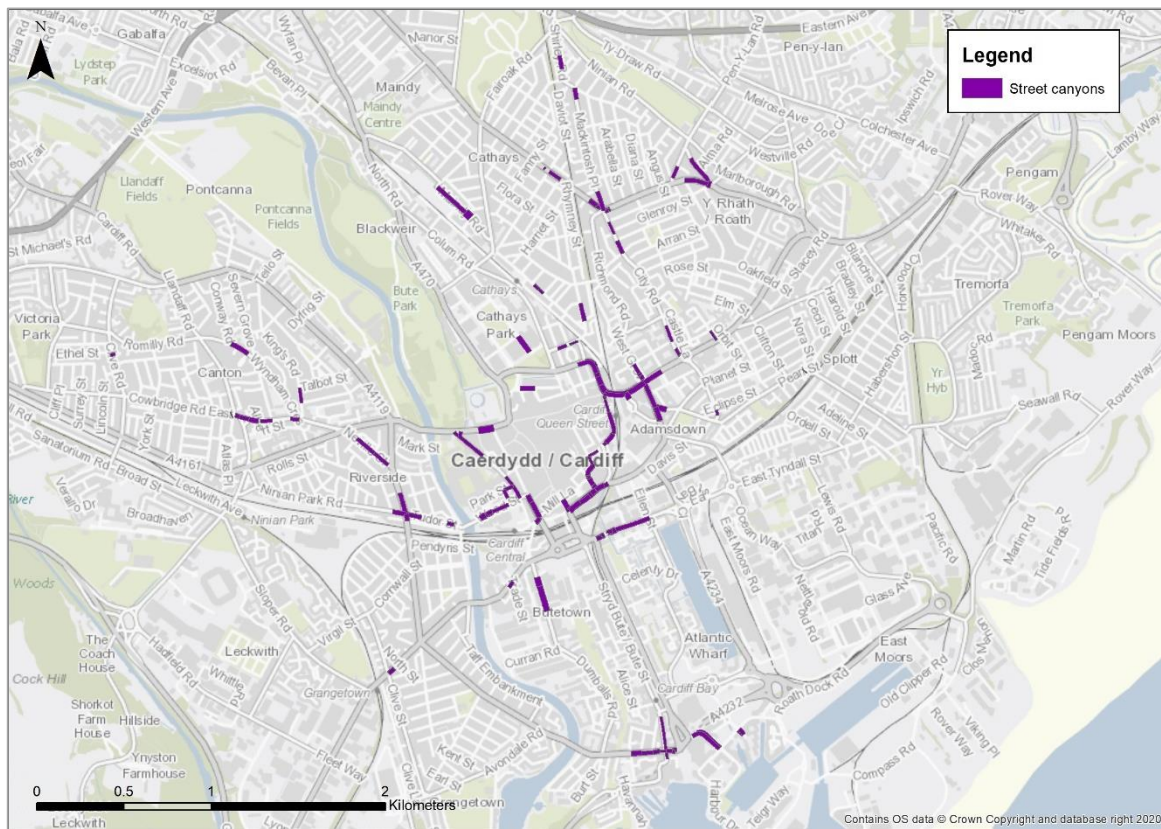
¹⁴ Manning AJ, Nicholson KJ, Middleton DR and Rafferty SC, 1999, Field study of wind and traffic to test a street canyon pollution model, Environmental Monitoring and Assessment, 60(2), 283-313.

¹⁵ Middleton DR, 1999, Development of AEOLIUS for street canyon screening, Clean Air, 29(6), 155-161, (Nat. Soc for Clean Air, Brighton, UK).

¹⁶ Hertel O and Berkowicz R, 1989, Modelling pollution from traffic in a street canyon: evaluation of data and model development (Report DMU LUFT A129), (National Environmental Research Institute, Roskilde, Denmark).

¹⁷ Berkowicz R, Hertel O, Larsen SE, Sørensen NN and Nielsen M, 1997, Modelling traffic pollution in streets, (Ministry of Environment and Energy, National Environmental Research Institute, Roskilde, Denmark).

Figure 2-1 Location of street canyons modelled



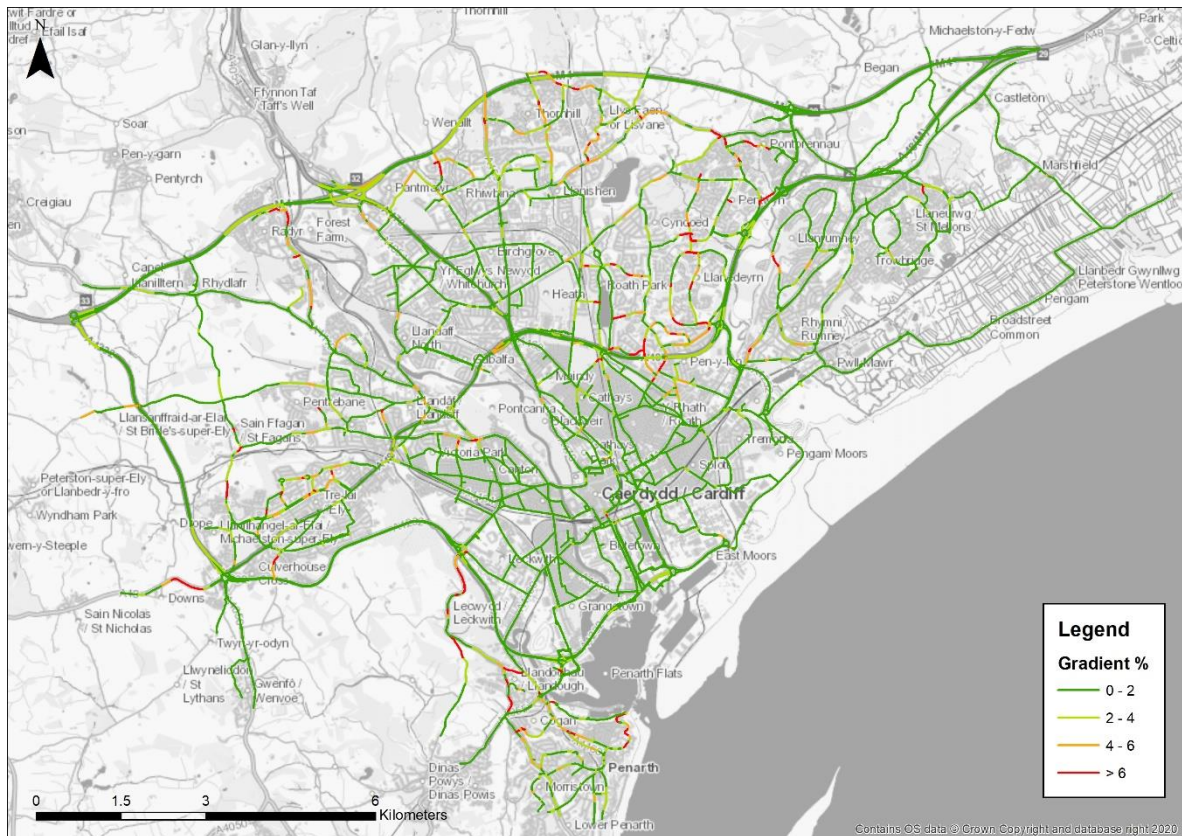
2.1.3 Gradient, tunnels and flyovers

Gradient effects have been included for relevant road links during emissions calculations. LIDAR Composite Digital Terrain Model (DTM) and Digital Surface Model (DSM) datasets at 1m resolution are available over the proposed model domain¹⁸. Link gradients across the model domain can be calculated using GIS spatial analysis of LIDAR datasets.

Figure 2-2 shows the roads where gradient effects were included during emissions calculations.

¹⁸ <http://lle.gov.wales/GridProducts#data=LidarCompositeDataset>

Figure 2-2 Gradient effects (absolute value of gradient percent)



No modelling of tunnels or flyovers was included as the RapidAir kernel approach applies the same source height across the model domain. All roads provided by the traffic modellers within CCC boundary were modelled at ground level, this includes both flyovers and tunnels. For example, the A4232, Cardiff Bay Link Road, flyover and tunnel have been included. If modelling of flyovers was considered to be beneficial for this assessment, we could have modelled road link at a higher elevation using a dispersion kernel created with a different source height in AERMOD. It was not however considered beneficial to do this for this assessment.

2.2 RECEPTOR LOCATIONS

As RapidAir produces concentration grids (in raster format), modelled NO₂ concentrations can be extracted at receptor locations anywhere on the 1m resolution model output grid. For comparison with PCM model results, annual mean concentrations at a distance of 4m from the kerb have been extracted from the RapidAir data and presented as a separate model output file. This will allow the selected locations to be assessed according to the Air Quality Directive (AQD) requirements Annex III A, B, and C3.

To aid interpretation of the outcomes of the study when considering compliance with the air quality directive (AQD), annual mean concentrations at the roadside exceedance locations identified in the PCM model were extracted from the RapidAir dispersion model results and presented as a separate model output file. Roadside receptor locations in the PCM model are at a distance of 4m from the kerb and at 2m height. A subset of the OS Mastermap GIS dataset provided spatially accurate polygons representing the road carriageway, receptor locations were then placed at 10m intervals along relevant road links using a 4m buffer around the carriageway polygons. For Cardiff's modelling exercise concentrations were sampled at 4m from the kerbside and at a height of 1.5 metres.

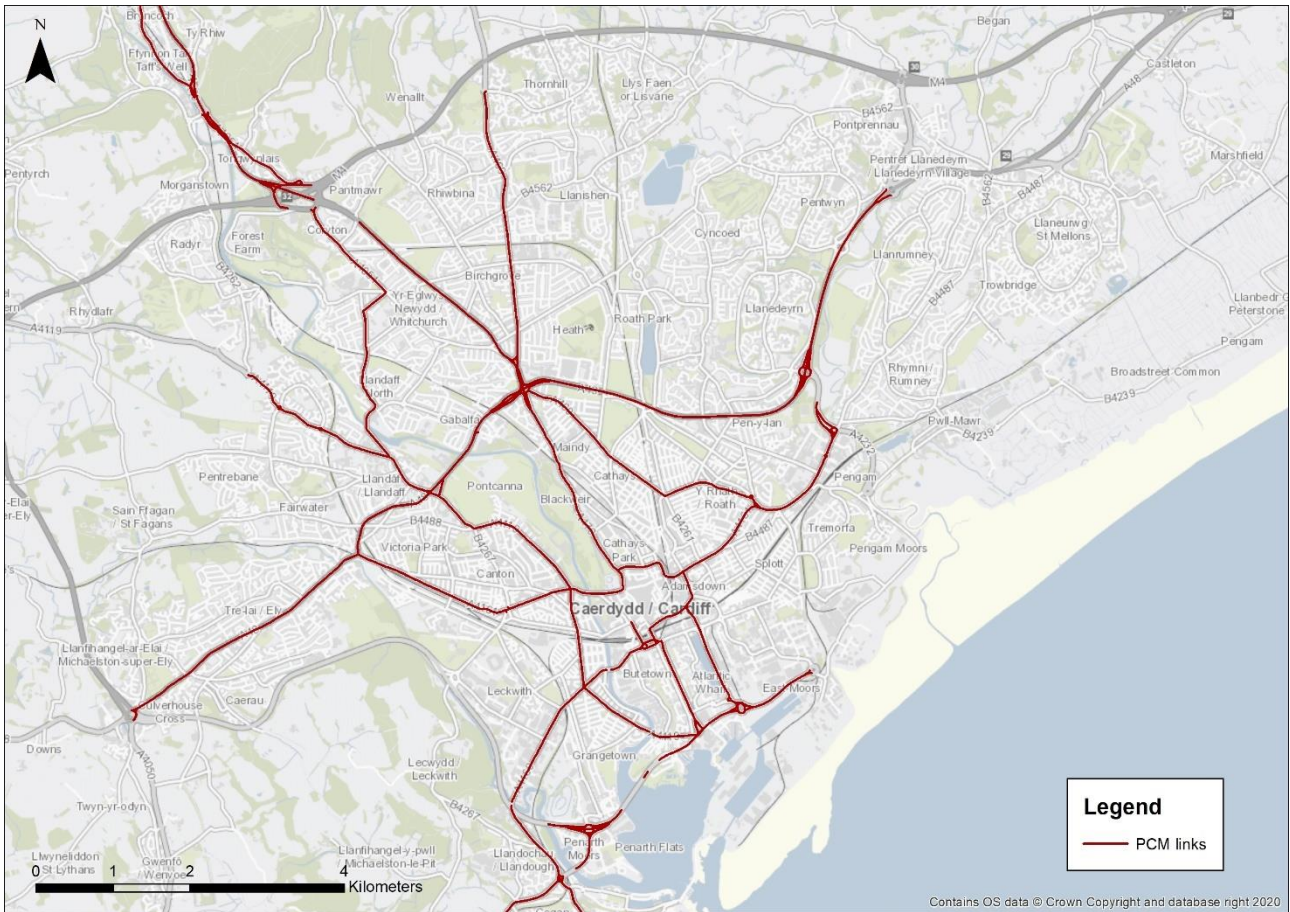
Annex III of the AQD specifies that microscale sampling should be at least 25 m from the edge of major junctions. When reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain have also been excluded.

Geospatial analysis permitted point allocation to the closest Census IDs used within the PCM model. The maximum estimated concentration at discrete receptors representative of Census IDs were used for this

localised dispersion modelling study. Consequently, the worst-case modelled concentrations are being used in comparison with those from the PCM model.

Figure 2-3 shows the PCM links in Cardiff. PCM receptors generated along these links for the previous modelling work were updated with the latest Census IDs from the PCM 2018 baseline.¹⁹

Figure 2-3 PCM links



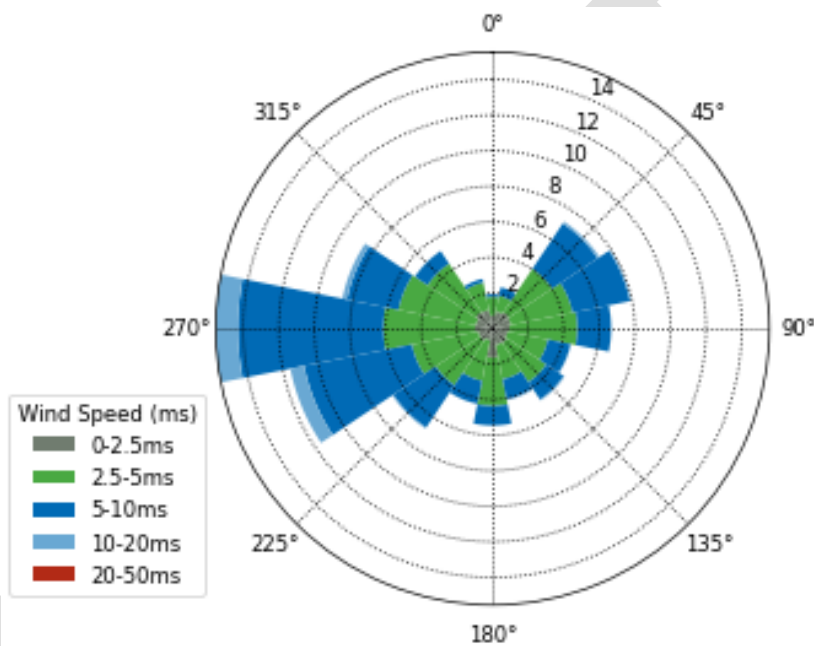
¹⁹ <https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data>

3. BASE YEAR MODELLING

3.1 BASE YEAR AND METEOROLOGICAL DATASET

A baseline year of 2022 has been used as the foundation of this study. The air dispersion model uses the 2022 annual surface meteorological dataset measured at Cardiff City Centre. The model uses an open overseas meteorological databases which hold the same observations as supplied by UK meteorological data vendors. The RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; we have derived this from the closest radiosonde site and process with the surface data in the USEPA AERMET model. Where necessary we have utilised data filling following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). A wind rose for the 2022 Cardiff City Centre met dataset is presented in Figure 3-1.

Figure 3-1 Windrose



3.2 ROAD TRAFFIC MODELLING

3.2.1 Average daily vehicle flow and speeds

Baseline and future year annual average daily traffic (AADT) link flows for each model link were calculated using 2022 traffic surveys from the South East Wales Transport Model (SEWTM) that covers the areas of Cardiff, Newport, Caerphilly and east of Swansea. Traffic flows were provided for the following vehicle types; cars, taxis, light goods vehicles (LGV), heavy goods vehicles (HGV). Bus flows were projected to 2022 from the previous modelling dataset using a conversion factor calculated from an analysis of bus timetable information.

Speeds were provided for four modelled periods: AM (peak hour 07:45-08:45), Inter-Peak (average of period 09:30-15:30), PM (peak hour 16:30-17:30) and Off-peak (average between 18:00-07:00). Ricardo calculated the AADT equivalent speeds with a weighted average. This involves summing the multiplication of each peak hour speed by the corresponding period traffic flow and dividing by AADT, see equation below.

$$AADT\ speed = \frac{(AM\ phs \times AM\ ptf) + (IP\ aps \times IP\ ptf) + (PM\ phs \times PM\ ptf) + (OP\ aps \times OP\ ptf)}{AADT}$$

Where: *phs* = peak hour speed
ptf = period traffic flow
aps = average period speed

In traffic modelling there is an area of detailed modelling (AODM) and rest of area (ROF), the former denotes areas where the traffic modellers have greater accuracy in traffic forecasts and the latter less accuracy. It has been confirmed all roads links included in the dispersion modelling exercise are within the AODM.

A standard diurnal profile calculated from DfT statistics TRA0307 was considered suitable for representing Cardiff's hourly traffic profile. This diurnal profile was used in RapidAir's dispersion model.

3.2.2 Vehicle fleet composition

The 4 core vehicle fleet types are; cars, LGVs, HGVs and buses. The subcategories of these vehicle types with emission rates are;

- Cars: are split into passenger/private, private hire taxis and hackney taxis;
- LGVs: there is no split for LGVs;
- HGVs: are split into articulated HGVs and rigid HGVs; and
- Buses: there is no split for buses.

These can be calculated using the latest COPERT 5.3 NOx emission functions.

The traffic model provided vehicle flows for four highway user classes which are: Car, LGV, HGV and Buses. HGVs were further broken down into rigid and articulated and cars were divided into private hire and Hackney taxis subcategories, this was undertaken using Automatic Number Plate Recognition (ANPR) data. ANPR locations were selected if they were in an area of key concern for air quality. This includes AQMAs and non-compliance links in the PCM model. One fleet mix was used across Cardiff.

The ANPR survey enables emission rates from road traffic to be represented in the greatest detail possible within COPERT 5.3, which includes:

1. Cars, split between Petrol and Diesel from pre-euro standards up to Euro 6 and alternative technologies such as electric and plug in hybrids;
2. Light Goods Vehicles (LGV) (<3.5 tonnes), split between Petrol and Diesel from pre-euro standards through to Euro 6; LGVs consist of Vans and People Carriers e.g. large passenger cars and mini-buses.
3. Rigid and Artic Heavy-Goods Vehicles (HGV), from pre-euro standards through to Euro 6.
4. Bus and Coach, from pre-euro standards through to EURO VI.
5. Motorcycles are an option within COPERT, however, the NAEI defaults for 2022 and 2024 have been used.

Emission calculations for each vehicle category will be based on vehicle fuel type and Euro classification. Information on the local fuel type mix and Euro standard distribution has been collected from the ANPR surveys conducted over 24 hours on 5th March 2022. The ANPR data were used to calculate the proportions of vehicle types, fuel splits, and Euro classification for the 2022 fleet used in the modelling. The fleet was projected forward to 2024 using NAEI projections for the future year modelling.

Representing Fleet Mixes with ANPR data

ANPR records were matched to the DVLA database. Each individual vehicle which has been captured and matched to the DVLA database has had a vehicle type assigned. Further detail provided includes the vehicle type associated with each vehicle captured e.g. car, LGV, HGV and bus. As mentioned above, there are euro standards for each of the vehicle types, as such these have been associated and used within the COPERT 5.3 emission calculations.

