

# N52 TULLAMORE TO KILBEGGAN LINK

## Option Selection Report

### Volume F – Environmental Appendices Appendix F4 – Air Quality

MDT0891-RPS-00-XX-RP-Z-0023  
Option Selection Report  
Volume F Appendix F4  
Air Quality  
S3.P02  
5<sup>th</sup> August 2021

Document status					
Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
S3.P01	Draft Issue	JG	SB	PC	31 <sup>st</sup> May 2021
S3.P02	Final Draft Issue	JG	SB	PC	5 <sup>th</sup> August 2021

Approval for issue	
PC	5 August 2021

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# 1 INTRODUCTION

This report outlines the comparative assessment of options in relation to air quality for the seven options for the N52 Tullamore to Kilbeggan Link Scheme. This assessment will form part of a Phase 2 – Option Selection Report which is a deliverable under Phase 2 – Options Selection of the TII PMG 2019. The purpose of the Option Selection Report is to present the project constraints and the assessments that were undertaken in order to identify the Preferred Option for the project.

This report assesses the impact of each option shortlisted for Stage 2 from an air quality perspective. Specifically, this report evaluates the potential air emissions associated with the operation of each of the options under consideration. The impacts for each of the options are identified so that those with unacceptably high levels of impact can be avoided to the extent feasible as part of the overall option assessment process.

## 1.1 Guidance

This analysis was undertaken by means of a desktop assessment based on the following guidance and information sources:

- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011);
- National Roads Authority(NRA)/Transport Infrastructure Ireland(TII) “*Guidance for the Treatment of Air Quality during Planning and Construction of National Road Projects*” (May 2011);
- Transport Infrastructure Ireland “*Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis*” (2016);
- EPA Air Quality Monitoring Database <https://www.epa.ie/air/quality/reports/>;
- UK Highways Agency “*Design Manual for Roads and Bridges, Volume 11, Section 3, Air Quality Assessment*” (2007) and the updated LA105 (November 2019);
- Road traffic predictions for each option as supplied by the traffic expert for the project (AADT, average speed and %HGV); and
- Geodirectory information on sensitive receptors for each option.

The NRA/TII document “*Guidance for the Treatment of Air Quality during Planning and Construction of National Road Projects 2011*” provides guidance on the assessment procedures utilised for air quality of the option selection process. The primary aspects of the assessment relate to existing ambient air quality and the proximity of sensitive locations to each option. The guidelines require that “*the total number of sensitive receptors within 50m of the carriageway of each feasible route option should be recorded with a view to eliminating those routes with the greater number of sensitive receptors likely to be impacted by the proposed scheme*”.

## 1.2 Project Appraisal Guidelines Requirements

The TII “*Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis*” (PAG) states that for a Stage 2 appraisal of air quality the following elements should be considered in the route corridor selection:

- Changes to baseline air quality conditions (Qualitative);
- Calculation of the Index of Overall Change in Exposure (Quantitative);
- Calculation of local scale pollutant (NO<sub>2</sub> and PM<sub>10</sub>) concentrations, if relevant (Quantitative); and
- Consideration of impacts on sensitive ecosystems (Quantitative).

Each of the above elements is addressed within this report with the exception of the local scale pollution which is not relevant at this route option stage for this scheme but will be addressed in greater detail in the EIAR for the preferred route.

### 1.3 Assessment Criteria

The Stage 2 Appraisal Process was carried out using the full range of sub criteria recommended in PAG unit 7.0, and with regard to the objectives of the scheme, so as to take account of all the predicted impacts of each option or alternative. In many cases there is a strong overlap between the objectives of the scheme and one or more of the PAG sub criteria.

All appraisal criteria use a standard scale. Each impact is scored on a scale of 1 (major or highly negative impact) to 7 (major or highly positive impact). A score of 4 represents a neutral or not significant impact. Each impact is scored as per the system presented in **Table 1-1**.

