Air Quality

Executive Summary

Air quality adjacent to the Scheme is currently good with low background concentrations of air pollutants. However, there are areas within Cambridge city centre which currently experience poor air quality which may be affected by the Scheme.

The Scheme aims to result in a shift away from the use of private vehicles by encouraging people to use public transport and off road cycle routes. The benefits of the Scheme to local air quality from the reduction in private car use, is expected to be relatively small with reductions in vehicle flows spread across the road network rather than focused on those areas currently experiencing poor air quality. A high-level appraisal, undertaken to inform the business case reflects this, with both positive and negative changes to pollutant concentrations expected be to negligible outside of central Cambridge.

At the next stage, further assessment will be undertaken to assess in detail the change in concentrations of pollutants at sensitive locations. Should further assessment indicate adverse effects due to an increase in bus traffic in the city centre, these may be mitigated by encouraging bus companies to use vehicles with lower or zero emissions or by incentivising specific routes and bus stops to minimise the effect on the most sensitive locations within the city centre. Should the scheme lead to a renewal of the current bus fleet, then this could have a beneficial impact on air quality in the city centre.

Study Area

The study area for the air quality assessment consists of the area within 200m of the proposed route for each option and within 200m of any road which is likely to be affected by a change in traffic, as per guidance in the Highways Agency's Design Manual for Roads and Bridges (DMRB).

Summary of existing environment

Cambridge City Council (CCC) and South Cambridgeshire District Council (SCDC) have investigated air quality within their districts as part of their responsibilities under the Local Air Quality Management (LAQM) regime. To date, one Air Quality Management Area (AQMA) has been declared by Cambridge City Council; an area encompassing the inner ring road and the land within it, including a buffer zone around the ring road and its junction with main feeder roads. This AQMA has been declared due to exceedances of the annual mean nitrogen dioxide (NO_2) UK Air Quality Strategy (AQS) objective. In addition, South Cambridgeshire District Council has declared an AQMA within an area along the A14 between Bar Hill and Milton. It has also been declared due to exceedances of the annual mean NO_2 AQS objective, and additionally for exceedances of the daily mean PM_{10} AQS objective.

Air quality in the study area outside of the Cambridge city centre AQMA is relatively good, with monitoring data showing exceedances of the annual mean NO_2 UK AQS objectives only at locations not representative of sensitive receptors within the study area, i.e. a kerbside site. The majority of monitoring undertaken within the Cambridge city centre AQMA also indicates concentrations below the UK AQS objectives. There is however, one monitoring site, located adjacent to the affected road network, which is currently exceeding the NO_2 AQS objective (CM4 Parker Street) [1]. Parker Street is located adjacent to the Drummer Street bus station and therefore currently experiences high levels

[1] https://www.cambridge.gov.uk/sites/default/files/annual_status_report_cambridge_city_council_2016_.pdf

of bus traffic; it is in a narrow residential street lined with sensitive residential properties at kerbside locations.

The CCC Local Plan policy 4/14 states that any new development should have no adverse effect on air quality in the AQMA. It is therefore essential to fully understand the impact, both negative and positive, of the scheme on local air quality within the AQMA.

Potential Impacts

During construction, air quality could be affected by dust emissions from construction activities on site, and from additional traffic travelling to and from site. Any effects during construction would be of a temporary nature only. With appropriate mitigation measures in place, any adverse impacts resulting from the construction works would be minimised such that there should not be any significant residual effect.

Once the route is complete and operational, air quality could be affected by additional buses on the new bus route, and by changes in traffic along other roads due to any modal shift from private cars to public transport. The Scheme is likely to result in areas having a benefit and other areas having a dis-benefit to local air quality.

As noted in the study area section, sensitive receptors within 200m of both the new route and any other affected road could be affected by changes in NO_2 and PM_{10} concentrations which have human health effects, while sensitive ecological sites could be affected by changes in NO_x emissions. Sensitive receptors within 200m of the route options include the residential areas of Cambourne, Hardwick, Coton, and west Cambridge. In addition, there are two schools in Cambourne within 200m of option 3a: Harwick The Blue School; and Jeavons Wood Primary School. The Madingley Wood SSSI lies within 200m of the route options and would need to be considered in an air quality assessment. It is assumed that the bus routes, and thus the affected road network, will continue from the scheme extent at Grange Road into the city centre.

A high-level appraisal of the impact on air quality and greenhouse gases for the proposed A428 Better Bus Journeys Scheme was undertaken to inform the Strategic Outline Business Case (SOBC) for a number of scheme options, including option 3 and 3a, using the Department for Transport's Transport Analysis Guidance (TAG)[2].

The SOBC reported net dis-benefits across all options for both local air quality and greenhouse gases. The TAG methodology utilised in the SOBC does not assess the significance of the impact; rather it looks at the overall change across all assessed road links. The assessment concluded that there would be an overall dis-benefit for all options, however the methodology does not take into account the magnitude of change in total concentrations relative to AQS objectives, nor the significance of any effect at individual receptors. This is particularly relevant for sensitive receptors adjacent to the offline route options, which currently experience low concentrations of both NO_2 and PM_{10}, where a change in concentrations may not be significant, and for those receptors within the Cambridge City Centre AQMA, for which the same change in concentrations could be significant.