There were few vehicles classified as taxi in the 2022 ANPR dataset, and sub-types of PHV and Hackney were not available. The 2018 ANPR data from the previous modelling was used to determine the taxi fleet split as it was found to represent movement data reliably and included a PHV/Hackney split. It was projected forward to 2022 using 2022 taxi registration data provided by Cardiff County Council.

Figure 3-2 to Figure 3-8 present the Euro classification split for each vehicle type in 2022. For all vehicle types, the ANPR data show a slower fleet renewal in Cardiff than projected by the NAEI.

Figure 3-2 Car fuel type split

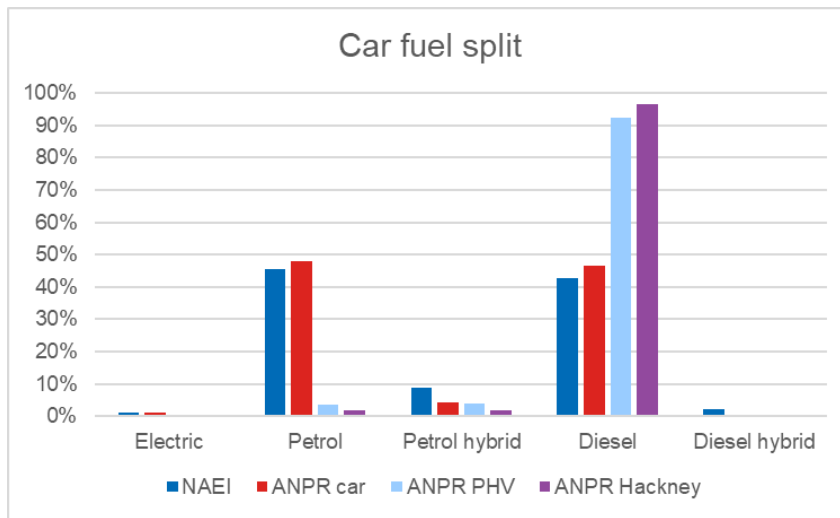


Figure 3-3 Diesel car Euro classification distribution

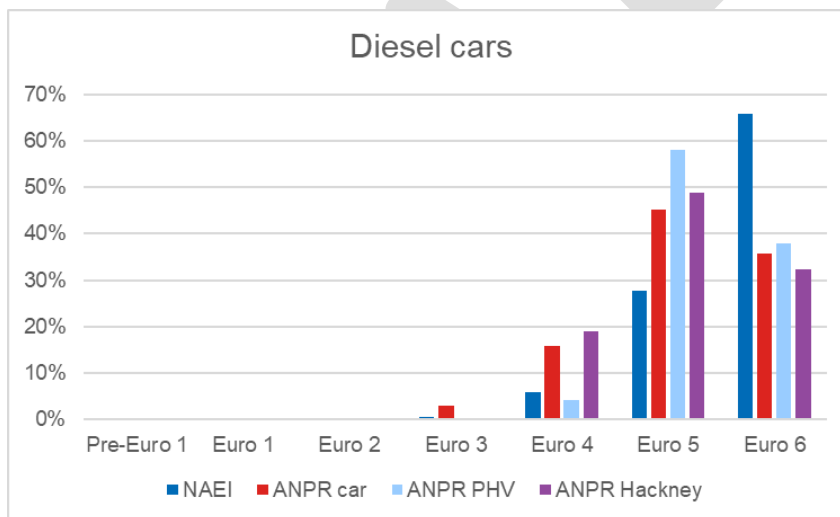


Figure 3-4 Petrol car Euro classification distribution

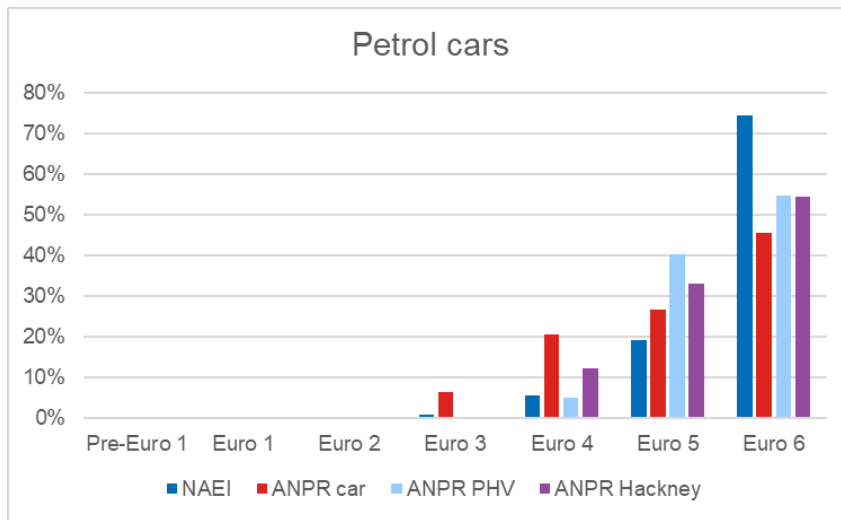


Figure 3-5 Diesel van Euro classification distribution

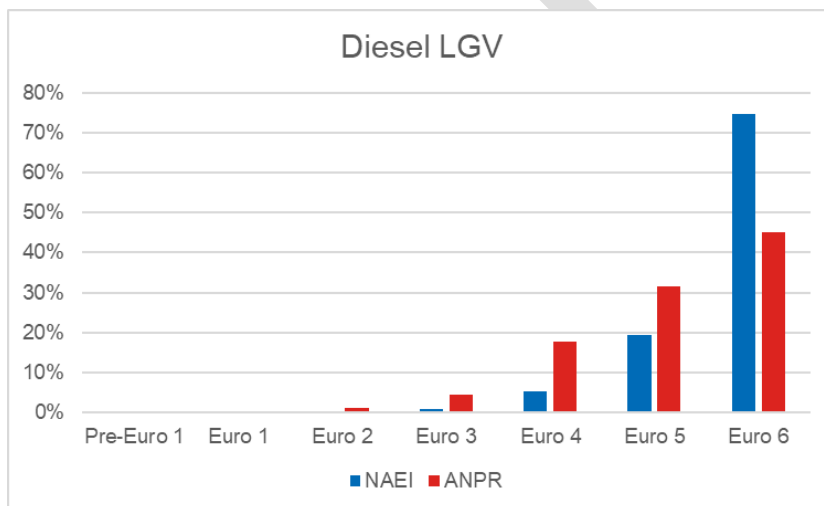


Figure 3-6 Rigid HGV Euro Classification distribution

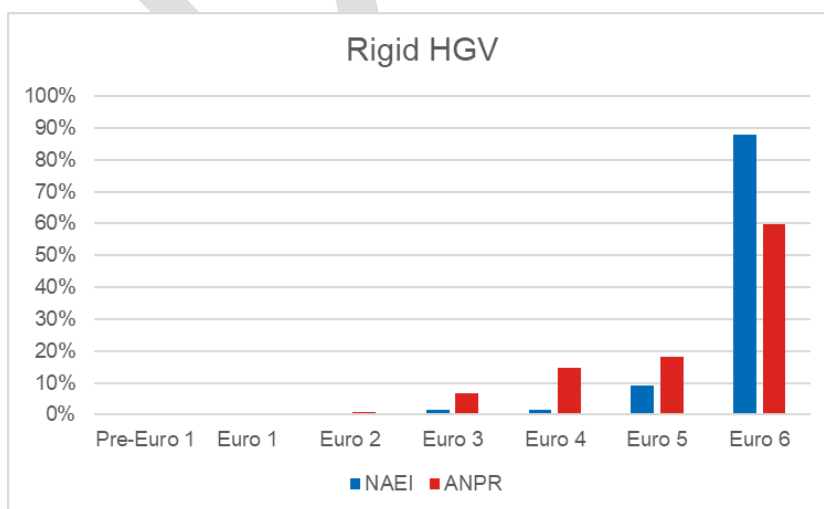


Figure 3-7 Artic HGV Euro Classification

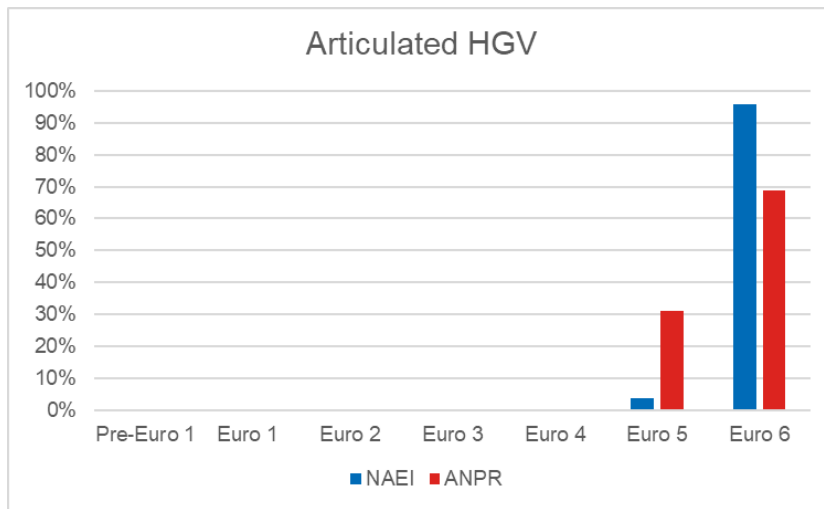
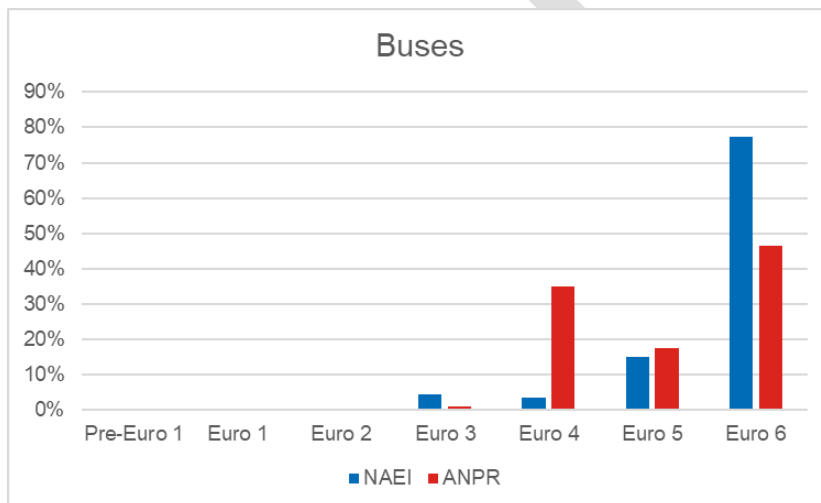


Figure 3-8 Bus Euro Classification



3.2.3 NOx/NO2 emissions assumptions

Link specific NOx emission factors have been calculated using the COPERT 5.3 emission functions for all vehicles up to and including Euro 6/VI. Emission rates have been calculated with our in-house emission calculation tool RapidEMS, which is fully consistent with COPERT 5.3 and links directly to our RapidAir dispersion modelling system.

JAQU recommend the use of data on primary NO₂ emissions (fNO₂) by vehicle type which is available via the NAEI website (based on 2014 NAEI) to provide a more detailed breakdown than the LAQM NOx to NO₂ convertor. This suggests a link specific f-NO₂ emissions estimate for use in the NO₂ modelling.

Based on this requirement, the RapidEMS road emissions calculation tool includes functionality to calculate NO₂ emission rates for each road link. Link specific fNO₂ fractions can then be calculated for each link by dividing NO₂ by total road NOx emission rate. Calculating link specific NO₂ emission rates also facilitate dispersion modelling of both road NOx and NO₂ across the entire model domain to produce separate concentration rasters, which can then be combined with background concentrations to calculate NO₂ concentrations in each grid cell.

The recently updated version (v8.1) of the LAQM NOx to NO₂ conversion spreadsheet has been used to convert road NOx, fNO₂ and background NOx into NO₂ concentrations where results at discrete receptor

locations are required. This currently includes all NO₂ monitoring site locations and receptors placed at 4m from the PCM road links.

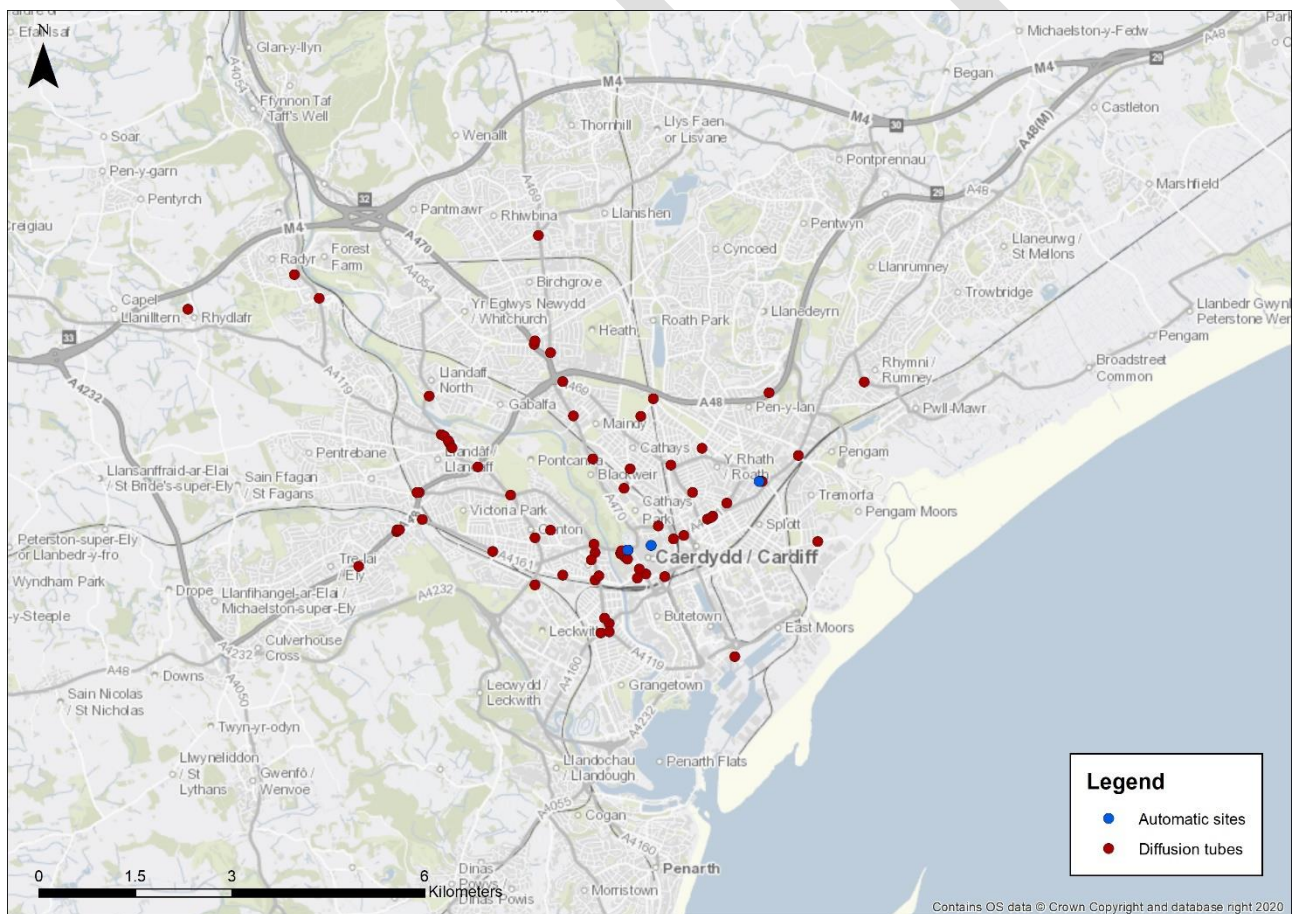
3.3 NON-ROAD TRANSPORT MODELLING AND BACKGROUND CONCENTRATIONS

The latest Defra NO_x background maps with a 2018 baseline were downloaded for 2022 and 2024.²⁰ The 1km resolution LAQM background maps were used to provide estimates for all sources with the exception of motorway, primary and trunk roads contribution. To avoid double counting of modelled road transport sources motorway, primary and trunk roads contributions were discounted from Defra’s background maps.

3.4 MEASUREMENT DATA FOR MODEL CALIBRATION

CCC’s 2022 automatic and diffusion tube annual mean NO₂ measurements from roadside sites were considered for model verification. Further information on model verification has been presented within Appendix 1. Information on monitoring data QA/QC, diffusion tube bias adjustment factors etc. will be as presented in the CCC’s 2023 LAQM Annual Progress Report. Diffusion tube data from the full year of 2022 was provided by CCC. Figure 3-9 displays the monitoring locations used in verification.

Figure 3-9 Monitoring locations



²⁰ <https://uk-air.defra.gov.uk/data/laqm-background-home>

4. PROJECTED FUTURE YEAR SCENARIO MODELLING

4.1 ROAD TRANSPORT FUTURE YEAR BASELINE

The assessment year for all future scenarios is 2024. The basic projections used for the future year baseline scenario are:

- AADT flows for future baseline year were provided from the SEWTM. Further information on how these traffic flows were derived and how local growth in traffic is calculated is presented in 'Transport Modelling Methodology Report'.
- Projected fleet split (vehicle type): All future year scenarios will have the four-core vehicle category fleet splits provided from the traffic model in the same breakdown as provided for the 2022 base year. The further split of HGVs into artic and rigid, and cars into private hire and hackneys will use the same ratios as derived for the 2022 baseline.
- Projected fuel type and Euro class distribution: a local fuel type and Euro class distribution has been projected forward from the local ANPR results to provide Euro class distributions for each of the future modelling years. This projection has been carried out in line with the draft methodology provided by JAQU. This has been done by deriving future scaling factors from the national NAEI data, applying these to the local ANPR results and then normalising to 100%. This gives an evolution of the local fleet that is slightly behind the national fleet. This can be seen in Figure 3-2 to Figure 3-8, which shows that the average Euro classes across all ANPR sites have a slower uptake of Euro VI than NAEI.

DRAFT

5. RESULTS

5.1 PCM RESULTS

An evaluation was undertaken to compare how concentrations of NO₂ from the three modelled scenarios compare to the outputs of PCM modelling undertaken for 2022 and 2024. Table 5-1 displays the maximum NO₂ value predicted at receptors at each given road link (Census ID). It is important to note that the PCM model forecasts values for 2022 and 2024 from a 2018 base year whilst the model used in this study has been validated against annual NO₂ measurements collected during 2022 and has been based upon fleet data captured by the city’s ANPR network.