**Table 1-1: Project Appraisal Guidelines Scoring**

Score	PAG Score
7	Major or highly positive
6	Moderately positive
5	Minor or slightly positive
4	Not significant or neutral
3	Minor or slightly negative
2	Moderately negative
1	Major or highly negative

All scores refer to impacts measured relative to the Do-Minimum. The Do-Minimum consists of doing nothing further to improve the N52 route. The Do- Minimum would therefore by definition be scored as Neutral (relative to itself) under all sub criteria.

PAG 7.0 notes that simply adding up the scores of the different sub-criteria gives an indication of the overall performance of each option under a given criterion, but this is not to be used in a mechanistic way as a decision process. The performance of each option in meeting the scheme objectives was then considered to be one of the criteria presented in **Table 1-2**.

**Table 1-2: Qualitative Scoring**

Score	PAG Score
Preferred	The choice which most fully meets the project objectives.
Good	Where project objectives are met notably better than with the intermediate choices but notably not as well as with the best choice.
Intermediate	Where project objectives are met considerably less well than with the best choice but considerably better than with the worst choice.
Poor	Where project objectives are met notably less well than with the intermediate choices but notably not as well as with the best option.
Least Preferred	The choice which does least to achieve the project objectives.

Having regard to the full range of impacts assessed in each case. This is a high level of ranking of the options or alternatives. The scoring process allows for options or alternatives to be identified as being “Good”, falling between “Intermediate” and “Preferred”, or as “Poor”, falling between “Least Preferred” and “Intermediate”.

For some options there will be very little between their impact scores and some may even have the same impact scores. In such circumstances, the author has applied expert judgement and evaluated each option comparatively against the other options, taking into account the quantitative and qualitative assessments. This has allowed the author to determine a preference for each option. In some instances, similar options may have the same preference.

## 2 EXISTING ENVIRONMENT

### 2.1 Baseline

Under the Clean Air for Europe (CAFE) Directive, EU member states must designate "Zones" for the purpose of managing air quality. For Ireland, four zones were defined in the Air Quality Standards Regulations (2011). The zones were amended on 1 January 2013 to take account of population counts from the 2011 CSO Census and to align with the coal restricted areas in the 2012 Regulations (S.I. No. 326 of 2012). The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). The four air quality zones in Ireland are:

- Zone A: Dublin;
- Zone B: Cork;
- Zone C: Other cities and large towns comprising Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, Balbriggan, Greystones, Leixlip and Portlaoise; and
- Zone D: Rural Ireland i.e. the remainder of the State excluding Zones A, B and C.

The proposed scheme is situated within Zone D - Rural Ireland, i.e. in an area with the absence of any major sources of air pollution. Air quality in Zone D is generally described as "good" given the absence of major pollution sources.

Existing sources of pollution in the area include road traffic on the local road network including the N52 and the M6, agriculture (dusts, odours, etc.) and space heating (e.g. domestic heating systems).

### 2.2 Study Area and Options

Residential receptors are present along the existing N52 and the local roads which intersect with the N52 between Tullamore and Kilbeggan. Durrow National School and Saint Colmcille Church Durrow, with a graveyard, are located within the constraints study area just east of the N52 at its junction with the L2006. The school, church and graveyard are each located within the central section of the study area.

#### 2.2.1 "Do-Something" Options

Each of the six "Do-Something" route options brought forward for Stage 2 assessment are described below:

- Proposed Option 1 (8.54km) follows existing N52 closely in horizontal and vertical alignment. The proposed cross section is wider than the existing carriageway in sections and will involve land take along the edges of the road. Multiple existing field accesses along N52 will be joined by parallel collector roads or diverted to the local roads minimizing field access points to the new carriageway.
- Proposed Option 2 (8.17km) follows the existing N52 closely in horizontal and vertical alignment from the Tullamore Bypass roundabout until chainage 2050. At chainage 2050 it diverges east from the existing N52 and joins back to the existing alignment at chainage 6400. The 4350m new offline road allows for elimination of substandard junctions at Four Roads and Durrow Village. The Option 2 will cross Derrygolán Esker at chainage 5050 to 5200. Option 2 contains the shortest offline section, trying to utilise as much as possible of the existing road. Option 2 skirts to the left of the national monument of Meeneglish avoiding direct impact on the monument at chainage 5700. Four crossings of waterbodies will be required on Option 2 at chainages: 2150, 3850, 5900 and 7000.
- Proposed Option 3 (7.90km) diverges east from the existing N52 at chainage 600. It crosses Molloy's Quarry at chainage 1250-1600 and the source protection area at chainage 1000-2100. Three road crossings are proposed along the Option 3: at chainage 2240 with L2003, at chainage 3120 with L2005 and at chainage 4790 with L2006. Three crossing of waterbodies will be required on the Option 3 at chainages: 2150, 5780 and 6800. Option 3 joins the existing N52 alignment at chainage 7000 following to the M6 junction.
- Proposed Option 4 (8.09km) is an eastern option and diverges east from existing N52 at chainage 250. It crosses Molloy's Quarry at chainage 1750-1950 and the source water protection area at chainage

1000-2400. Two road crossings are proposed along Option 4: at chainage 3200 with L2005 and at chainage 4900 with L2006. Option 4 avoids crossing Derrygolán Esker passing it on the east at chainage 4900. It then goes north west passing west of Pallas forest at chainage 6000. Two crossings of waterbodies will be required on Option 4 at chainages: 2730 and 7050. Option 4 joins the existing N52 alignment at chainage 7850 and follows to the M6 interchange.

- Proposed Option 5 (8.05km) diverges east from the existing N52 at chainage 2300 making use of an already upgraded alignment of N52 up to this point. The proposed alignment east of the existing N52 replaces two substandard junctions at Four Roads and Durrow Village and substandard horizontal and vertical alignment of N52 at the middle section. Two road crossings are proposed at Option 5: at chainage 3480 with L2005 and at chainage 4990 with L2006. Option 5 crosses Derrygolán Esker at chainage 4900-5000. Two crossings of waterbodies will be required on Option 5 at chainages: 2150 and 7050. Option 5 joins the existing N52 alignment at chainage 7850 and follows to the M6 interchange.
- Proposed Option 2-3 (8.10km) was developed during the course of the scheme development and appraisal as a combination of Options 2 and 3 above. This option combines the southern part of Option 2 with the northern part of Option 3 and has been developed as a means of further minimising impact on the Ballybought Castle site identified for Option 2.

## 2.2.2 Management Option

As a result of the TII review process (July 2021), an additional “Management Option” has been put forward for consideration/assessment within the Stage 2 Options Assessment Phase. The proposed “Management Option” follows the existing N52 Tullamore to Kilbeggán alignment (8.54km) and would involve upgrading a number of sections, mainly along the centre of the existing scheme. This would result in a single carriageway in each direction with roundabouts at junctions, including the following elements:

- Three roundabout junctions proposed; at R42-N52 junction, at Four Roads Cross / L2005, and Durrow Village / Balleek Beg;
- Priority junctions at L2003-N52 Junction north of existing Silver River Bridge and at the L2006-N52 junction north of Durrow Village / Balleek Beg;
- Carriageway to be upgraded to Type 1 Single Carriageway Cross Section (circa chainage 2500);
- Proposed *cul de sac* at L2005-N52 Junction; and
- Carriageway to be upgraded to Type 1 Single Carriageway Cross Section with localised green verge narrowing between proposed *cul de sac* at L2005-N52 Junction and Durrow Village / Balleek Beg.

Regarding the context of this additional option, this is a Management Option as opposed to a Do-Minimum option. This option sits between a Do-Minimum and the Do-Something options proposed. This Management Option considers a short to medium term solution that may be able to achieve some of the objectives of the scheme.

In comparison to Option 1 (Brown), while the Management Option will follow the same centre line (i.e. the existing N52 Tullamore to Kilbeggán alignment), it is proposed as a single carriageway (Type 1 single) rather than a dual-carriageway as per the other Do-Something options. This option provides at-grade roundabouts at the key junctions, rather than grade separated junctions. However, this Management Option does not address the significant private accesses onto the N52 while Option 1 (Brown) requires a significant number of parallel roads to accommodate private accesses.