[2] https://www.gov.uk/transport-analysis-guidance-webtag

The net worsening in local air quality reported for all options was largely driven by the increase in bus traffic, especially on new offline sections of the scheme, affecting sensitive receptors (in this case, residential properties). In addition, regional air quality and greenhouses gases were affected by an increase in emissions, again largely driven by the additional buses, especially when options included long offline route sections. The results for options 3 and 3a are provided in Table 1.

The TAG appraisal is designed to be conservative, adopting the precautionary principle in order to raise potentially significant issues at an early stage of scheme development. The methodology as followed for the purposes of the SOBC therefore represents a 'worst case' approach for a number of reasons and thus may not have captured fully the potential benefits of the scheme for air quality. The assessment also used predicted bus frequency data for the Scheme, which has subsequently been reduced markedly, especially in Cambridge city centre, where it is likely there will now be only a minimal increase in bus traffic.

Benefits are likely to be due to smaller changes in modal shift spread over a much larger area than the dis-benefits close to the bus routes. Potential benefits of the Scheme resulting from a renewal of the bus fleet were also not included within the SOBC appraisal. It should be noted that both the benefits and dis-benefits are only likely to be significant within areas which are already or are close to exceeding air quality criteria, notably within the Cambridge City Centre AQMA.

Impact Significance

Impact descriptors to show the effect of changes in local air quality at receptors are provided in the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) Development Control Guidance[3]. These descriptors, which may be used in the assessment of the annual mean concentrations of NO_2 and PM_{10}, are expressed as the magnitude of incremental change as a proportion of the relevant air quality objective. The impact descriptors are designed for use where concentrations have been modelled at individual receptor locations. The high level appraisal undertaken for the SOBC, followed the TAG methodology, whereby NO_2 and PM_{10} concentrations were estimated at set distances within 50 m distance bands (20 metres, 70 metres, 115 metres and 175 metres) away from the centreline of roads in the affected road network (ARN), rather than at discrete receptor locations. The results from the TAG appraisal do not reflect a detailed air quality assessment and applying the EPUK/IAQM impact descriptors to the results of the assessment should therefore be treated with caution.

Nevertheless, in order to provide an indication of the significance of the change in concentrations at individual receptors, the EPUK/IAQM impact descriptors have been assigned to the change in NO_2 and PM_{10} concentrations where there are properties within the 50m distance band from the road centreline. As noted above, concentrations within this distance band are estimated at a distance of 20m from the road centreline and so are only indicative of the properties within this distance band which may be closer to or further from the road.

The TAG assessment for Options 3 and 3a found estimated concentrations below the relevant air quality criteria at a distance of 20m from all road centrelines for both NO_2 and PM_{10}. Applying the EPUK/IAQM significance descriptors, the significance of the change in PM_{10} concentrations can be described as negligible adjacent to the ARN for both options. Applying the EPUK/IAQM significance descriptors the significance of the change in NO_2 concentrations can be described as negligible adjacent to the ARN for both options, with the exception of locations adjacent to a single road. Downing Street, within central Cambridge has a change in NO_2 concentrations at a distance of 20m from the road described as slight adverse for both options 3 and 3a. There are very few sensitive receptors located in this area of central Cambridge, the closest residential property to Downing

[3] http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

Street is located 35m from the road. The NO_2 concentrations, as calculated for the TAG appraisal, at a distance of 20m from the road, are therefore again conservative for the sensitive receptors within the 0-50m band, at this location.

There is no guidance on classification of magnitude of impact or significance of effect for the regional NO_x or greenhouse gases assessment.

Table 1 Option Summary

Option	Summary results										
	Local Air Quality Assessment for NO_2 & PM_{10}		Regional NOx Emissions			Air Quality Valuation			Estimated Change in Emissions of Carbon Dioxide (Tonnes) and the Associated Net Present Value		
	NO_2	PM_{10}	Total NOx Emissions with Proposed Scheme in Opening Year (tonnes)	Change in NOx Emissions with Proposed Scheme in Opening Year compared to Do-Minimum (tonnes)	Change in NOx Emissions with Proposed Scheme over 60 year appraisal period compared to Do-Minimum (tonnes)	Present value of change in NOx emissions (£)	Present value of change in PM10 concentrations (£)	Total value of change in air quality (£)	Change in CO2 Emissions with Proposed Scheme in Opening Year compared to Do-Minimum (tonnes)	Change in CO2 Emissions with Proposed Scheme over 60 year appraisal period compared to Do-Minimum (tonnes)	NPV (£)
3	1122	105	78.4	4.8	100	-77,150	-323,199	-400,349	4,187	189,901	-7,022,713
3a	1332	244	76.4	2.8	46	-38,332	-754,748	-793,081	2,940	133,880	-6,133,635

Methodology for further assessment

A detailed assessment of the impact on air quality and greenhouse gases should be undertaken to better reflect the impact of the scheme. Further assessment would be undertaken using a detailed dispersion model, and would focus in detail on the total concentrations relative to the AQS objectives and the significance of change at individual receptors. Local air quality and regional emissions would be determined over a wider area to capture smaller changes in traffic flow from modal shift not included in the SOBC appraisal.