Table 5-1 Maximum NO₂ concentrations on PCM links

CensusID	Previous ID	Road name	PCM Baseline		Local Baseline		2024 measures
			2022	2024	2022	2024 DM	2024 DS
802000522	312000	A48/ Cowbridge Rd West	20.2	17.9	30.4	24.9	24.8
802000638	317670	A4119/ Clare Rd	16.8	15.2	35.8	22.6	22.8
802000642	319033	A4160/ Fitzalan Place	25.6	23.3	37.2	28.4	29.6
802010527	315040	A48/ Western Avenue	23.3	20.8	29.4	25.9	27.1
802010629	314860	A4054/ Station Rd, Llandaff	13.2	11.8	21.0	18.6	19.4
802010655	315350	A4119/ Cardiff Rd	21.4	19.1	27.1	23.9	25.0
802010659	318000	A4160/ Penarth Rd	22.3	20.4	29.0	25.2	25.0
802010660	320730	A4161/ Newport Rd	28.7	25.7	34.7	29.1	29.3
802010661	317140	A4161/ Wellington St	18.2	16.5	20.7	18.0	17.5
802020527	320000	A48/ Eastern Avenue	35.1	31.2	39.2	33.4	33.3
802020548	317940	A470/ North Rd	22.0	19.6	26.2	23.5	20.2
802030659	314920	A4119/ Llantrisant Rd	19.2	17.1	21.4	19.0	19.4
802030660	318000	A4119/ Corporation Rd	15.6	14.2	38.0	31.1	32.2
802030665	318000	A4161/ Castle St	28.2	25.3	38.1	33.9	26.4
802040549	316998	A470/ North Rd	29.1	25.7	29.5	25.7	26.3
802040582	318000	A469/ Whitchurch Rd	21.7	19.4	32.9	28.9	28.8
802040655	317430	A4160/ Penarth Rd	18.7	16.8	20.6	18.9	18.9
802040656	319475	A4161/ Newport Rd	24.8	22.5	30.9	27.2	27.4
802050527	316017	A48/ Western Avenue	31.9	28.4	34.8	31.0	32.8
802050541	315785	A470/ Manor Way	25.1	22.4	37.2	32.4	32.4

CensusID	Previous ID	Road name	PCM Baseline		Local Baseline		2024 measures
			2022	2024	2022	2024 DM	2024 DS
802050580	316835	A469/ Caerphilly Rd	19.9	17.8	28.8	26.1	25.7
802050647	317550	A4119/ Lower Cathedral Rd	21.7	19.6	28.8	27.2	26.7
802050651	316145	A4119/ Cathedral Rd	20.5	18.3	28.6	24.9	28.0
802050657	314950	A4161/ Lansdowne Rd	20.6	18.3	21.8	19.4	19.4
802050660	318220	A4161/ Kingsway	27.7	24.8	28.2	25.3	19.8
802070055	318590	A4161/ Boulevard de Nantes	25.8	23.3	39.0	34.0	34.1
802074101	317500	A4232/ Grangetown Link	36.1	32.0	27.2	22.1	22.4
802077018	318580	A470/ Bute St	22.2	20.2	26.4	23.4	24.3
802080726	318210	A470/ St Mary St	20.9	18.5	30.3	30.4	31.2
802080896	319000	A470/ Lloyd George Avenue	19.8	18.8	28.8	23.8	24.1
802088061	318315	A4232/ Cardiff Bay Link Rd	32.5	28.9	32.7	27.4	27.8
802099671	316659	A469/ Thornhill Rd	18.8	16.8	25.4	23.0	22.9
802099955	318680	A4160/ Bute Terrace	24.7	22.3	35.4	32.3	33.5
802099956	319420	A4234/ Central Link	34.0	30.7	29.8	26.4	27.5
802099960	317740	A4055/ Cogan Spur	24.8	22.1	27.4	23.3	23.3
801050524	320725	A48/ Eastern Avenue	39.1	34.5	32.9	27.5	27.3

Table 5-1 shows that:

- The modelling predicts that annual averaged NO₂ concentrations differ from those predicted by the PCM model using a 2018 baseline. One potential explanation might be that the PCM model was based upon a fleet composition where a higher number of older vehicles were assumed to be replaced by a new vehicle. A likely impact of the pandemic and cost of living crisis is older vehicles may not have been replaced as quickly as expected.
- The modelled maximum annual average NO₂ concentration predicted in 2022 and 2024 (do minimum) by the model used in this study is predicted to be higher than the maximum values predicted by the PCM model.
- The 2022 baseline model does not indicate exceedances of the NO₂ annual average 40 µg/m³ threshold limit on any PCM links. The maximum concentration on the link representing Castle Street (census ID 802030665) was 38.1 µg/m³. As the model is known to over-predict concentrations in this location (see Appendix 1), exceedances on Castle Street are not likely.
- The 2024 do minimum model predicts that annual average NO₂ concentrations are likely to reduce on most PCM road links, and there are no exceedances of the NO₂ annual average 40 µg/m³ threshold limit. On Castle Street the maximum NO₂ concentration reduces to 33.9 µg/m³.
- The 2024 do something model also predicts that annual averaged NO₂ concentrations are likely to fall compared to both the 2022 baseline and 2024 do minimum scenario on Castle Street, where the peak

concentration is expected to be $26.4 \mu\text{g}/\text{m}^3$. There are no exceedances of the NO_2 annual average $40 \mu\text{g}/\text{m}^3$ threshold limit.

- Differences in NO_2 concentrations between the 2024 do minimum and 2024 do something are smaller at most locations than between the 2022 baseline and 2024 do minimum. In some locations, the maximum concentrations of the 2024 do something are slightly higher than the maximum 2024 do minimum; this is expected to be caused by traffic from vehicles other than buses and taxis that are diverted from Castle Street to surrounding roads. However, the diverted traffic is not predicted to cause exceedances of the NO_2 annual average $40 \mu\text{g}/\text{m}^3$ limit, even when model uncertainty is considered.

Figure 5-1 to Figure 5-4 shows how the data shown in Table 5-1 corresponds to PCM receptors and the associated road network across the study domain.

Figure 5-1: Maximum predicted NO_2 assigned to corresponding road links (2022 baseline)

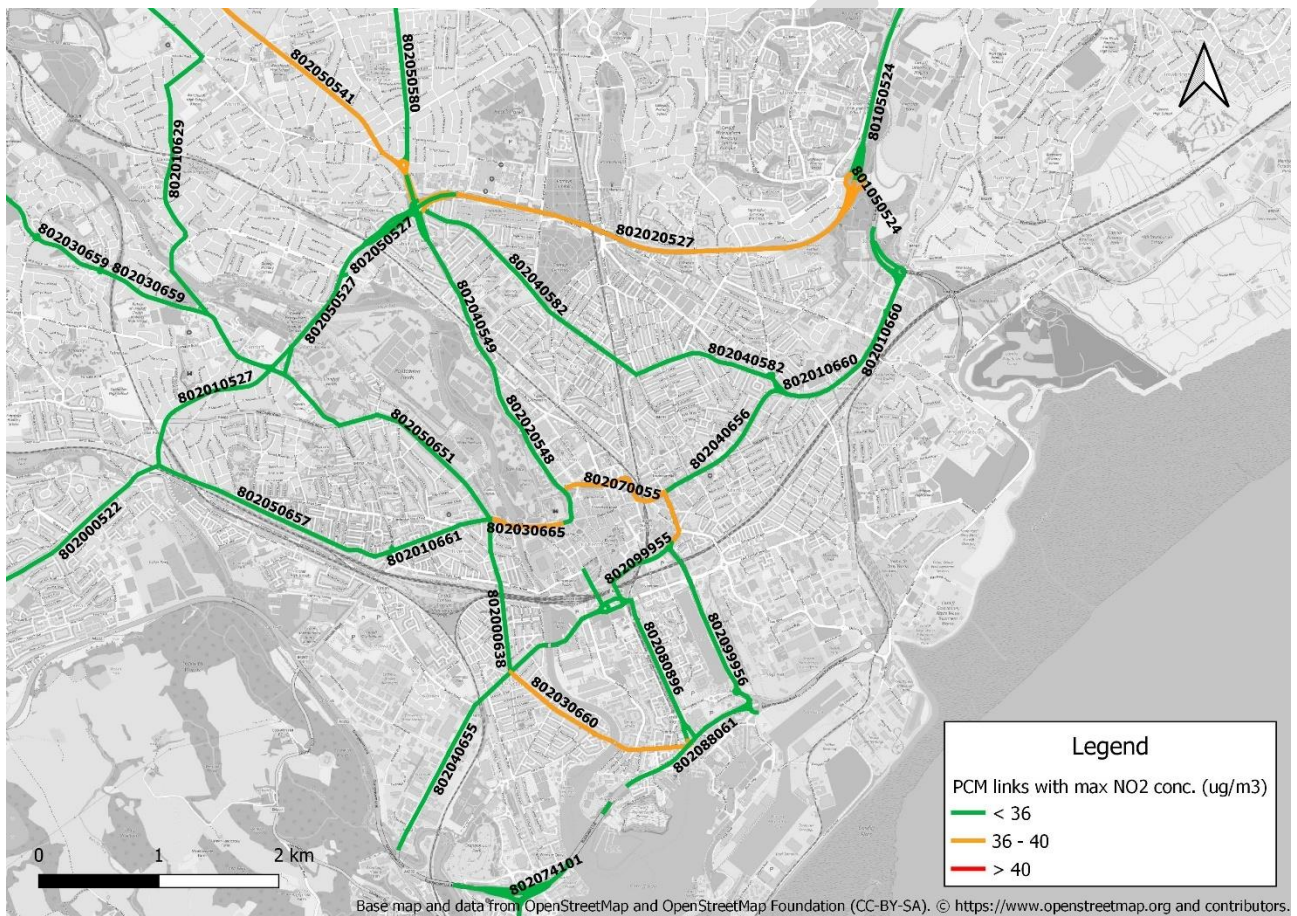


Figure 5-1 shows a mapped projection of the data shown in Table 5-1, where the entirety of the PCM road link has been assigned the maximum 2022 baseline NO_2 value, sampled along that section of road link.

Figure 5-2: PCM receptors with NO₂ concentrations above desired thresholds (2022 baseline)



Figure 5-2 displays the same values as shown in Figure 5-1 with the section of road link replaced by the locations where predicted NO₂ concentration exceeded the 36 µg/m³ threshold. The table shows that although long stretches of road links were shown to be above targeted thresholds in Figure 5-1, the number of locations this exceedance occurred was very localised.

Figure 5-3: Maximum predicted NO₂ assigned to corresponding road links (2024 DM)

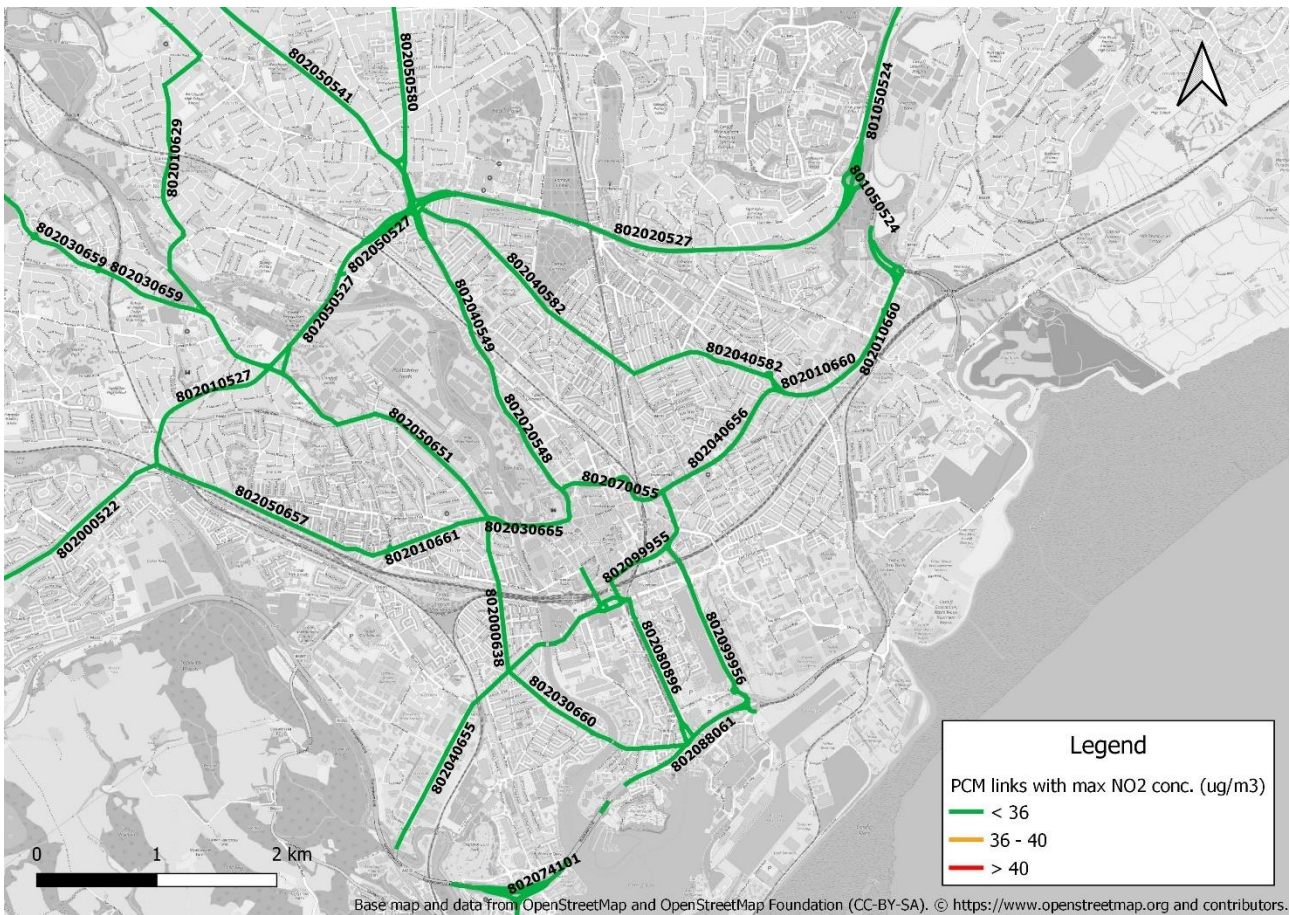


Figure 5-3 shows a mapped projection of the data shown in Table 5-1, where the entirety of the PCM road link has been assigned the maximum 2024 do minimum NO₂ value, sampled along that section of road link. The figure shows that all PCM links are expected to fall below 36 µg/m³ including along Castle Street.

Figure 5-4: Maximum predicted NO₂ assigned to corresponding road links (2024 DS)

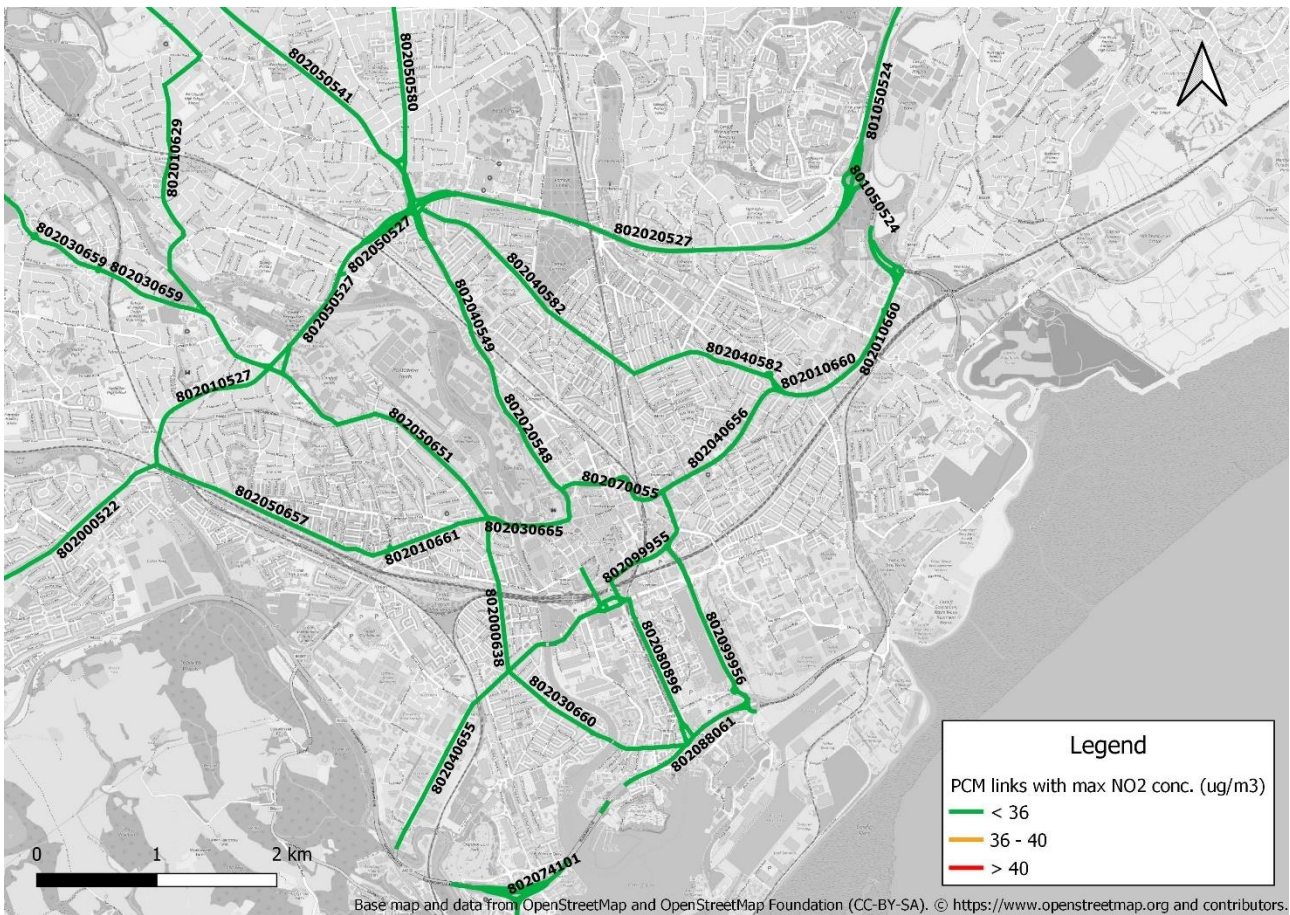


Figure 5-4 shows a mapped projection of the data shown in Table 5-1, where the entirety of the PCM road link has been assigned the maximum 2024 do something NO₂ value. This shows that all PCM receptors along these road links are predicted to be below the 36 µg/m³ threshold.

6. SUMMARY

This report has detailed the results from the dispersion modelling undertaken to understand the potential impacts of alterations to the use of the road network in Cardiff Castle Street.

The results given in section 5 show that:

- The 2022 baseline scenario indicates that there were no exceedances of the NO₂ annual average concentration above the 40µg/m³ target threshold. There were six locations likely to have been above the 90% compliance threshold of 36 µg/m³, and one of these PCM links is on Castle Street. It is noted that only small stretches of these road links were above these thresholds whilst the majority of PCM receptors along these road links are expected to be below 36 µg/m³.
- The 2024 do minimum model suggests that the maximum concentration on all road links will be below 36 µg/m³, including on Castle Street.
- The 2024 do something model suggests that the maximum concentration on all road links will be below 36 µg/m³.

The results from the study therefore show that:

- Annual averaged NO₂ across Cardiff will be reduced naturally should the assumptions made in the do minimum scenario occur. This will bring the highest NO₂ concentration at PCM receptors to below 36 µg/m³.
- The 2024 do something model suggests that implementing action targeting the reduction of annual averaged NO₂ concentration along Castle Street would further reduce concentrations on Castle Street.

APPENDICES

APPENDIX 1 MODEL VERIFICATION

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations; this helps to identify how the model is performing and if any adjustments should be applied. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. The LAQM.TG(22) guidance recommends making the adjustment to the road contribution of the pollutant only and not the background concentration these are combined with.

The approach outlined in the LAQM.TG(22) guidance has been used in this case. All roadside diffusion tube NO₂ measurement sites in Cardiff have been used for model verification. A single road NO_x adjustment factor was derived and used to calculate:

Citywide modelling results at receptor points adjacent to relevant PCM road links.

Citywide 1 m resolution NO₂ annual mean concentration rasters providing a continuous representation of the spatial variation in modelled concentrations.

It is appropriate to verify the performance of the RapidAir model in terms of primary pollutant emissions of nitrogen oxides (NO_x = NO + NO₂). To verify the model, the predicted annual mean Road NO_x concentrations were compared with concentrations measured at the various monitoring sites during 2022. The model output of Road NO_x (the total NO_x originating from road traffic) was compared with measured Road NO_x, where the measured Road NO_x contribution is calculated as the difference between the total NO_x and the background NO_x value. Total measured NO_x for each diffusion tube was calculated from the measured NO₂ concentration using the latest version of the Defra NO_x/NO₂ calculator (v8.1).

The initial comparison of the modelled vs measured Road NO_x identified that the model was under-predicting the Road NO_x contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road NO_x contribution vs. measured Road NO_x contribution was then determined using linear regression and used as a domain wide Road NO_x adjustment factor. This factor was then applied to the modelled Road NO_x concentration at each discretely modelled receptor point to provide adjusted modelled Road NO_x concentrations. A linear regression plot comparing modelled and monitored Road NO_x concentrations before and after adjustment is presented in Figure 6-1.

The total annual mean NO₂ concentrations were then determined using the NO_x/NO₂ calculator to combine background and adjusted road contribution concentrations.