The southern and northern sections will require only minimal intervention as these have been recently upgraded, and it is essentially the middle section of the route that requires the most intervention (from the R421 junction to a point approx. halfway between the L2006 High Road and the M6 interchange). Across this section there is still likely to be hedge line loss to accommodate the wider carriageway (on both sides), although the extent of this loss will be considerably lower than Option 1.

In terms of impacts on Durrow Demesne, while Option 1 will potentially directly impact on the boundary at Durrow Demesne with tree and hedge line loss and the design can try to reduce the impacts on the wall, there is potential that there would be direct impact to the boundary wall with Option 1. This tree and hedge line loss impact would be more limited for the Management Option with less road widening and no impact on the boundary walls.

### 2.2.3 Property Data and Traffic

There are several residential properties within the 50m of the centreline for each of the proposed route options which have been identified for inter-comparison and these are shown in **Table 2-1**. In addition, the projected 2040 design year traffic patterns for each of the route options are also presented **Table 2-1**. Average speed is assumed as 100 kph for all route options. This data has been derived from the Traffic Modelling Report for the scheme (based on the average of the traffic on the northern section of the N52) – traffic for Option 2-3 has been presented as the same as traffic for Option 2

**Table 2-1: Sensitive receptors and design year traffic flows**

Route Option	Residential Receptors within 50m	Design Road Length (km)	2040 AADT	%HGVs	Average Speed (kph)
Management Option	25	8.54	17,384	7.3	100
Option 1	39	8.54	18,150	7.3	100
Option 2	17	8.17	15,500	7.3	100
Option 3	17	7.90	16,330	7.3	100
Option 4	14	8.09	16,110	7.3	100
Option 5	13	8.05	17,500	7.3	100
Option 2-3	12	8.10	15,500	7.3	100



## 3 OPTION SELECTION

### 3.1 Methodology

MapInfo software has been used to perform a geographic information system (GIS) analysis of GeoDirectory data. 50 metre buffer zones have been generated around each of the Stage 2 options' centrelines. These buffer zones have been used to identify all properties within 50 metres of the centrelines, which were subsequently exported from GIS as text files (.csv format) for use in the exposure assessments.

The index exposure assessment for each route was carried out using the methodology outlined in the NRA/TII Guidelines and the UK Highways Agency Design Manual for Roads and Bridges (UK DMRB 2007), Volume 11, Section 3, Air Quality Assessment. The UK DMRB Screening Method software (V1.03c) has been used to model air quality indicators (in this case NO<sub>x</sub> and PM<sub>10</sub>).

### 3.2 Changes to baseline Air Quality Conditions

Traffic data for the project indicates that current (pre-Covid 2019 data) traffic levels on the existing N52 are circa 14,264 annual average daily traffic (AADT) with circa 7.3% estimated heavy goods vehicles. At these existing traffic levels, baseline air quality conditions will remain generally low and below the statutory limits for the protection of human health (S.I. 180 of 2011).

The development of the proposed road scheme will potentially alter the volumes, nature and average speed of traffic volumes with a resultant net change in the baseline air quality. **Table 2-1** shows the extent of traffic and speed changes on the proposed road and with these changes there will likely be a net increase in emissions from road traffic pollution on the road network.

Traffic forecasting indicates that this baseline level of traffic will increase to circa 18,000 AADT by 2050 (even without the scheme) based on typical growth rates. Again, with the increased average speed and changes in traffic patterns there would likely be a net increase in baseline air quality impact from the proposed development.

However, it should be noted that the Climate Action Plan 2019 proposes the introduction of new legislation to ban the sale of new fossil fuel cars from 2030 and to stop the granting of NCT certificates from 2045 to fossil fuel cars. In addition, the Climate Action Plan target is that by 2030 840,000 electric vehicles will be in use on Irish roads (this will equate to circa one third of the Irish fleet).