The SOBC appraisal used conservative assumptions regarding bus frequency and emission rates, these will be revisited in order to be reflect the specific fleet composition, which is expected to meet Euro VI emission limit standards or higher, with the potential for zero emission vehicles running within central Cambridge. With 90 percent[4] of emissions within some areas of Cambridge city centre attributable to buses, any renewal of the current bus fleet within Cambridge would have a beneficial impact on air quality. Prior to commencement of the work, the methodology for further air quality assessment will be agreed with the environmental health officers for both Cambridge City Council and South Cambridgeshire Council. It is expected that further assessment of the scheme will include:

- A review of bus flow estimates to provide a more realistic case (to date 24hr peak operation has been assumed as a worst case). If appropriate, further assessment could include a range of additional bus flow rates.
- Use of the most up to date CRSM traffic modelling data to take congestion into account.
- Inclusion of future, cumulative development traffic in the modelled opening year traffic flows so that any future benefits due to the scheme alleviating congestion are fully accounted for.
- Detailed assessment using the latest version of the dispersion model ADMS Roads for the purposes of Environmental Impact Assessment. This would focus on the significance of any change in air quality for the pollutants NO_2 and PM_{10}. The modelling would include specific sensitive receptors, particularly those within the Cambridge City Centre AQMA. Fleet analysis on roads within the AQMA would provide an indication of the possible increase in emissions, prior to detailed modelling.
- Where possible, any further assessment will use fleet specific emissions factors, or best estimates based on likely bus size and manufacturer. If suitable information is not available then average Euro VI bus emissions standards should be utilised rather than the average bus fleet data within the Defra emission factor database.
- The magnitude and change in total pollutant concentrations presented as part of any future assessment will be assessed in accordance with the IAQM 2017 Land-Use Planning & Development Control guidance[5].
- Total change in NO_x, PM_{10} and CO_2 emissions should be calculated across a much larger network to capture roads with smaller changes in flow, to give a more accurate estimate. This may include the full extent of the traffic model (within the area defined as suitably reliable by transport modellers)

Potential mitigation measures

Further advice on potential mitigation measures to be implemented during construction are given in the 2014 IAQM Guidance on the assessment of dust from demolition and construction[6] for activities with low, medium and high risk of dust emissions. The precise measures relevant to the Scheme will

[4] https://www.cambridge.gov.uk/sites/default/files/docs/Further%20assessment%20of%20nitrogen%20dioxide%202006.pdf
[5] http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[6] http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

be determined once all data on construction processes is known. Required mitigation measures are likely to be included within a dust management plan (DMP) to form part of the construction environmental management plan (CEMP). It is expected that clear formal procedures for the control of dust (and other emissions to air) will be developed.

Mitigation of emissions of vehicle derived pollutants is regulated at a national and European level through the introduction of increasingly stringent exhaust emissions criteria, known as the Euro emissions categories or standards. It is expected that any new buses, introduced as part of the scheme, would aim to meet Euro VI emission standards or higher. Further assessment is required to determine if any further operational scheme specific mitigation of traffic emission impacts is required, these could include bus priority schemes and traffic management to incentivise bus companies to operate services along preferred routes, selected to minimise the impact on sensitive receptors within the Cambridge City AQMA.

Risk Summary

A high-level assessment of environmental risk has been undertaken by assigning a red, amber or green rating to potential local air quality impacts across the Scheme study area. The assignment of an environment risk rating provides an early, high level indication of environmental constraints associated with a project, based on the best readily available information at the time. The assigned category is based on professional judgement and may be refined as the scheme progresses and more detailed information becomes available. Based on the baseline information available and the appraisal undertaken to date, a green risk category has been assigned to sensitive locations within the SCDC boundary and along all offline sections of the Scheme. An amber category has been assigned to sensitive locations within the CCC AQMA boundary, where there is the possibility that a relatively small increase in bus traffic may have a significant impact on already constrained locations such as Downing Street and Parker Street.

Conclusions

The high level SOBC appraisal indicates that changes in local air quality are likely to negligible outside central Cambridge; a green risk category has been assigned to local air quality impacts outside of the Cambridge City AQMA and an amber risk category assigned within the AQMA. Further assessment should be undertaken using a verified air quality dispersion model, assessing in detail the change in concentrations of NO_2 and PM_{10} at discrete receptor locations. Should further assessment indicate adverse impacts in the Cambridge city centre these may be mitigated by encouraging bus companies to use vehicles with more stringent emissions standards or by incentivising specific routes and bus stops to minimise the impact on the most sensitive locations within the city centre. Should the scheme lead to a renewal of the current bus fleet, then this could have a beneficial impact on air quality in the Cambridge City AQMA.