Some clear outliers were apparent during the model verification process, whereby we were unable to refine the model inputs sufficiently to achieve acceptable model performance at these locations. These sites were excluded from the model verification. The reasons why acceptable model performance could not be achieved at these sites include:

- Sites located next to a large car park, bus stop, petrol station, or taxi rank that has not been explicitly modelled due to unknown activity data.

The RapidAir canyon allocator identified Westgate Street as a canyon, however including a canyon in this location leads to very scattered data in the model verification and the sites located in this canyon do not follow the general trends shown by the remainder of the monitoring locations. Consequently, the canyon in Westgate was manually removed which resulted in the relationship between measured and modelled concentrations at sites in this street following similar trends to the other verification sites and reduced the error in the model predictions.

To present a conservative approach to adjusting future year predictions of road NO_x concentrations, a primary NO_x adjustment factor (PAdj) of **2.4294** based on model verification using all of the 2022 NO₂ measurements was applied to all modelled Road NO_x data prior to calculating an NO₂ annual mean.

A polynomial regression factor was derived from combining the primary NO_x adjustment factor with concentrations taken from set sampling locations from the total NO_x and primary road NO₂ raster's outputted from the air dispersion model and the background NO_x concentrations given for in the Defra background concentration maps at the same location.

A plot comparing modelled and monitored NO₂ concentrations before and after adjustment during 2022 is presented in Figure 6-2.

Figure 6-1 Comparison of modelled Road NO_x Vs Measured Road NO_x before and after adjustment

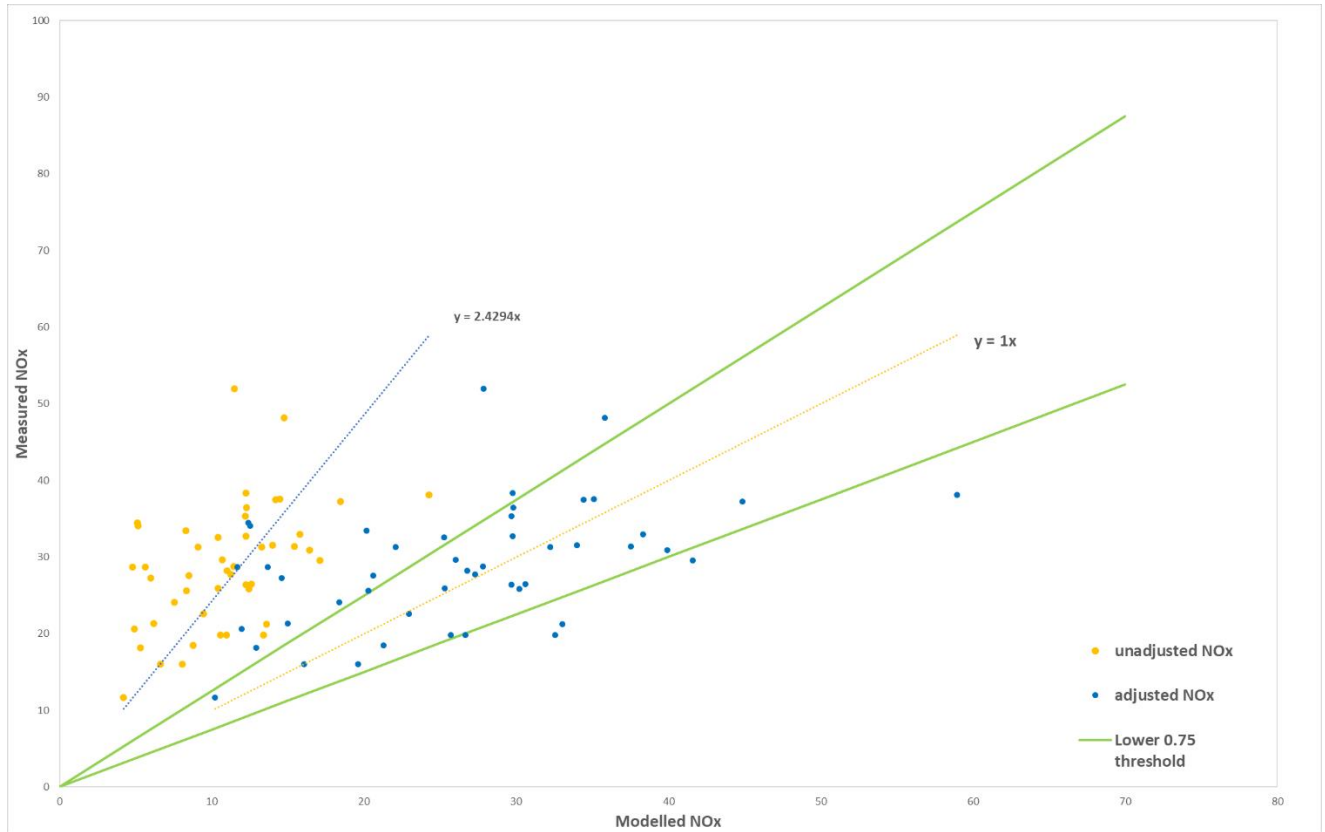
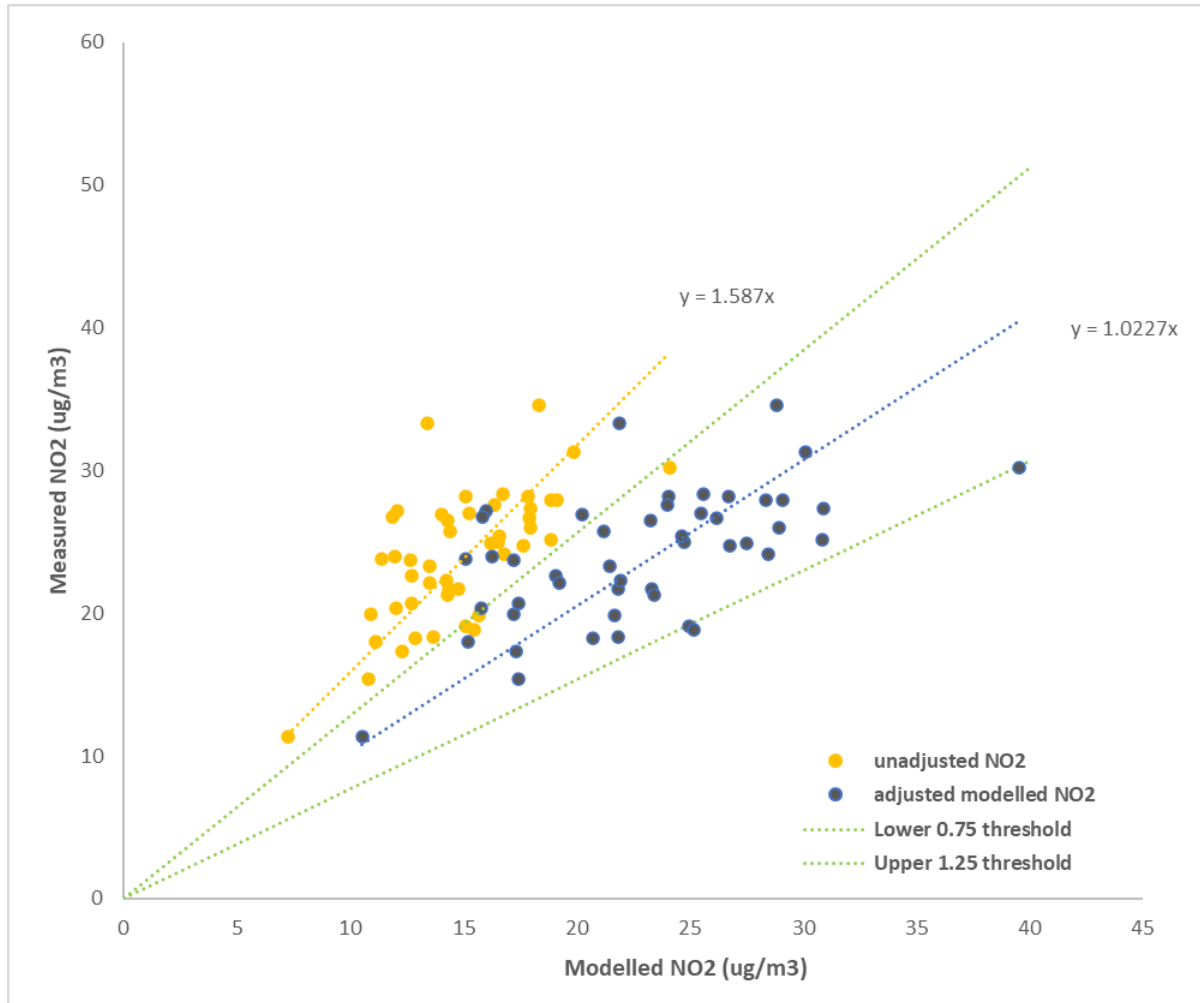


Figure 6-2 Modelled vs. measured NO₂ annual mean 2022 before and after adjustment



Model performance

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO₂ annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(122). This guidance indicates that an RMSE of up to 4 µg/m³ is ideal, and an RMSE of up to 10 µg/m³ is acceptable. The calculated RMSE is presented in Table 6-1. In this case the RMSE was calculated at 4.7 µg/m³ which is close to the ideal range suggested by the guidance.

Using a single adjustment factor for a city-wide model causes under-prediction in some areas and over-prediction in others. In particular, the model is over-predicting the NO₂ concentration on Castle Street (DT 186), although the modelled concentration is not predicted to exceed the 40 µg/m³ annual mean objective.

Table 6-1 Comparison of measured and modelled concentrations at measurement locations in 2022, and the model root mean square error

NO ₂ monitoring site	Site name	Measured NO ₂ annual mean concentration 2022 (µg/m ³)	Modelled NO ₂ annual mean concentration 2022 (µg/m ³)
16	167 Ninian Park Road	23.8	15.1
81	Stephenson Court	26.7	26.2
86	19 Fair oak Road	28.2	24.1
96	Manor Way Junction	24.9	27.5

NO ₂ monitoring site	Site name	Measured NO ₂ annual mean concentration 2022 (µg/m ³)	Modelled NO ₂ annual mean concentration 2022 (µg/m ³)
98	Western Avenue (premises)	21.7	23.3
99	Cardiff Road Llandaff	26.5	23.3
259	WELLFIELD ROAD (NEW 2022)	25.7	21.2
260	St Marys Catholic School CANTON (NEW 2022)	20.3	15.8
261	Rhydalfar Drive NEW 2022	11.3	10.5
106	30 Caerphilly Road	24.1	28.5
112	17 Sloper Road	22.6	19.1
115	21 Llandaff Road	27.1	16.0
117	25 Cowbridge Road West	33.3	21.9
126	Westgate Street Flats	25.0	24.8
128	117 Tudor Street	26.9	20.3
143	Windsor House	25.4	24.7
144	Marlborough House	27.6	24.0
147	211 Penarth Road	24.0	16.3
148	161 Clare Road	23.7	17.2
149	10 Corporation Road	26.7	15.9
156	2a/4 Colum Road	21.7	21.8
157	47 Birchgrove Road	19.1	25.0
158	64/ 66 Cathays Terrace	22.1	19.2
159	IMO facade replacement	28.4	25.6
168	570 Cowbridge Road East	23.3	21.5
179	Altolusso, Bute Terrace	31.3	30.1
184	Hophouse, St Mary Street	27.9	29.1
186	Dempseys Public House, Castle Street	30.2	39.6
187	Angel Hotel	34.6	28.9
188	Westgate Street (45 Apartments)	28.2	26.7
191	7 Mackintosh Place	25.1	30.9
194	115 Cowbridge Road West	19.9	17.2
195	244 Newport Road	24.7	26.7
196	2 Pencisely Road	22.3	22.0
198	Next Building to Stephenson Court	27.9	28.4
199	157 Newport Road	19.9	21.7
200	350 Whitchurch Road	27.3	30.9

NO ₂ monitoring site	Site name	Measured NO ₂ annual mean concentration 2022 (µg/m ³)	Modelled NO ₂ annual mean concentration 2022 (µg/m ³)
202	22 Clare Street	26.0	29.0
203	10 Fairoak Road	17.3	17.4
204	53 Neville Street	20.7	17.4
207	42 Waungron Road	18.3	21.8
208	2 Llantrisant Road	21.2	23.4
209	178 North Road	18.8	25.2
210	485 Caerphilly Road	18.0	15.2
214	Mitre Place	27.0	25.5
224	110 Cardiff Road	18.3	20.7
251	Heol Isaf, Radyr	15.4	17.4
Correlation coefficient			0.6
RMSE (all sites)			4.7
Fractional bias			0.05

DRAFT



T: +44 (0) 1235 75 3000

E: enquiry@ricardo.com

W: ee.ricardo.com

Mae'r dudalen hon yn wag yn fwriadol

Yn rhinwedd paragraff (au) 16 Rhan (nau) 4 a 5 o Atodlen 12A
o Ddeddf Llywodraeth Leol 1972.

Mae'r ddogfen yn gyfyngedig

Mae'r dudalen hon yn wag yn fwriadol

**CYNGOR CAERDYDD
CARDIFF COUNCIL**

ENVIRONMENTAL SCRUTINY COMMITTEE

24 APRIL 2023

**DELIVERING CARDIFF'S SUSTAINABLE TRANSPORT STRATEGY:
REVIEW OF ROAD USER PAYMENT OPTIONS**

Purpose of the Report

1. The Cabinet Report, attached at **Appendix A** (*and its subsequent Appendices*), are due to be considered at the Cabinet meeting on 27 April 2023. The purpose of this Cover Report is to provide Members with background information, and to act as a signposting tool to enable their pre-decision scrutiny of the report to Cabinet.

Structure of the Papers

2. Attached to this report is:
 - **Appendix A** – Cabinet Report – Delivering Cardiff's sustainable transport Strategy: review of road user payment options.
 - Appendix A1 – Summary of Road User Charging schemes in the UK
 - Appendix A2 – Comparison of Transport Metrics for UK Core Cities

Scope of Scrutiny

3. During this scrutiny, Members have the opportunity to explore the following:
 - i. UK Government Policy Framework,
 - ii. Welsh Government Policy Framework,
 - iii. Cardiff Council policy Framework,
 - iv. Schemes in the UK
 - v. Issues
 - a. The case for change,
 - b. Key transport delivery commitments,
 - c. The objectives of the scheme,
 - d. Types of schemes,
 - e. Approach to public and key stakeholder engagement.
 - vi. Legal powers
 - vii. Next Steps

Background

4. The Council set out an ambitious 10 year strategy in their Transport White Paper. Achieving the objectives of the strategy has stalled recently and the delivery of plans needs to be sped up if objectives are to be met. There needs to be more investment in transport infrastructure and services in order to address the challenges in relation to air quality, climate change, congestion and encourage growth in the Cardiff and the City Region. The opportunities to secure grant funding for transport projects are dwindling. Environmental levy options provide an opportunity for the Council to generate the revenue needed to invest in transport to encourage more walking, cycling and use of public transport providing high quality, safe and convenient alternatives to travelling by private car. The Welsh Government has a priority in the Wales Transport Strategy Llwybr Newydd to develop a framework for fair and equitable road-user charging in Wales. This framework will require secondary legislation. Developing the business case is needed to work towards Cardiff Council and Welsh Government decisions on a future levy agreement.
5. Cardiff was also recently successful in securing Levelling Up Funding that will be matched by Welsh Government to deliver the first phase of the Cardiff Tram system from Cardiff Central to Cardiff Bay

UK Government Policy Framework (Points 17 – 20)

6. The publication of the Department for Transport's 'The Future of Transport: A Network for 2030' in 2004 which expected to cut congestion dramatically and reduce carbon emissions following the introduction of national road charging from 2014.
7. The potential negative impact to commuters was highlighted in the Eddington Transport Study in 2006, but also the potential to make transport more efficient, without out needing to build more infrastructure.
8. Acceleration of the UK Governments plans were announced in 2020 which include phasing out the sale of new petrol and diesel cars by 2030 and new cars and vans to have zero tailpipe emissions from 2035.

Welsh Government Policy Framework (Points 21 – 30)

9. Welsh Government has accepted the links between responding to the climate emergency, public health and efficient active travel and transport system and therefore has a supportive approach to road user payment schemes.
10. In order to explore ways to workable ways alleviate the congestion on the M4 in the long term, in 2019 The First Minister established the Southeast Wales Transport Commission (SEWTC), this was also following the announcement that 'Black Route' proposals should not go ahead.
11. In November 2020 Welsh Government published the SEWTC recommendations that:
 - i. Travel alternatives must exist before local charges can be considered, "For ongoing public support, experience from other countries demonstrates the importance of linking any charges to wider transport improvements."
 - ii. There is an overarching policy framework, "...strongly agree with the conclusion of the Turner report, which states that any local or regional schemes in Wales need to be governed by an overarching set of principles to avoid unintended consequences or unfair outcomes in different parts of the country. This is particularly relevant if different schemes were to exist in Cardiff and Newport."
 - iii. Local Authorities consider introducing a Workplace Parking Levy (WPL).
12. Also, in November 2020 Welsh Government published Derek Turners *'Independent review of road user charging in Wales'* which established that a National Policy Framework was needed urgently in Wales as such schemes "...can be an excellent tool to help the Welsh Government and Welsh Local Authorities deliver a more equitable, efficient and sustainable transport system directly for all road users and for others across the wider transport system. Furthermore, in the spirit of the Well-being of Future Generations Act, it can help Government achieve wider economic, societal, cultural and environmental priorities such as improving air quality, sustainability and benefiting 'placemaking' and health."

13. In January 2021 Welsh Government published their response to the SEWTC recommendations, and in May 2021 they published Llwybr Newydd Wales Transport Strategy
14. In October 2021 Net Zero Wales was published, which includes a number of transport related targets i.e. reduce car mile per person and increase sustainable travel modes
15. The Welsh Government Roads Review was published in February 2023, and following this the Welsh Government National Transport Delivery Plan published in February 2023 includes the action to “Develop a Strategy for fair road user charging”.

Cardiff Council Policy Framework (Points 31 - 34)

16. In January 2020 Cabinet approved the Transport White Paper which is the Councils strategy to tackle the climate emergency, reduce congestion and improve air quality.
17. The strategy includes targets to double the number of journeys made by cycling or public transport by 2030 to 76%
18. The estimated costs to transform the transport system in Cardiff is between £1 – 2 billion, therefore a wide range of potential charging options needs to be considered.
19. The One Planet Cardiff Strategy published in October 2020 also supports the need to address climate change, air quality and the shift to more sustainable and active travel options.
20. The recently approved Corporate Plan includes the Commitment, “*Consider and review road user charging options to identify opportunities and benefits for Cardiff residents and deliver transport improvements.*”

Schemes in the UK (Points 35 – 39 and Appendices A1 & A2)

21. Appendix A2 provides a comparison of a range of transport metrics across the UK Core Cities and indicates that Cardiff has the most ambitious mode shift target and is ranked as follows:

Metric	Value	Rank (out of 11)
Population (2021)	362,301	8
Households (2021)	147,333	9
Car Ownership (HH without a car) (2021)	26%	1
Commuting (2011) (Sustainable modes)	36%	10
Commuting (2011) (Distance travelled , km)	12.7	7
Traffic Volume (MVkm) (2021)	2794	4
Congestion (Delay hours)	61	7
CO2 Emissions per capita (tonnes) (2022)	4.5	10
Road Safety (casualties) (2017 – 2021)	2,180	9

22. The different types of scheme that have been introduced include:

- i. Congestion Charging
- ii. Clean Air Zone
- iii. Workplace parking levy

23. **Point 36** and **Appendix A1** identify the different types of charging schemes have been introduced in a number of UK cities. The first being in London in 2003, 2008 and 2019 and more recently Birmingham (2021), Bristol (2022), Glasgow, Newcastle and Sheffield (2023)

24. Any scheme implemented may have a negative impact on particular groups or road users and **point 39** lists those that could be exempt or receive reimbursements/reductions.

Issues Identified in the Cabinet Report

25. Central to **the case for change** is the ability to generate income over and above what is currently available, to address low carbon, air quality and transport goals. The ‘case for change’ identifies issues that will result from no action specifically:

- i. City-Wide air quality will remain at levels damaging to health (**points 42 – 44**)
- ii. Street environment will remain car dominated/polluted (**points 45 – 47**)

- iii. Failure to deliver sustainability/transport 10 year targets **(points 48 & 49)**
- iv. Cardiff transport in the long-term will remain fragmented, inequitable, ineffective and costly **(points 50 & 51)**
- v. Congestion will increase further **(points 52 – 55)**
- vi. The Cardiff economy will remain constrained **(points 56 – 58)**

26. Investment is needed to provide alternative transport options that are integrated, frequent and reliable, this in turn will reduce traffic on the roads and air quality will improve as a consequence.

27. The **key transport delivery commitments** that need a long term funding commitment to meet the goals in the Transport Strategy and One Planet Cardiff include:

- i. A Metro city-wide tram system including Crossrail (in city area) & Circle line, new stations with a minimum of 4 tram/trains an hour.
- ii. A prioritized bus network across the city with reliable turn up and go services – targeting a 100% increase in bus ridership.
- iii. Support the development of wider regional commuter/shopper Metro and Bus network.
- iv. The completion of the Eastern Bay Link, which in conjunction with enhancement to city centre highway network may enable traffic to move around the wider city circumference.
- v. Sustainable travel incentives - Travel discounts, tickets, bike purchase.
- vi. Delivery of an EV Bus and Taxi fleet.

28. **Points 60 and 61** note the need to ensure that alongside introducing any charging scheme that there are transport benefits, which would be:

- i. The introduction on key routes of £1 bus fares.
- ii. Enhancements to the bus network to provide better and expanded bus services.
- iii. The delivery of the Phase 1 tram from Central Station to Pierhead Station in the Bay, Coryton and City Line frequency enhancements.
- iv. Improvements to regional commuting infrastructure.

29. The wider objectives of a charging scheme are stated in **point 62** and relate to:

- a. Health, Wellbeing, Climate Change & Air Quality
- b. Transport - Access
- c. Sustainability & Fairness
- d. Community Inclusiveness
- e. Transport - Safety & Security
- f. Transport - Economic
- g. Transport - Investment

30. There are a number of different schemes that could be implemented, listed in **point 65**, although not all have examples in the UK. Any scheme implemented in Cardiff would be based on UK good practice.

31. **Points 67 – 74** discuss the **approach to public and key stakeholder engagement** which is vital to the success of any schemes whose impact will be on both local residents and business and the wider region.

32. The need for a comprehensive engagement programme is noted in **point 68**

33. The process will follow Welsh Transport Appraisal Guidance (WelTAG), and a list of key stakeholders to be included at WelTAG Stage 1 (Strategic Outline Case) is provided in **point 70**.

34. Proposed engagement with the general public and again key stakeholders will take place as part of WelTAG Stage 2 (Outline Business Case).

35. The establishment of a Review Group to support the Council decision making is commented on in **point 73** which also includes a list of organisations and groups that would be represented.

36. The necessity for Cabinet to consider and approve the preferred option of the Review Group at Stage 2 (Outline Business Case) before progressing any proposed scheme to Stage 3 (Full Business Case) is highlighted in **point 74**. Cabinet will again consider the outcome of Stage 3 to approve the scheme to be delivered.

37. The Legal Powers under which road user charging schemes can be delivered are noted in **point 75**, i.e. Transport Act 2000 although secondary legislation maybe required in Wales.

38. **Point 76** notes that the phrase 'road user payment' includes road user charging and workplace parking levies.

39. The Future Generations and Wellbeing Act will also need to be taken in consideration in the decision making process along with the consultation conditions of the Public Sector Equality Duty.

40. The next steps are clarified in **points 77 – 79** and include further details on each WeITAG stage and the full guidance can be found here: [WeITAG2017 \(gov.wales\)](https://gov.wales/WeITAG2017)

41. The proposed draft timeline is below (**point 80**):

Draft Target Date	Milestone Description
2023/24	Research, planning and public consultation
End of 2024	Cabinet Decision
End of 2025	Completion of detailed design including all associated planning, legal and financial requirements.
Early - 2026	Submit any draft orders requiring Ministerial Approval.
2027/28	Implementation subject to approvals.
2026/27 and onwards	Parallel implementation/construction of schemes that would be funded from the Road User Payment.

42. The engagement of Local Members at WeITAG stages 1 and 2 is confirmed in **point 81**.

43. The reasons for the recommendations are highlighted in **points 82 - 85**

44. **Points 86 and 87** note the financial implications of the report and that a full business case that clearly identifies cost of any scheme going forward will be needed.

45. Legal implications are noted in **points 88 – 96** and the use of terminology is highlighted in **point 89** so that the it is clear what the proposals being considered are.

46. The duties in respect of the Equalities Act are noted in **points 97 – 100**

47. The Wellbeing of Future Generations (Wales) Act 2015 is noted in **points 101 – 104**

48. No implications in relation to the Welsh Language Act are noted

49. There are no HR or Property implications noted

RECOMMENDATIONS TO CABINET

50. Cabinet is recommended to:

- i. Approve the in-principal case for the introduction of a Road User Payment scheme subject to consultation, equality impact assessment and preparation of a robust business case.
- ii. Delegate authority to the Director of Planning, Transport and Environment to develop the business case and WelTAG studies for a Road User Payment scheme, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
- iii. Delegate authority to the Director of Planning, Transport and Environment to establish a Review Group in WelTAG Stage 2 to recommend the preferred option to be taken forward to WelTAG Stage 3 preparation of the Final Business Case, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
- iv. Note that the outcome of WelTAG Stage 2 Outline Business Case together with consultation responses and equality impact assessments will be presented to Cabinet for a decision on the preferred option to be taken forward for the WelTAG Stage 3 Full Business Case.
- v. Note that the outcome of WelTAG Stage 3 Full Business Case will be presented to Cabinet for a final decision.
- vi. Approve the undertaking of consultation and engagement associated with each stage of preparing the WelTAG business case for a Road User Payment scheme.
- vii. Approve the undertaking of research and prepare a communication and public and key stakeholders strategy to support the preparation of the business case for a Road User Payment scheme.

Way Forward

Cllr Dan De'Ath, Cabinet Member for Transport & Strategic Planning and Andrew Gregory, Director of Planning Transport & Environment have been invited to make a statement and answer Member's questions. They have been asked to make a brief presentation followed by Member's questions.

Legal Implications

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters, there are no direct legal implications. However, legal implications may arise if and when the matters under review are implemented with or without any modifications. Any report with recommendations for decision that goes to Cabinet/Council will set out any legal implications arising from those recommendations. All decisions taken by or on behalf of the Council must (a) be within the legal powers of the Council; (b) comply with any procedural requirement imposed by law; (c) be within the powers of the body or person exercising powers on behalf of the Council; (d) be undertaken in accordance with the procedural requirements imposed by the Council e.g. Scrutiny Procedure Rules; (e) be fully and properly informed; (f) be properly motivated; (g) be taken having regard to the Council's fiduciary duty to its taxpayers; and (h) be reasonable and proper in all the circumstances.

Financial Implications

The Scrutiny Committee is empowered to enquire, consider, review and recommend but not to make policy decisions. As the recommendations in this report are to consider and review matters, there are no direct financial implications at this stage in relation to any of the work programme. However, financial implications may arise if and when the matters under review are implemented with or without any modifications. Any report with recommendations for decision that goes to Cabinet/Council will set out any financial implications arising from those recommendations

RECOMMENDATION

The Committee is recommended to:

- i. Consider the information in this report, and the presentation and any further information presented at the meeting; and
- ii. Determine whether they would like to make any comments, observations or recommendations on this matter to Cabinet.

DAVINA FIORE

Director of Governance & Legal Services

17th April 2023

Mae'r dudalen hon yn wag yn fwriadol

BY SUBMITTING THIS REPORT TO THE CABINET OFFICE, I, ANDREW GREGORY, DIRECTOR OF PLANNING, TRANSPORT AND ENVIRONMENT AM CONFIRMING THAT THE RELEVANT CABINET MEMBER(S) ARE BRIEFED ON THIS REPORT

**CARDIFF COUNCIL
CYNGOR CAERDYDD**

CABINET MEETING: 27 APRIL 2023

DELIVERING CARDIFF'S SUSTAINABLE TRANSPORT STRATEGY: REVIEW OF ROAD USER PAYMENT OPTIONS

TRANSPORT & STRATEGIC PLANNING (COUNCILLOR DAN DE'ATH)

AGENDA ITEM:

Reason for this Report

1. To seek authority from Cabinet for endorsement of the in-principle case for the introduction of a Road User Payment (RUP) scheme subject to consultation and equality impact assessment of the proposals and the preparation of a robust business case.
2. To seek delegated authority from Cabinet for the Director of Planning, Transport and Environment to develop the business case and Welsh Transport Appraisal Guidance (WelTAG) studies for a Road User Payment scheme, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
3. To seek delegated authority from Cabinet for the Director of Planning, Transport and Environment to establish a Review Group in WelTAG Stage 2 to recommend the preferred option to be taken forward to WelTAG Stage 3 preparation of the Final Business Case, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
4. To note that the outcome of WelTAG Stage 2 Outline Business Case together with consultation responses and equality impact assessments will be presented to Cabinet for a decision on the preferred option to be taken forward for the WelTAG Stage 3 Full Business Case.

5. To note that the outcome of WeITAG Stage 3 Full Business Case will be presented to Cabinet for a final decision.
6. To seek authority from Cabinet to undertake the consultation and engagement associated with each stage of preparing the WeITAG business case for a Road User Payment scheme.
7. To seek authority from Cabinet to undertake research and prepare a communications and public and key stakeholders engagement strategy to support the preparation of the business case for a Road User Payment scheme.

Background

8. Cardiff Council have in recent years been successful in the planning and implementation of major highway, public transport and active travel schemes that directly address the climate emergency and enhance citywide air quality. This includes achieving full compliance with the clean air direction on Castle St, the roll out of the city-wide cycle network, supporting public transport throughout the covid period, and partnering the development of the regional metro.
9. More recently, Cardiff has made a breakthrough in funding by successfully bidding for UK Levelling Up Funding and gaining significant support from Welsh Government in bringing forward the first phase of a new Cardiff Tram system.
10. Nonetheless, recent data from Public Health Wales demonstrates that across Cardiff and Vale poor air quality accounts for an effect equivalent of more than 200 deaths per annum. It is important to recognise the impacts on health and wellbeing that poor environmental quality produces directly attributable to congested, overcrowded and busy roads. These impacts disproportionately fall on those that are most vulnerable often living in the most deprived inner-city neighbourhoods.
11. In addition, data indicates that transport and congestion is responsible for 40% of Cardiff's carbon emissions.
12. In this context, despite significant success, it is clear that at the current rate of progress of mode shift the overarching low carbon, air quality and transport targets committed to by the Council in the 10-year transport and One Planet strategies are unlikely to be achieved. This fact presents a potentially critical position for the Council and one which, unless proactively addressed, is likely to have a significant detrimental impact on the city as a whole.
13. Indeed, analysis suggests that the levels of structural transport funding provided on an annual basis is approximately only 10-15% of the levels required to deliver the step change in train, tram, bus and cycle network and service quality to deliver this city-wide low carbon, and healthy transport environment. Without substantial new levels of infrastructure support – beyond that already made available by Welsh Government and

the Council itself - the scale of bus and rail usage are in many respects at risk of stagnating. This position is only made more challenging in the recent post-covid economic climate. In this context, a step change is required that can only be achieved by developing a new source of long-term infrastructure support in addition to existing funding.

14. In this challenging context, London and many other cities have recognised that the only means of achieving the very substantial levels of funding essential for this key step will require the detailed consideration of some form of Road User Payment (RUP) scheme or demand management system. Although, this report is not specifying one form or other this type of scheme includes Road User Charging, Congestion Zones, Clean Air Zones and Workplace parking levies, to name a few. But all are similar in seeking some road users – although many local users may be exempt or heavily discounted - to pay for access and use of the city network. Alongside this would be the commitment to minimise the charging impacts on residents, the most economically disadvantaged and regular users in the city and region. Regarding exemptions for example, residents in London qualify for a 90% discount on the Congestion Charge if they live within the charging zone.
15. Without this step, it is clear that the key Transport and Climate Emergency priorities will not be fulfilled. However, if successful in the implementation – with clear commitment to the ringfencing all of the net income against transport and highway priorities - then the opportunity exists to transform not just the Cardiff Transport system but also in a substantial manner address poor levels of air quality, combat climate change, improve people’s health and well-being, reduce congestion and improve economic prospects and productivity.
16. Overall, the aim would be that on the successful establishment of this long-term funding stream the commitment would be for Cardiff to deliver one of the most sustainable, cost-effective, convenient public transport and active travel systems outside of London, with transport enhancements committed to be delivered alongside implementation of any Road User Payment scheme. This would also have wider benefits for general traffic users by significantly reducing congestion and potentially delivering new strategic highway enhancements in the longer term such as the Eastern Bay Corridor Link.

UK Government Policy Framework

17. The need for investment in transport and the appropriate mechanism to fund it has been a long-standing policy consideration nationally and in the wider UK context. This was highlighted in ‘The Future of Transport: A Network for 2030’ published in 2004 by the Department for Transport. It was expected that national road charging may be feasible from 2014 that “could cut congestion dramatically, while reducing carbon emissions” and be designed to allow for variations in larger urban areas through working with Local Authorities.

18. The Eddington Transport Study in 2006 advised the UK Government on making the transport more efficient through road pricing, reducing the need to build road infrastructure with significant environmental benefits. The report also advised that distributional effects needed to be considered, with some commuters being worse-off unless they can be flexible with travel times or good alternative travel options are available.
19. In November 2020, the UK Government announced plans to accelerate a greener transport future to 'net-zero' through a 2-step phase-out of petrol and diesel cars:
 - Step 1 will see the phase-out date for the sale of new petrol and diesel cars and vans brought forward to 2030.
 - Step 2 will see all new cars and vans be fully zero emission at the tailpipe from 2035.
20. The subsequent document 'Decarbonising transport: a better, greener Britain' published by the UK Government in July 2021 was followed by 'Net-Zero Strategy: Build Back Greener' published in October 2021. The strategy sets out policies and proposals for decarbonising all sectors of the UK economy to meet our net zero target by 2050. It recognises the need to, "ensure that the taxation of motoring keeps pace with the change to electric vehicles to ensure that we can continue to fund the first-class public services and infrastructure that people and families across the UK expect." The Office of Budget Responsibility forecasts that receipts from fuel duties are, "...expected to continue on a downward trajectory [as a percentage of GDP], partly reflecting the move from petrol and diesel engine vehicles to battery powered electric vehicles (EVs)." It also identifies that additional targeted action may be required to, "reduce use of the most polluting cars and tackle urban congestion."

Welsh Government Policy Framework

21. Overall, Welsh Government has provided a highly positive approach to the assessment of road user payment schemes. It has recognised the strong relationship between an effective response to the climate emergency, public health and developing an efficient active travel and transport system.
22. In policy terms, The Welsh Government published the "*Independent review of road user charging in Wales*" by Derek Turner in November 2020. It concluded, there is a pressing need for a "National Policy Framework for RUC [Road User Charging] in Wales" to be developed and introduced as soon as possible. It also explains that such schemes, "...can be an excellent tool to help the Welsh Government and Welsh Local Authorities deliver a more equitable, efficient and sustainable transport system directly for all road users and for others across the wider transport system. Furthermore, in the spirit of the Well-being of Future Generations Act, it can help Government achieve wider economic, societal, cultural and environmental priorities such as

improving air quality, sustainability and benefiting 'placemaking' and health."

23. The First Minister established the Southeast Wales Transport Commission (SEWTC) in 2019 to investigate sustainable ways to tackle congestion on the M4 in Southeast Wales and make recommendations to the Welsh Government on a suite of alternative solutions in the light of the First Minister's statement of 4 June 2019 that the 'Black Route' proposal should not proceed. The Welsh Government published the 'Southeast Wales Transport Commission: final recommendations' in November 2020. It recommended support for Local Authorities taking earlier steps to implement local charging schemes to address congestion, improve environmental outcomes or raise revenue to invest in public transport schemes. It also recommended that:

- Travel alternatives must exist before local charges can be considered, *"For ongoing public support, experience from other countries demonstrates the importance of linking any charges to wider transport improvements."*
- There is an overarching policy framework, *"...strongly agree with the conclusion of the Turner report, which states that any local or regional schemes in Wales need to be governed by an overarching set of principles to avoid unintended consequences or unfair outcomes in different parts of the country. This is particularly relevant if different schemes were to exist in Cardiff and Newport."*

24. The SEWTC report also recommended that Local Authorities consider introducing a Workplace Parking Levy (WPL).

25. The Welsh Government response to the SEWTC report recommendations was published in January 2021. The Welsh Ministers accepted in principle all the SEWTC recommendations and included the following statements:

"Following an independent review into Road User Charging in Wales our new Wales Transport Strategy, Llwybr Newydd, sets out that we will support a move from fuel duty to a more equitable approach to road charging that can assist with improving air quality and congestion in urban areas, whilst recognising that some people, including those in rural areas, depend on car use. Road charging is just one form of travel demand management, and we will develop an action plan including other measures such as digital strategies and land-use planning."

And regarding WPL:

"This is a matter for local authorities who have the powers to put such measures in place if they wish as part of their strategies for managing congestion in our towns and cities."

26. The Welsh Government published Llwybr Newydd Wales Transport Strategy in May 2021. It includes the following priority:

“Develop a framework for fair and equitable road-user charging in Wales and explore other disincentives to car use, taking into account equality issues including the needs of people in rural areas, people who share protected characteristics and people on low incomes.”

And,

“Deliver a strategy for fair road-user charging in Wales as part of a broader package of measures to improve travel choices.”

27. Net Zero Wales was published in October 2021 setting the foundations to make Wales net zero by 2050. Transport makes up 15% of total carbon emissions in Wales (source: Welsh Government response to the Roads Review, Feb 2023). Net Zero Wales also aims to reduce the number of car miles travelled per person by 10% by 2030 and to increase the proportion of trips by sustainable travel mode (public transport and active travel) to 35% by 2025 and 39% by 2030.

28. The Welsh Government Roads Review was published in February 2023. It recommends:

“To reduce congestion and the perceived need for new road infrastructure, Welsh Government and local authorities should work together to deliver ‘benefits-and-charges’ packages at a regional level. Charges would influence whether and when people travel, while providing a revenue stream to finance improvements in public transport, active travel infrastructure and digital accessibility.”

29. The Welsh Government National Transport Delivery Plan published in February 2023 includes the action to “Develop a Strategy for fair road user charging”. The following key statements underlines the strength of policy support for the assessment of the introduction of RUC. In relation to key priorities for delivery, innovative approaches, motivation to make a shift away from private car use, air quality and social justice/equality are included in the plan:

“Delivering against our targets requires a change in the way we travel. We need fewer cars on our roads, and more people using public transport, walking or cycling. An emerging area which has the potential to deliver modal shift, address carbon targets and support investment in sustainable transport is demand management schemes such as road user charging.

The devolution settlement surrounding the use of road user charging is complex. These powers reside within the Transport Act 2000, which covers the different powers that apply for different types of schemes. Local schemes could deliver against our target and provide funding for improvements in public transport and active travel as the local authority would receive the revenue. These potential future revenue streams must be used on local transport priorities and could contribute to the expenditure needed

to make transport infrastructure improvements or to provide cheaper fares.

We will explore a 'benefits and charges packages' approach to introducing any new schemes, looking at ways to improve services before charges or introduce lower fares when charging starts. We will support local authorities exploring options to borrow against the future demand management related revenue streams to deliver enhancement in public transport and active travel in advance of any local charging regime being introduced.

We will also motivate people away from private car use through demand management - the Wales Transport Strategy includes a commitment to develop a national road user charging framework. Further work will be undertaken to develop a fair and equitable road user charging framework, including how local authorities can borrow against these future revenue streams to fund transport improvements; and also consider other alternatives such as workplace car parking levies and road space reallocation.

In reviewing our legislative proposals, we will consider existing powers to introduce road user charging to ensure these can be fully deployed where there is a case to do so, such as where evidence shows a Clean Air Zone would be the most effective means of tackling air pollution problems.

Road user charging is often presented as inequitable. However, ONS data shows that the average Welsh household with a car has an income 69% above a similar household without a car, so charging that supports improving non-car modes is progressive and supports those on lower incomes."

30. The Welsh Government is also in the process of considering the 'Introduction of the Environment (Air Quality and Soundscapes) (Wales) Bill' as announced on 20th March 2023. It will be a key step in bringing forward measures that will contribute to improvements in the quality of the air environment in Wales and reduce the impacts of air pollution on human health, biodiversity, the natural environment and our economy.

Cardiff Council Policy Framework

31. Cabinet approved the Transport White Paper on 23rd January 2020.
32. The Transport White Paper aims to achieve a doubling of the numbers cycling and travelling by public transport and make 76% of all journeys by sustainable travel modes by 2030 from a 2018 base. The Transport White Paper includes the following consideration towards achieving these targets:
"...as Cardiff Council's Cabinet, have become more and more convinced that to undertake the kind of radical change required

we will need to investigate a form of charging mechanism that could help deliver on the following:

1. improve air quality
2. tackle climate change
3. provide ring fenced funding to invest in much-needed public transport initiatives
4. reduce congestion

[Note: this list has been reordered for the purposes of reflecting the emphasis of this Cabinet report.]

As part of a robust decision-making process, we will consider a number of options...We estimate that transforming Cardiff's transport system will cost between £1-2billion...Paying for these schemes will require a shift in the way transport in Cardiff is funded. We propose to consider all possible delivery options and will work with Welsh Government to develop a comprehensive investment plan to bring forward this vision and make it a reality. As part of a robust decision-making process, we will consider a wide range of possible charging mechanisms which will include some form of Road User charging. Any revenues raised from such a scheme would be spent directly on public transport...Exemptions for emergency vehicles, motorcycles, registered blue badge holders' people with disabilities could form part of any scheme (see Note 11) ...We fully understand and want to make clear that several key public transport projects and initiatives would need to be in place before any charging mechanism could be introduced...

Note 11: any exemptions will have to be considered as part of the detailed assessments and business cases."

33. The One Planet Strategy approved by Cabinet on 15th October 2020 includes key transport related actions and identifies a significant change in the level of investment is needed to address climate change, improve air quality and provide more sustainable travel options.

34. In March 2023 the Council approved the new Corporate Plan, 'Delivering a Stronger, Fairer, Greener Cardiff' which included the commitment, "Consider and review road user charging options to identify opportunities and benefits for Cardiff residents and deliver transport improvements."

Schemes in the United Kingdom

35. As mentioned above, many major UK cities are currently considering, or have already implemented, some form of city scale demand management system, including Congestion Zones, Clean Air Zones or Workplace Parking Levy. All of these approaches, although differing in detail in one form or another result in private car usage being charged to enable environmental or transport benefits. A common recognition is emerging among these urban centres that the step change in investment

to create a sustainable transport system requires a fundamentally new approach to long-term funding. A comparison of transport metrics for UK Core Cities is provided in **Appendix B** with Cardiff having the most ambitious mode shift targets which reflects the relative scale of the transport challenges compared in the rankings.

36. The following list are schemes in the UK that are being developed or have been implemented, along with their start date.

Congestion charging:

- London – February 2003

Sustainable Travel Zone:

- Cambridge – second stage consultation in 2022/23 with charges starting from 2025 and full implementation by 2027/28.

Clean air zone:

- Birmingham – June 2021
- Bristol – November 2022
- London Low Emission Zone (LEZ) – February 2008
- London Ultra Low Emission Zone (ULEZ) – April 2019
- Glasgow – for implementation from June 2023
- Newcastle – January 2023
- Sheffield – February 2023

Workplace parking levy:

- Nottingham - 2012
- Leicester – proposed scheme withdrawn in November 2022

37. In this context, Cardiff would be progressing a scheme that is being considered in other urban areas in the UK and indeed in a wider international context. Indeed, implementing demand management systems is becoming a common approach.

38. Further details of the schemes in the UK are provided in **Appendix A**.

39. Many of the schemes have identified that there may be varying degrees of disproportional impacts. For example, the Council wants to protect low-income drivers from the financial hardship that may be caused by a RUP scheme. The Council will seek views on what a fair and equitable payment might look like through engagement and consultation with key stakeholders and the general public. Similar concerns have been addressed through identifying appropriate exemptions, discounts and mitigations in other schemes. Exemptions can be arranged to be applied automatically through the Driver and Vehicle Licensing Agency (DVLA) whereas discounts and reimbursements would require a larger resource to administer which increases costs of any scheme depending on the level of complexity. Consideration will be given to the following that may be eligible for exemptions, discounts and/or reimbursements:

- Emergency vehicles.
- Military vehicles.

- Disabled tax class vehicles.
- Blue badge holders.
- Breakdown services.
- Dial-a-ride services.
- Certain local authority operational vehicles.
- Car club vehicles.
- People on low incomes.
- Residents.
- Registered bus services.
- Type of vehicle engine.
- Size of vehicle engine.
- Hackney Carriages (Taxis) and private hire vehicles.
- NHS patients clinically assessed as too ill, weak or disabled to travel to an appointment on public transport.
- NHS staff using a vehicle to carry certain items.
- NHS patients accessing Accident and Emergency services.
- NHS and other emergency services staff responding to an emergency when on call.
- Social care, community health workers and Care Quality Commission registered care home workers.
- Minibuses and LGVs used by charities and not-for-profit groups.

Issues

The Case for Change

40. The case for the introduction of a Road User Payment scheme is based on a careful analysis of the core challenges faced by Cardiff, its strategic transport and growth priorities and the most effective approach to address these. The central case for change, as highlighted, relates to the fundamental assessment that without identifying a new approach to major capital and revenue funding Cardiff, like all major UK cities, will be unable to meet its low carbon, air quality, transport, or indeed economic targets and ambitions. Funding in addition to existing sources is needed.
41. More specifically, without the introduction of some form of Road User Payment scheme the following untenable issues will emerge:
- i. City-Wide Air Quality will remain at levels damaging to health
42. Air pollution affects us all and is associated with impacts on lung development in children, heart disease, stroke, cancer, exacerbation of asthma and increased mortality, among other health effects. In particular, people with chronic lung conditions are more likely to be susceptible to the effects of air pollution. As analysis from Public Health Wales demonstrates across Cardiff and Vale poor air quality accounts for an effect equivalent of more than 200 deaths per annum. It is estimated that on average life expectancy in the UK is reduced by 7-8 months due to air pollution. In towns and cities with air pollution levels higher than the

UK average, including Cardiff, this figure is likely to be higher. In addition:

- Wales has a higher prevalence of asthma than the European average, with 7% of adults in Cardiff diagnosed with asthma.
- More than 9,000 Cardiff residents are registered with chronic obstructive pulmonary disease (COPD).
- 6% of children aged 10-14 have asthma in Wales.

43. Much of this pollution can be attributed to vehicle emissions and usage of carbon-based fuels. Although, national emission projections suggests that emissions of NOx and PM2.5 pollutants will reduce (see **Table 1**), mainly as a result of increasing numbers of Electric Vehicles, these are only projections and therefore the real-world improvements in air quality may not reflect these projections if fleet transition is reduced. Non combustion sources of particulate matter (PM2.5/PM10) from wider vehicle road surface and tire wear can lead to poor air quality and EVs will therefore still contribute to these sources of pollution. Furthermore, the transition to EV across all vehicle types and sizes including HGVs may not be complete by 2030. In this context, it is critical to encourage viable alternatives to enable mode shift away from general traffic. However, this will only occur at sufficient levels where viable alternatives found in a good transport system is in place.

Table 1: Projected improvements in pollutants for cars

Year	NOx kt	PM2.5 kt
2021 (Base)	95	1.6
2025	74	0.92
2030	37	0.46
2040	9	0.22

Source: National Atmospheric Emissions Inventory NAEI, <https://naei.beis.gov.uk/data/>

44. The current cost of living crisis could have an impact on EV transition rates due to the cost of upgrading vehicles. The Council will also explore the balance between wanting very polluting vehicles to possibly pay more while ensuring that people on low incomes, who may drive older more polluting cars, are not unfairly penalised. This may include consideration of vehicle engine size.

ii. Street Environment Will Remain Car Dominated/Polluted

45. Irrespective of fuel type it has been documented how the mass use of private vehicles results in a street environment that is vehicle dominated, unsafe levels of air pollution and blighting in varying degrees to large areas of the cityscape, particularly those adjoining busy roads and junctions, and in city centre and inner urban areas i.e. large areas of the city. Currently it is expected that large numbers of people, with children and vulnerable family members, predominantly in the more deprived areas of the city, live in a substandard and life-limiting environment. The only means of tackling this poor-quality environment is to shift movement into buses, trains or active travel, all of which limit the number of vehicles on street. This position will only be addressed if these alternatives are

sufficiently cost effective and convenient to attract car and vehicle uses to switch mode.

46. Sedentary behaviour – sitting too much – has become a routine part of our modern lifestyles. However, alongside this comes a nearly doubled risk of type 2 diabetes, increased rates of overweight and obesity, increased rates of many cancers, and an increased chance of developing dementia. More than 600 people die in Cardiff each year from circulatory diseases including heart attacks and strokes. The levels of activity and obesity of residents in Cardiff in comparison with Wales are provided in **Table 2** which also demonstrates the importance of encouraging people to live more active lifestyles.

Table 2: Adult Lifestyles and Cardiff and Wales 2016/17 to 2019/20

Category	Cardiff	Wales
Active less than 30 minutes in week	31%	33%
Active 150 minutes in week	56%	53%
Overweight or obese (BMI 25+)	55%	60%
Obese (BMI 30+)	20%	23%

Source: StatsWales

47. Cycling in Cardiff is currently estimated to prevent 151 serious long term health conditions each year, including hip fractures, dementia and cases of depression, saving the NHS the equivalent of £1m per year locally, or 33,000 GP appointments (Source: Sustrans Walking and Cycling Index, 2022). People feel safest walking and cycling when they are not mixing on busy roads with cars, buses and lorries. High quality separate (segregated) walking and cycling routes have been shown around the world to make people more likely to get out and about and active as they get around. Two thirds of people living in Cardiff support more segregated cycle tracks along roads (Source: Sustrans Walking and Cycling Index, 2022), with a similar proportion saying fewer motor vehicles on their streets would help them walk and cycle more.

iii. Failure to Deliver Sustainability/Transport 10 yr Targets:

48. The Council has committed to deliver a Zero Carbon City and Council. Without introducing a step change in infrastructure investment current evidence suggests that this target will be unachievable and the City will not become carbon neutral without more control of vehicle emissions and providing convenient alternative transport options. This position is underlined by careful examination of the current progress to achieve public transport, bus, train ridership indicates which reveal, aside from in cycle activity, all the key targets will not be achieved (see **Table 3**). Cardiff has the second highest figure for CO₂e (carbon dioxide equivalent) emissions per capita out of the UK's Core Cities (see **Figure 1**). Transport represents approximately 40% of the total carbon emissions for the City (see **Figure 2**). Current, mainstream funding currently provides only 10-15% approx. annual capital funding required to

create the level of transport infrastructure to achieve compliance. Additional funding over and above what is currently available is needed.

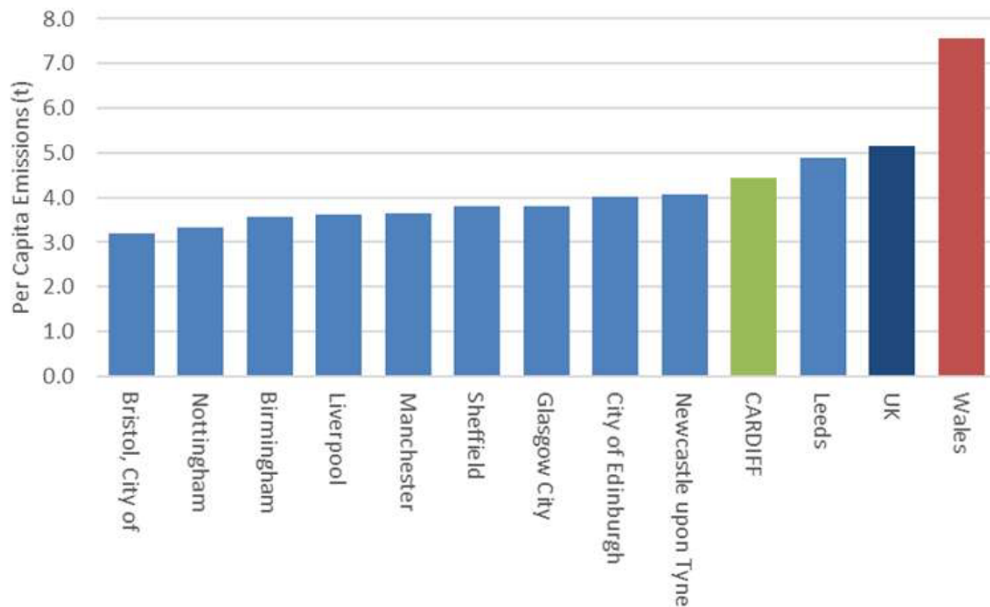


Figure 1: Total Per Capita CO₂e Emissions (kt CO₂e), 2019. Source: Department for Business, Energy & Industrial Strategy (BEIS) reported in the 2022 Cardiff Assessment of Local Well-being by the Cardiff Public Services Board.

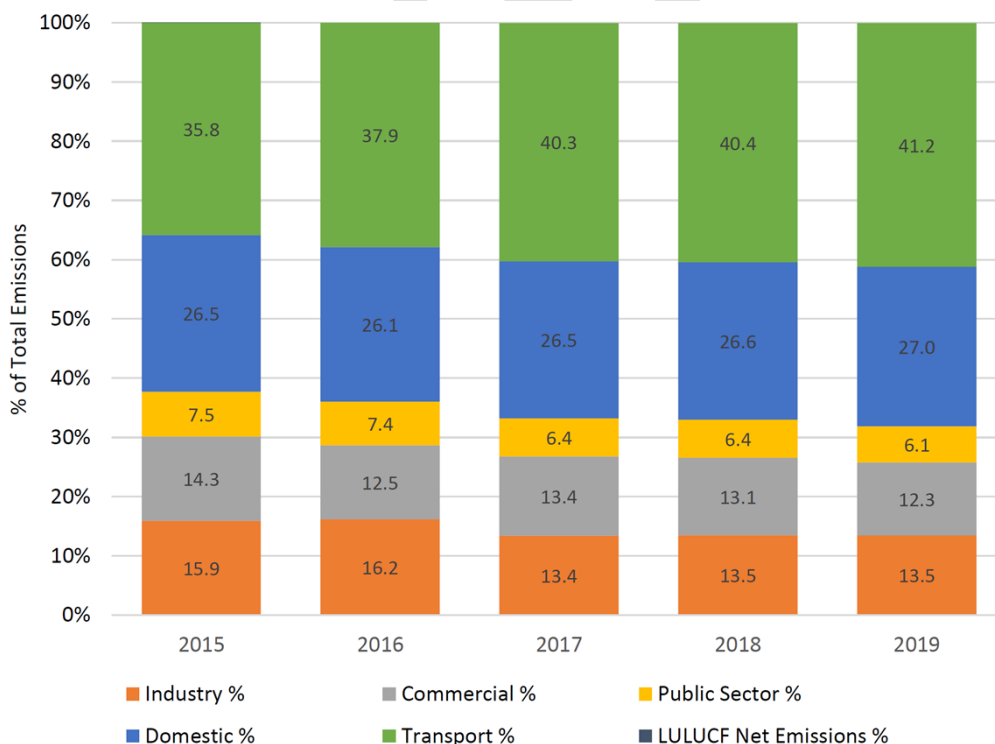


Figure 2: Cardiff CO₂e Emissions by Main Emission Type (% of Total Emissions 2015-2019). Source: Department for Business, Energy & Industrial Strategy (BEIS) reported in the 2022 Cardiff Assessment of Local Well-being by the Cardiff Public Services Board.

49. **Table 3** illustrates the limited gains in public transport usage in the period leading to 2019.

Table 3: Percentage of Travel by Sustainable Modes in Cardiff

Mode of Travel	2015	2016	2017	2018	2019	2030 Journey to Work Targets
Sustainable Modes	43.9%	44.9%	45.8%	48.1%	51.2%	75%
Walking	16.5%	16.7%	16.0%	15.9%	16.4%	17%
Cycling	9.2%	10.0%	11.4%	13.7%	15.4%	26%
Public Transport	16.7%	16.8%	16.9%	16.9%	18.1%	33%

iv. Cardiff Transport In The Long-Term Will Remain Fragmented, Inequitable, Ineffective And Costly:

50. The reason why current ridership on public transport and active travel is still relatively low relates to the quality, effectiveness, frequency and network integration – despite best efforts - of existing public transportation in Cardiff. These factors are a direct consequence of the long-term low levels of investment in capital and revenue available as a result of largely national UK policy decisions. The record shows that both Cardiff Council and Welsh Government have sought to proactively support public transport through the Bus Emergency Scheme (BES), £1 ticket fares, subsidised bus routes etc to the utmost that the current budget envelope will allow. In this context, it is challenging to identify the potential sources of additional funding that could be provided. In addition, these impacts will be particularly experienced by the most deprived areas within the city, which have low car ownership, but also are in central areas of high car through movements. This position is accelerated by lower bus usage that drives up ticket costs – potentially leading to a detrimental spiral of worsening services and increased costs impacting mostly on already challenged communities.

51. By considering Road User Payment scheme options the Council is taking a proactive and responsible approach to provide a cost-effective and reliable transport system for the city and region.

v. Congestion will Increase Further:

52. As a result of the current quality and effectiveness of public transport, and in the post covid environment, not only car use but also car ownership is increasing. This is clearly a retrograde step and shows that viable alternatives to car use are not currently in place.

53. The cost of congestion to the economy in Cardiff was estimated by INRIX to be £109 million in 2019. Whilst congestion has reduced since 2019 following the impacts of Covid-19 and external shocks to the economy resulting in significant changes in travel patterns, the following **Table 4** provides a comparison of updated measures that were reported in the

Transport White Paper. If this trend increases then not only will congestion become more common across the focal areas of the network but also, car usage will become more challenging and costly in terms of lost hours spent in queuing.

Table 4: Comparison of Congestion Measures in Cardiff

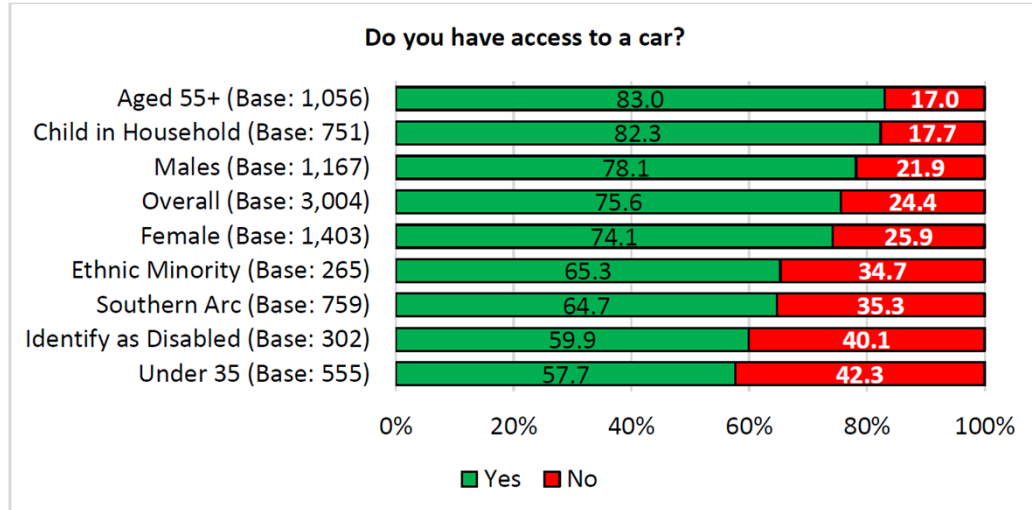
Congestion Measure	2021/22 Update	2018 (Transport White Paper)
Number of hours (full working days) drivers lose stuck in traffic during peak times.	61 (8 days)	143 (19 days)
Cost per driver of being stuck in traffic during peak times.	£540	£1,056
Average speed in the City Centre	13mph	9mph
Percentage of journey time spent in delay (additional time to a 30-minute journey).	33-39% 10 minutes	56-57% 17 minutes
How much longer journey times are during the day on average than during the off-peak when there is little or no congestion.	24%	28%

54. However, the following travel trends post-Covid highlight the targets are increasingly difficult to achieve without significant investment in transport infrastructure and services:

- Current daily traffic in Cardiff overall is back to pre-Covid (2019) levels (Source: UTC).
- Daily traffic in the City Centre specifically is also near pre-Covid levels (Source: UTC).
- The profile of traffic across the day during the peak and off-peak periods have returned to a similar pattern that was experienced prior to Covid (Source: UTC).
- This is in spite of commuting levels only being around 60% what they were pre-Covid as of October 2022 (Source: Google).
- As of 2023, traffic delays due to congestion are slightly increased (~ +5%) from pre-Covid levels (Source: Tom Tom).
- Both bus and rail service frequencies are at around 80% of pre-Covid levels.
- Rail patronage is currently at around 70% relative to pre-Covid levels (Source: TfW Rail), although is lower than it achieved in November 2022, due in part to on-going works and industrial action since this time.
- Bus use is currently estimated to be in the range of 70-80% of pre-Covid levels.
- Concessionary bus travel is lower at around only 60% of pre-Covid levels as of November 2022.

- Car ownership as a percentage of households in Cardiff has increased from 71% in 2011 to 74% in 2021 (Census).

55. The following graph demonstrates the reliance that many groups of the population in Cardiff have on alternatives to travelling by car (Source: Bus Strategy Consultation, February 2022).



vi. The Cardiff Economy Will Remain Constrained - With Reduced Productivity.

56. A further rationale for a step change in funding for transport infrastructure and services is the fundamental importance this has in underpinning long-term economic growth and prosperity. Increasingly it is recognised that transport accessibility, allowing people and businesses to engage, access labour markets, providing an increased range of employment options, enable the disadvantaged to work and the city trade to become more competitive is crucial to productivity of large urban areas and regions. Called ‘agglomeration benefits’, in short, this term refers to enabling cities to benefit from large work forces and markets. Many UK large cities have suffered from poor public transport networks. Currently only 5-6 UK cities have metro/tram systems – which are the bedrock of almost all successful public transport systems. German cities, by comparison have over 70 such systems. Although expensive to build tram systems offer sustained long-term economic and productivity benefits that significantly boost economic activity and the prosperity of households, individuals and businesses across the city. This benefit is effective in a way that car use cannot replicate because as car commuter use increases it soon results in unacceptable levels of congestion and degraded environment.

57. With improvements in air quality health outcomes for a wide diversity of residence should also improve. Workers on average should experience fewer days off work due to sickness thereby enhancing the productive capacity of employers within and outside of Cardiff.

58. By delivering a sustainable transport network, improving air quality and reducing carbon emissions, the city will position itself to attract new inward investment. This is particularly important for attracting investment in clean technology, green economy industries and higher-end professional services sectors that seek locations with strong credentials associated with sustainability and future economic resilience.

The Key Transport Delivery Commitments

59. In line with the Cardiff 10-year Transport Strategy and One Planet Cardiff report, the core commitment of this report is ensuring the delivery of one of the best public transport and active travel networks in the UK. This is subject to a major new source of long-term funding being identified, publicly supported and implemented. The key commitments of proposals we will bring forward in partnership with the Welsh Government using grant funding supported with the additional ringfenced funding of the Road User Payment scheme includes:

1. A Metro city-wide tram system including Crossrail (in city area) & Circle line, new stations with a minimum of 4 tram/trains an hour.
2. A prioritized bus network across the city with reliable turn up and go services – targeting a 100% increase in bus ridership.
3. Support the development of wider regional commuter/shopper Metro and Bus network.
4. The completion of the Eastern Bay Link, which in conjunction with enhancement to city centre highway network may enable traffic to move around the wider city circumference.
5. Sustainable travel incentives - Travel discounts, tickets, bike purchase.
6. Delivery of an EV Bus and Taxi fleet.

60. These proposals when all fully developed would ensure that Cardiff meets its 10-year transport and Climate Emergency targets and delivers one of the most sustainable and user-friendly public transport/active travel networks in the UK.

61. However, it is recognised that it will be important to introduce transport benefits both ahead of and at the same time as implementing any new charging regime. The current programme suggests this could be by 2027 but the important point is that the implementation of these improvements would need to be ahead of and coincide with the start date for any charging regime. These improvements will demonstrate the immediate benefits of the scheme. They would include:

1. The introduction on key routes of £1 bus fares.
2. Enhancements to the bus network to provide better and expanded bus services.
3. The delivery of the Phase 1 tram from Central Station to Pierhead Station in the Bay, Coryton and City Line frequency enhancements.
4. Improvements to regional commuting infrastructure.

The Objectives of the Scheme

62. It will be essential to clearly define the wider objectives whichever form of charging mechanism were to be adopted. As referenced, the intention of the Road User Payment scheme would be to support the primary objective of delivering an effective mass transport system for Cardiff that enables a city and region-wide shift to sustainable (low carbon), convenient and cost-effective transport. However, to achieve this end there are a range of wider objectives to consider. The following indicative objectives have been mapped against the Wellbeing Goals of the Wellbeing of Future Generations Act and will be used to help inform the stakeholder engagement and consider the need to address the transport problems and issues identified above:

Health, Wellbeing, Climate Change and Air Quality Objective: Reduce vehicle emissions to improve air quality (NO₂ & PM_{2.5}) to address public health concerns, protect the environment, and address the climate emergency.

Transport Access Objective: Ensure fair access to transport services that encourage behaviour change required to achieve mode shift targets to walking, cycling and public transport.

Sustainability and Fairness Objective: Ensure value for money and a sustainable, equitable and deliverable solution that balances potential impacts across the city, the Cardiff City Region and elsewhere in Wales and the UK.

Community Inclusiveness Objective: Improve inclusiveness of participation to encourage cohesive communities and make streets safe and attractive for citizens, enhancing opportunities for place-making or urban domain improvements. This inclusiveness would also seek to ensure that access and charging are appropriately balanced within and across Cardiff as well as the Cardiff City Region.

Transport Safety and Security Objective: Improve safety and security for all modes of travel.

Transport Economic Objective: Boost the competitiveness, productivity, and employment growth in the Cardiff Capital Region by supporting businesses and community groups in the city and district centres.

Transport Investment Objective: Generate sufficient revenue to be ring-fenced for walking, cycling, highway and public transport investment, enabling modal shift.

This objective would ensure commitment to ring-fence the income to transport measures. Also, it would seek to ensure that the scheme generated sufficient funding, in addition to existing sources, to fund the identified projects.

63. Furthermore, the approach adopted will need to be practical, deliverable, cost-effective to implement and operate, and adopt an overall approach to charging that is publicly acceptable. We would also seek to implement a scheme that is based on UK good practice.
64. The shaping of the objectives will also be informed by research and engagement which will seek to understand the strategic context for people and communities who might be impacted by, or benefit from, the scheme options. This will include understanding the wider social, economic, environmental and cultural context such as socio-economic deprivation or health issues that shape people's lives in Cardiff.

The Types of Schemes

65. There are a wide range of potential options for assessment against the objectives including:
 - 1) Cordon Based: Charge based on crossing a line.
 - 2) Whole City Area Based: Charge based on moving within the city.
 - 3) Single Road/Toll Roads and Toll Lanes: Charge for the use of a road.
 - 4) Distance Based Charging Schemes: Charge related to distance travelled.
 - 5) Truck' Charging: Charge related to specific types of vehicles.
 - 6) Workplace Parking Levies: Charge related to number of off-street non-residential parking places.
 - 7) Retail Park Levies: Charge related to 'shoppers' parking at retail parks.
 - 8) Low Emission Zone (LEZ): Charges linked to air pollutant levels rather than congestion.
66. The next stages of assessment will consider in detail the relative merits of these differing schemes in terms of technical, transport, community and wider strategic benefits.

The Approach to Public and Key Stakeholder Engagement

67. The Council is committed to ensuring that the diverse voices of residents are at the heart of decision making, and that's why consultation and engagement will be central to any review of road user payment options. A comprehensive engagement programme will therefore be developed to engage with the city's diverse range of residents, as well as all key stakeholder groups. This will allow the public to express their views on the scheme and help identify any impact - positive or negative - on communities, business, the environment and the economy in Cardiff and the wider Region.

68. This will involve a robust programme of engagement - including resident panel focus groups - to help ensure a representative cross-section of the city's population is directly involved in the engagement work. As part of this approach, the Council will consider a wide range of socio-demographic characteristics- including gender, age, ethnicity, disability, and socio-economic status. Residents will be encouraged to learn about the problems and issues, identify opportunities and options, deliberate upon them and make recommendations. The work that emerges from this process will be used to ensure that the business case is fully informed by the voices of citizens. Key stakeholder and advisory panels will also be established that provide the opportunity for interactive dialogue and feedback as the assessment work is progressed. Crucially, the stakeholder engagement programme will help inform the development of the full project scope and will also support the identification of the potential mitigations necessary for residents, regular highway users, public benefit bodies and transport operators to ensure the scheme can be introduced in a way that manages any impacts.
69. Tailored research will be undertaken in support of the engagement and preparation of the business case. It will also guide the communications framework to ensure that information is meaningful, understandable and responsive to the issues as they are raised to account for perceptions, beliefs and reactions and learning from them.
70. The WelTAG Stage 1 study work will be informed by key stakeholder engagement including, but not limited to, the following:
- Local elected members.
 - Community Councils.
 - Cardiff Council Directorates.
 - Cardiff Capital Region and Local Authorities.
 - Welsh Local Government Association.
 - Welsh Government.
 - Burns Delivery Unit.
 - Transport for Wales.
 - Disabled access groups.
 - Active travel representatives.
 - Equality, Diversity and Inclusion Groups
 - Bus operators.
 - Professional transport industry institutions.
 - Road, rail, freight and logistics representatives.
 - Educational institutions.
 - Public Services.
 - Emergency services.
 - Tourism industry representatives.
 - Retail and business representatives.
 - Placemaking representatives.
 - Welsh Local Government Association; and
 - Office of the Future Generations Commissioner for Wales.
71. The Welsh Government WelTAG Guidance recommends the establishment of a Review Group depending on the type of project. The

purpose of the review group is to provide feedback and constructive challenge before progressing to a preferred scheme identifying key issues and risks and helping find solutions. They can also help the project team to develop the best possible business case. They are not there to make the final decision on the project. Review group members help the project manager to ensure that the right people are involved in the development of the project. The review group will involve people with expertise in key areas of well-being appraisal, including social, economic, environmental, place based and cultural impacts. The review group will also involve representatives of people likely to be most affected by the potential project. The group will also include representatives of major partner organisations or stakeholders. It will meet at key stages in the WelTAG process to make recommendations for example when selecting the short list to be assessed in WelTAG Stage 2 and recommending the preferred option in WelTAG Stage 3. In establishing the Review Group, the Council will seek representation from the following organisations and groups:

- Cardiff Council
- Welsh Government
- Burns Delivery Unit
- Transport for Wales
- Equality, Diversity and Inclusion
- Accessibility & Disabled
- Community & Third Sector Charities
- Education
- Active Travel
- Bus Operators
- Network Rail
- Business & Commercial
- Freight and Logistics
- Tourism
- Public Services
- Office of the Future Generations Commissioner

72. The Council will consult with the general public and undertake further stakeholder engagement as part of the WelTAG Stage 2 process to assist the Review Group in recommending a preferred option.
73. The preferred option recommended by the Review Group in WelTAG Stage 2 together with the relevant consultation responses and equality impact assessment will be considered by Cabinet for approval to proceed to preparation of the full business case in WelTAG Stage 3. Cabinet will consider the outcome of the WelTAG Stage 3 full business case in approving any Road User Payment scheme to implement.
74. The finding of the engagement process will be a central component of the business case.

Legal Powers

75. Whilst the Transport Act 2000 provides powers to implement road user charging schemes, it is understood that secondary legislation under the Act would be required in Wales to provide the legal framework for implementing a road user charging style of scheme. It is also relevant to note that consultation requirements, the Public Sector Equality Duty, and the Future Generations and Wellbeing Act will apply to the decision-making process.
76. The term 'Road User Payment' used in this report includes any schemes that may be delivered through the legal framework of the Transport Act 2000 which refers to "Road User Charging and Workplace Parking Levy".

Next Steps

77. The preparation of a business case is needed to work towards Cardiff Council and Welsh Government decisions on a potential future Road User Payment scheme. This business case will be informed by evidence, research and engagement using the Welsh Government WelTAG Guidance. The first steps involve engagement with key stakeholders to scope the transport related problems and issues, identify the strategic objectives that are most important to address them and develop a long list of options that will deliver the intended outcomes.
78. The WelTAG study work will include comprehensive public and key stakeholder engagement to build the business case for a Road User Payment scheme. It involves the following stages through to completion and post-scheme monitoring:

Stage 1, Outline Business Case: Identification of problems and issues, objectives and a wide range of options informed by stakeholder consultation that are assessed against the objectives and outcomes with a recommendation to proceed to the more detailed assessment of a shorter list of options in Stage 2 that will be considered by the Review Group.

Stage 2: Assessment of a short list of options informed by public consultation: The Stage 2 report will recommend a preferred option that will be recommended by the Review Group in accordance with the WelTAG Guidance (Note: the final decision on the preferred option will be considered by Cabinet). Cabinet will be informed by the stakeholder engagement, public consultation, equality impact assessment and recommendation of the study to select the preferred option to assess for the WelTAG Stage 3 Full Business Case.

Stage 3: Full business case of the preferred option selected by Cabinet including preliminary design, cost estimates, revenue forecasts, risks, mitigation and programme timescales. The report would recommend whether there is a case to proceed to implementation of a Road User Payment for approval by Cabinet, taking into account the consultation responses and the equality impact assessment.

Stage 4: Delivery of the Road User Payment scheme including detailed design, planning approvals (if required) and the finalisation of any orders that may require ministerial approval. The financing, legal agreements, management, notifications, infrastructure, enforcement and back-office arrangements would be progressed once any orders are confirmed, and any planning permissions needed granted. The process of requesting Ministerial approval may result in public inquiry which would delay confirmation of the orders significantly.

Stage 5: Post-delivery monitoring to report on the outcomes of the scheme and capture any lessons learned.

79. The process will involve independent review using specialist experts.

Draft Timeline

80. The following **Table 5** provides draft target dates for the study work, decision making and implementation of Road User Payment scheme subject to consultation, equality impact assessment, approvals, funding and procurement if the decision is to implement a charging scheme.

Table 5: Draft Target Dates and Milestones

Draft Target Date	Milestone Description
2023/24	Research, planning and public consultation
End of 2024	Cabinet Decision
End of 2025	Completion of detailed design including all associated planning, legal and financial requirements.
Early - 2026	Submit any draft orders requiring Ministerial Approval.
2027/28	Implementation subject to approvals.
2026/27 and onwards	Parallel implementation/construction of schemes that would be funded from the Road User Payment.

Local Member consultation

81. Local Member consultation will be undertaken as part of the WeITAG Stage 1 stakeholder engagement. Further consultation with local members will be undertaken to inform the WeITAG Stage 2 study work.

Reason for Recommendations

82. To seek Cabinet endorsement of the in-principal case for the introduction of a Road User Payment scheme subject to consultation and equality impact assessment of the proposals.
83. To seek Cabinet delegated approval to progress the WeITAG study work and associated consultation and engagement in the preparation of a

business case for a road user charging scheme so that it is progressed in an efficient and timely manner in accordance with Welsh Government guidance.

84. To seek Cabinet approval to undertake research and prepare a communication and public and key stakeholders' strategy to support the preparation of the business case for a road user charging scheme. Along with the consultation and engagement, this work will enable the development of the full scope of the project by directly listening to concerns, being responsive to the issues that are raised and making appropriate adjustments that account for them.
85. Progressing the business case for a Road User Payment scheme aimed at delivering key commitments in the Transport White Paper and One Planet Strategy.

Financial Implications

86. This report recommends the preparation of and development of a business case and WelTAG studies on road user charging options. In principle revenue budget has been made available in the short term to deliver the business case, subject to leverage of available WG grant funding.
87. Any business case will need to clearly identify a robust basis of all related costs and income going forward and the likely financial return of any scheme proposed to be implemented.

Legal Implications (including Equality Impact Assessment where appropriate)

88. Cabinet approved the Council's Transport White Paper in January 2020 this outlined the Council's vision for transport in the city to 2030. One of the proposals was to investigate charging schemes including road user charging also referred to within this report as road user payment.
89. The point regarding the terminology is raised because if the scheme is not referred to as road user charging as per the legislation a third party may claim that matters have not been clearly identified. This is an important point given that consultation is to be undertaken on the proposal and it must therefore be clear as to what the proposal is.
90. In considering this proposal the Council will exercise legislative powers under the Transport Act 2000 ("the 2000 Act"), in Wales, a charging scheme will not come into force unless the order making it has been submitted to and confirmed by the Welsh Ministers (and it may be confirmed with or without modifications). Other legislative powers may also need to be relied on to support such a scheme such as the Road Traffic Regulation Act 1984, the Traffic Management Act 2004 and the Highways Act 1980 amongst various other legal provisions and statutory guidance. Accordingly, further legal advice should be obtained as the proposal is developed.

91. When considering this matter as well as the specific legislation great care is going to be required on how the Council meets the wider public sector duties which are highlighted in the general legal advice below.
92. The report also notes that the proposals will be subject to consultation. Consultation gives rise to the legitimate expectation that the outcome of the consultation will be duly considered when subsequent decisions are made. Accordingly, in considering this matter due regard should be had to the consultation feedback received.
93. Whether or not consultation is a legal requirement, if it is embarked upon it must be carried out properly and conform to the established law on consultation. The general principles applicable to consultation by public bodies were outlined in the case of *R v North and East Devon Health Authority, ex parte Coughlan* [2001] QB 213 (at paragraph 108), as follows,
- 1) The proposals must be set out clearly and accompanied by enough information to enable those being consulted to engage in the process and give an informed view. Sufficient information to enable an intelligible response requires the consultee to know not just what the proposal is, but also the factors likely to be of substantial importance to the decision, or the basis upon which the decision is likely to be taken;
 - 2) The consultation should be undertaken when the proposals are in their formative stage;
 - 3) Sufficient time to respond to the consultation must be given; and
 - 4) The decision maker must approach the process with an open mind and be prepared to change course if necessary. This is not to say that the decision maker cannot have an opinion in advance of the decision and it is not to say that the decision maker must act in accordance with the responses to consultation. The decision maker must properly consider the relevant considerations and be prepared to change the pre-held opinion if necessary.
94. A further factor to consider, is whether or not the form of consultation is appropriate in all the circumstances. Who should be consulted and how?
95. This involves not only consideration of the factors outlined above, but also more practical considerations relating to the characteristics of those who are potentially affected by the decision. In view of this the Council should ensure that the consultation covers other Councils in the area and their residents who may well travel into Cardiff for work or education, and businesses who may not be located in Cardiff but may work in Cardiff.
96. It is further noted in the report that it is proposed to establish a Review Group in accordance with WelTAG guidance. It should be noted that any decisions must be made in accordance with the Council's constitution and that the review group will not in itself have any decision-making powers. It is understood that the report that the outcome of the consultation together with the preferred option to be progressed will be

referred to Cabinet in order for it to make the final decision on how to proceed.

General Legal Implications

Equality and Socio-Economic Duty

97. The decision about these recommendations has to be made in the context of the Council's public sector equality duties. The Council also has to satisfy its public sector duties under the Equality Act 2010 (including specific Welsh public sector duties). Pursuant to these legal duties, Councils must in making decisions have due regard to the need to (1) eliminate unlawful discrimination, (2) advance equality of opportunity and (3) foster good relations on the basis of protected characteristics. The Protected characteristics are: age, gender reassignment, sex, race – including ethnic or national origin, colour or nationality, disability, pregnancy and maternity, marriage and civil partnership, sexual orientation, religion or belief – including lack of belief. If the recommendations in the report are accepted and when any alternative options are considered, the Council will have to consider further the equalities implications and a further Equality Impact Assessment ("EIA") may need to be completed.
98. When taking strategic decisions, the Council also has a statutory duty to have due regard to the need to reduce inequalities of outcome resulting from socio-economic disadvantage ('the Socio-Economic Duty' imposed under section 1 of the Equality Act 2010). In considering this, the Council must take into account the statutory guidance issued by the Welsh Ministers (WG42004 A More Equal Wales The Socio-economic Duty Equality Act 2010 (gov.wales) and must be able to demonstrate how it has discharged its duty.
99. An EIA aims to identify the equalities implications of the proposed decision, including inequalities arising from socio-economic disadvantage, consideration and due regard should be given to the outcomes of the EIA attached to this report so that the decision maker may understand the potential impacts of the proposals in terms of equality. This will assist the decision maker to ensure that it is making proportionate and rational decisions having due regard to the public sector equality duty.
100. Where a decision is likely to result in a detrimental impact on any group sharing a Protected Characteristic, consideration must be given to possible ways to mitigate the harm. If the harm cannot be avoided, the decision maker must balance the detrimental impact against the strength of the legitimate public need to pursue the recommended approach. The decision maker must be satisfied that having regard to all the relevant circumstances and the PSED, the proposals can be justified, and that all reasonable efforts have been made to mitigate the harm.

Well Being of Future Generations (Wales) Act 2015

101. The Well-Being of Future Generations (Wales) Act 2015 ('the Act') places a 'well-being duty' on public bodies aimed at achieving 7 national well-being goals for Wales – a Wales that is prosperous, resilient, healthier, more equal, has cohesive communities, a vibrant culture and thriving Welsh language, and is globally responsible.
102. In discharging its duties under the Act, the Council has set and published well being objectives designed to maximise its contribution to achieving the national well being goals. The well being objectives are set out in Cardiff's Corporate Plan 2022-25. When exercising its functions, the Council is required to take all reasonable steps to meet its well being objectives. This means that the decision makers should consider how the proposed decision will contribute towards meeting the well being objectives and must be satisfied that all reasonable steps have been taken to meet those objectives.
103. The well being duty also requires the Council to act in accordance with a 'sustainable development principle'. This principle requires the Council to act in a way which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs. Put simply, this means that Council decision makers must take account of the impact of their decisions on people living their lives in Wales in the future. In doing so, the Council must:
- Look to the long term.
 - Focus on prevention by understanding the root causes of problems.
 - Deliver an integrated approach to achieving the 7 national well-being goals.
 - Work in collaboration with others to find shared sustainable solutions.
 - Involve people from all sections of the community in the decisions which affect them.
104. The decision maker must be satisfied that the proposed decision accords with the principles above; and due regard must be given to the Statutory Guidance issued by the Welsh Ministers, which is accessible using the link below:
<http://gov.wales/topics/people-and-communities/people/future-generations-act/statutory-guidance/?lang=en>

General

105. The Council has to be mindful of the Welsh Language (Wales) Measure 2011 and the Welsh Language Standards when making any policy decisions and consider the impact upon the Welsh language, the report and Equality Impact Assessment deals with all these obligations. The Council has to consider the Well-being of Future Guidance (Wales) Act 2015 and how this strategy may improve the social, economic, environmental and cultural well-being of Wales.
106. All decisions taken by or on behalf the Council must (a) be within the legal powers of the Council; (b) comply with any procedural requirement

imposed by law; (c) be within the powers of the body or person exercising powers of behalf of the Council; (d) be undertaken in accordance with the procedural requirements imposed by the Council e.g. Council Procedure Rules; (e) be fully and properly informed; (f) be properly motivated; (g) be taken having regard to the Council's fiduciary duty to its taxpayers; and (h) be reasonable and proper in all the circumstances.

HR Implications

107. There are no HR implications arising directly from this report.

Property Implications

108. There are no Property implications arising from this report.

RECOMMENDATIONS

Cabinet is recommended to:

1. Approve the in-principal case for the introduction of a Road User Payment scheme subject to consultation, equality impact assessment and preparation of a robust business case.
2. Delegate authority to the Director of Planning, Transport and Environment to develop the business case and WelTAG studies for a Road User Payment scheme, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
3. Delegate authority to the Director of Planning, Transport and Environment to establish a Review Group in WelTAG Stage 2 to recommend the preferred option to be taken forward to WelTAG Stage 3 preparation of the Final Business Case, subject to consultation with the Cabinet Member for Strategic Planning and Transport.
4. Note that the outcome of WelTAG Stage 2 Outline Business Case together with consultation responses and equality impact assessments will be presented to Cabinet for a decision on the preferred option to be taken forward for the WelTAG Stage 3 Full Business Case.
5. Note that the outcome of WelTAG Stage 3 Full Business Case will be presented to Cabinet for a final decision.
6. Approve the undertaking of consultation and engagement associated with each stage of preparing the WelTAG business case for a Road User Payment scheme.

7. Approve the undertaking of research and prepare a communication and public and key stakeholders strategy to support the preparation of the business case for a Road User Payment scheme.

SENIOR RESPONSIBLE OFFICER	Director Name
	Date submitted to Cabinet office.

The following appendices are attached:

Appendix A: Summary of Road User Charging Schemes in the UK.

Appendix B: Comparison of UK Core Cities.

The following background papers have been taken into account.

- Transport White Paper Cabinet Report, 23 January 2020.
- One Planet Strategy Cabinet Report, 15 October 2020.
- Corporate Plan, 'Delivering a Stronger, Fairer, Greener Cardiff', March 2023.
- 'National Transport Delivery Plan', Welsh Government, February 2023.
- 'The Future of Road Investment in Wales', Advice from the independent Panel appointed by the Welsh Government, August 2022 – published February 2023.
- 'Llwybr Newydd Wales Transport Strategy', Welsh Government, 2021.
- 'Net-Zero Strategy: Build Back Greener' UK Government, October 2021.
- 'Net-Zero Wales', Welsh Government, October 2021.
- 'Decarbonising transport: a better, greener Britain', UK Government, July 2021.
- 'South East Wales Transport Commission: final recommendations', Welsh Government, November 2020.
- 'Independent review of road user charging in Wales', Derek Turner, November 2020.
- 'The Eddington Transport Study, The case for action: Sir Rod Eddington's advice to Government', December 2006.
- 'The Future of Transport: A Network for 2030', by the Department for Transport, 2004.
- Equality Impact Assessment.

Mae'r dudalen hon yn wag yn fwriadol

UK CORE CITIES & OTHER KEY CITIES – RUC SCHEME SUMMARY

City Name	Scheme	Status	Type	Charges	Timings	Other details of the Scheme
Cambridge	Congestion Charge	Second stage consultation in 2022/23 To be implemented from 2026	Area based	£5/day- For Cars and motorcycles. £10/day – For non-compliant LGVs. £5 for zero emission. £50/day – For non-compliant Coaches & HGVs	Charges will be applied during morning peak in 2026 (07:00 to 10:00) and all day (07:00 to 19:00) from 2027 onwards.	A charging scheme designed to reduce traffic and congestion in the city centre and generate revenue to invest in better bus services, more walking and cycling infrastructure, and measures to make better use of the network. The Strategic Outline Case was released in September 2022, and is expected to go out for consultation in October 2022.
London	Congestion Charge	Implemented from Feb 2003	Boundary-based	For non-compliant vehicles, the charge is £17.5/day (or £15/day if paid in advance or on same day)	07:00-18:00 Monday-Friday and 12:00-18:00 Sat-Sun and bank holidays except between Christmas Day to New Year's Day bank holiday (inclusive).	London's congestion charge system aims to reduce inner-city traffic and prevent pollution. The system requires a daily charge for people driving within an eight-square-mile zone of central London.
	Ultra Low Emission Zone	Implemented from April 2019	Area-based	For non-compliant vehicles, £12.5/day.	24/7, every day of the year except Christmas Day.	The zone covers all areas within the North and South Circular Roads. The North Circular (A406) and South Circular (A205) roads are not in the zone.
	Low Emission Zone	Implemented from Feb 2008	Area-based	For non-compliant vehicles, £100-300/day (ranging based on PM emissions)	24/7 every day of the year except Christmas Day.	
Birmingham	Clean Air Zone, Class D	Implemented from June 2021	Area-based	£8/day- For non-compliant Cars, Minibuses, LGVs. £50/day – For non-compliant Coaches, Buses, HGVs	24/7	One-time daily charge for non-compliant vehicles travelling into and within CAZ. Covers an area of the city centre inside the A4540 Middleway (but not the Middleway itself).
Bristol	Clean Air Zone, Class D	Implemented from November 2022	Area-based	£9/day- For non-compliant Cars, Minibuses, LGVs. £100/day – For non-compliant Coaches, Buses, HGVs	24/7	One-time daily charge for non-compliant vehicles travelling into and around the CAZ. Covers an area of the city centre.

UK CORE CITIES & OTHER KEY CITIES – RUC SCHEME SUMMARY (CONT.)

City Name	Scheme	Status	Type	Charges	Timings	Other details of the Scheme
Glasgow	Low Emission Zone	To be Implemented from June 2023	Area - based	For non-compliant vehicles £60 per entry into LEZ, charge doubling each time vehicle returns within a 90-day period	24/7	A penalty is charged each time a high-polluting vehicle travels into the LEZ. It will cover an area of the city centre, bounded by the M8 motorway to the north and west, the River Clyde to the south and Saltmarket/High St to the east.
Newcastle	Clean Air Zone, Class C	Implemented Jan 2023	Boundary based	£12.5 per day for non-compliant vans/LGVs and Taxis. £50 per day for non-compliant coaches, buses and lorries/HGVs.	24/7 (tentatively)	Zone will cover most of Newcastle city centre, including routes over the Tyne, Swing, Redheugh and high-level bridges.
Nottingham	Workplace Parking Levy	Implemented from 2012	Workplace parking levy on 11 or more parking spaces by single employer.	£458/parking space/year for employers who provide 11 or more liable places.	Not Applicable	Nottingham City Council has introduced a WPL to tackle problems associated with traffic congestion, by both providing funding for major transport infrastructure initiatives and by acting as an incentive for employers to manage their workplace parking provision.
Sheffield	Clean Air Zone, Class C	To be Implemented from early 2023	Boundary-based	£10 per day for non-compliant vans/LGVs and Taxis. £50 per day for non-compliant coaches, buses and lorries/HGVs.	24/7 (tentatively)	This is a class C chargeable zone for the most polluting large goods vehicles, vans, buses and taxi's that drive within the inner ring road and city centre. Private cars and motorbikes will not be charged.
Edinburgh	Low Emission Zone	Implemented in May 2022 and enforcement will start from June 2024 following grace period of 2 year for all.	Area-based	For non-compliant vehicles £60 per entry into LEZ, charge doubling each time vehicle returns within a 90-day period.	24/7	A city centre low emission zone (LEZ) was introduced as it would reduce harmful emissions across the whole city, not just within the zone and would help meet legal emission levels of certain pollutants, including nitrogen dioxide (NO2) which are currently higher than the legal standard.

Appendix B: Comparison of Transport Metrics for UK Core Cities

Population:

Core City:	2011 Population	2021 Population	Change in Population	Change Rank	Population Rank
Bristol	428,234	472,462	10%	1	7
Manchester	503,127	551,943	10%	2	5
Leeds	751,485	811,950	8%	3	2
Newcastle	280,177	300,131	7%	4	11
Glasgow	593,295	633,100	7%	5	3
Birmingham	1,073,045	1,144,916	7%	6	1
Nottingham	305,680	323,627	6%	7	10
Cardiff	346,090	362,301	5%	8	8
Liverpool	466,415	486,093	4%	9	6
Belfast	333,871	345,418	3%	10	9
Sheffield	552,698	556,519	1%	11	4

Comment: Cardiff's population is comparatively low amongst the Core Cities.

Data Source: 2011/2021 Census - <https://www.nomisweb.co.uk/sources/census>

Households:

Core City:	2011 Households	2021 Households	Change in Households	Change Rank	Households Rank
Belfast	120,595	149,208	24%	1	8
Leeds	320,596	341,466	7%	2	2
Bristol	182,747	191,640	5%	3	7
Newcastle	117,153	122,795	5%	4	11
Manchester	204,969	214,732	5%	5	5
Glasgow	285,924	298,847	5%	6	3
Cardiff	142,557	147,333	3%	7	9
Birmingham	410,736	423,456	3%	8	1
Sheffield	229,928	231,950	1%	9	4
Liverpool	206,515	207,491	0%	10	6
Nottingham	126,131	124,745	-1%	11	10

Comment: Cardiff has a comparatively low number of households amongst the Core Cities.

Data Source: 2011/2021 Census - <https://www.nomisweb.co.uk/sources/census>

Car Ownership:

Core City:	2011 HH Without a Car	2021 HH Without a Car	Change in Car Ownership	Change Rank	Cars Owned Rank
Cardiff	29%	26%	-3%	10	1
Bristol	29%	26%	-3%	11	2
Leeds	32%	29%	-3%	9	3
Sheffield	33%	29%	-4%	8	4
Birmingham	36%	32%	-4%	7	5
Belfast	40%	34%	-6%	1	6
Newcastle	42%	37%	-5%	5	7
Nottingham	44%	38%	-6%	2	8
Manchester	45%	39%	-6%	3	9
Liverpool	46%	40%	-6%	4	10
Glasgow	51%	46%	-5%	6	11

Comment: Cardiff has the least number of households without access to a car.

Data Source: 2011/2021 Census - <https://www.nomisweb.co.uk/sources/census>

Commuting (2011):

Core City:	Sustainable Modes	Sustainables Rank	Distance Travelled (km)	Distance Rank
Glasgow	52%	1	-	-
Manchester	49%	2	12.4	8
Nottingham	47%	3	13.6	3
Newcastle	45%	4	15.3	1
Liverpool	44%	5	13.1	5
Bristol	43%	6	12	10
Belfast	40%	7	13.09	6
Birmingham	37%	8	12.3	9
Sheffield	37%	8	14	2
Cardiff	36%	10	12.7	7
Leeds	35%	11	13.2	4

Comment: Cardiff had the 2nd lowest proportion of people travelling to work by sustainable modes.

Data Source: 2011 Census - https://www.nomisweb.co.uk/sources/census_2011

Traffic Volume:

Core City:	2019 Traffic (MVkm)	2021 Traffic (MVkm)	Change in Traffic	Change Rank	Traffic Volume Rank
Leeds	6988	6090	-13%	7	1
Birmingham	6024	5175	-14%	9	2
Glasgow	3623	3215	-11%	3	3
Cardiff	3210	2794	-13%	8	4
Sheffield	2846	2520	-11%	4	5
Manchester	2721	2391	-12%	5	6
Bristol	2405	2101	-13%	6	7
Liverpool	2228	2025	-9%	1	8
Nottingham	1702	1519	-11%	2	9
Newcastle	1783	1518	-15%	10	10
Belfast	-	-	-	-	-

Comment: Cardiff has the 4th highest traffic volume amongst the Core Cities.

Data Source: DfT - [Road traffic statistics \(TRA\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/statistics/road-traffic-statistics)

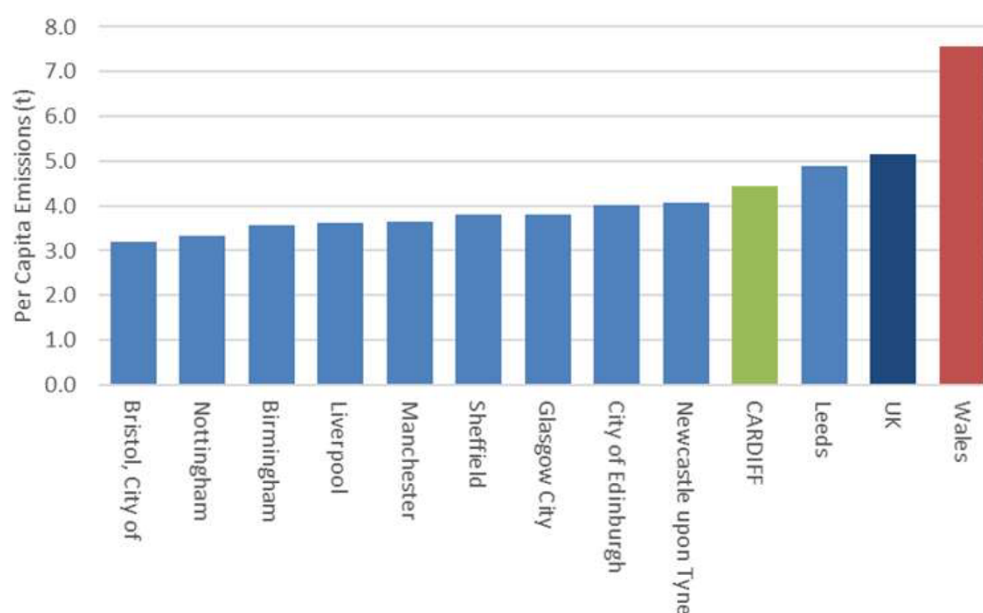
Congestion:

Core City:	2019 Annual Delay (Hrs)	2022 Annual Delay (Hrs)	Change in Delay	INRIX Global Rank	Relative Rank
Bristol	103	91	-12%	25	1
Manchester	92	84	-9%	31	2
Birmingham	80	73	-9%	41	3
Belfast	112	72	-36%	50	4
Nottingham	78	71	-9%	52	5
Leeds	66	60	-9%	64	6
Cardiff	87	61	-30%	75	7
Sheffield	-	54	-	89	8
Liverpool	52	50	-4%	104	9
Newcastle	57	40	-30%	186	10
Glasgow	43	31	-28%	230	11

Comment: Cardiff is ranked the 75th most congested city globally, and 7th of the Core Cities.

Data Source: INRIX Global Traffic Scorecard - <https://inrix.com/scorecard/>

CO2 Emissions per Capita:



Comment: Cardiff is ranked second worst of the Core Cities in terms of CO2 emissions.

Data Source: Department for Business, Energy & Industrial Strategy (BEIS) reported in the 2022 Cardiff Assessment of Local Well-being by the Cardiff Public Services Board -

<https://www.cardiffpartnership.co.uk/cardiff-local-wba-2022/>

Road Safety:

Core City:	2012-2016 Casualties	2017-2021 Casualties	Change in Casualties	Change Rank	Casualties Rank
Newcastle	3,230	1,082	-67%	1	10
Cardiff	3,907	2,180	-44%	2	9
Liverpool	6,848	3,907	-43%	3	4
Birmingham	12,381	7,160	-42%	4	1
Manchester	4,836	2,812	-42%	5	8
Glasgow	6,109	3,723	-39%	6	5
Sheffield	6,050	4,146	-31%	7	3
Leeds	8,732	6,427	-26%	8	2
Bristol	3,994	3,091	-23%	9	7
Nottingham	4,119	3,237	-21%	10	6
Belfast	-	-	-	-	-

Comment: Cardiff has seen the 2nd largest reduction in road user casualties.

Data Source: STATS 19 - <https://www.crashmap.co.uk/>

Targets:

Core City:	Net Zero	Mode-Shift	Increase in Cycling	Increase in Bus Use
Belfast	2050	-	-	-
Birmingham	2030	-	-	-
Bristol	2030	15%	-	-
Cardiff	2030	25%	100%	100%
Glasgow	2030	5%	200%	-
Leeds	2030	20%	400%	130%
Liverpool	2030	17%	-	-
Manchester	2038	17%	-	-
Newcastle	2030	9%	-	-
Nottingham	2028	-	-	-
Sheffield	2030	-	570%	-

Comment: Cardiff has the most ambitious target for mode-shift of 25% (from 51% to 76% by 2030).

Data Source: Transport Strategies