As a result of these legislative changes, the future baseline air quality conditions are predicted to improve with a general reduction in emissions from road traffic for climate but with associated air quality co benefits. These co-benefits will be realised regardless of whether the route option considered for the road scheme.

### 3.3 Index of Overall Change in Exposure

The aim of the assessment is to estimate the overall change in people's exposure to traffic pollutants, in this case, NO<sub>x</sub> and PM<sub>10</sub>. The more negative the exposure score, the greater the improvement in air quality and hence, those with the lowest scores have a lower potential impact for air quality. The changes in exposure for the 2040 design year are outlined in **Table 3-1** and **Table 3-2**. However, it should be noted that the scores are dimensionless and do not represent the extent of any impact.

Overall, **Table 3-1: Overall change in exposure to NO<sub>x</sub>**

indicate that Option 1 (Brown) has the potential to impact on the greatest number of properties relative to the other proposed route options and generates a significantly higher NO<sub>x</sub> and PM<sub>10</sub> score. This option follows the existing N52 closely in horizontal alignment but is significantly wider than the existing carriageway. This will involve land take along the edges of the road and increased proximity to existing dwellings along the existing N52. In short, this route will impact on over twice the number of properties impacted by the other options.

Option 1 largely maintains the distance from the existing alignment to Scoil Naomh Colmcille (Durrow National School) which is a particularly sensitive receptor for air quality. However, Option 1 does route a new supporting road between the main line junction and the L2006 to the north and east of the school (distance circa 150 metres) which would introduce a new, albeit minor, traffic pollution source to this area.

This option also requires the inclusion of three large junctions with the R421, L2005 and L2006 which have a potentially greater air quality impact given the slower traffic speeds associated with these junctions. These junctions are located within close proximity to a number of properties which may heighten any potential air quality impact for these properties.

The Management Option impacts on the second highest number of properties and impacts less properties than Option 1 because of the reduced road footprint. As with Option 1, the Management Option maintains the distance between the road and Scoil Naomh Colmcille. The NO<sub>x</sub> and PM<sub>10</sub> scores for the Management Option indicate that the impact, while less than Option 1, is significantly greater than each of the offline options.

The remaining options will impact on a lower number of properties than Option 1 and hence, generate NO<sub>x</sub> and PM<sub>10</sub> scores at circa 30-40% of that predicted for Option 1.

As each of these options is predominately offline there is also a lower requirement for larger junctions in the design thereby reducing any localised effects at these junctions. Options 2, 2-3 and 5 include a junction with the R421 only and the remaining design only requires a series of under/overbridges. In this regard, these options offer further air quality benefits for air quality above those presented in the NO<sub>x</sub> and PM<sub>10</sub> tables.

Each of the offline options move the main alignment further from the national school offering further air quality advantages over Option 1 for the primary school at Durrow.

**Table 3-1: Overall change in exposure to NO<sub>x</sub>**

Options	Residential Receptors within 50m	Link Length (km)	Predicted Emission NO <sub>x</sub> kg/year	Rate (kg/km/yr)	NO <sub>x</sub> Score
Management Option	25	8.54	26,077	3,054	76,338
Option 1	39	8.54	26,539	3,108	121,197
Option 2	17	8.17	21,683	2,654	45,118
Option 3	17	7.90	22,089	2,796	47,533
Option 4	14	8.09	22,315	2,758	38,617
Option 5	13	8.05	24,121	2,996	38,953
Option 2-3	12	8.10	21,497	2,654	31,847

**Table 3-2: Overall change in exposure to PM<sub>10</sub>**

Options	Residential Receptors within 50m	Link Length (km)	Predicted Emission PM <sub>10</sub> kg/year	Rate (kg/km/yr)	PM <sub>10</sub> Score
Management Option	25	8.54	954	112	2,793
Option 1	39	8.54	971	114	4,434
Option 2	17	8.17	793	97	1,650
Option 3	17	7.90	808	102	1,739
Option 4	14	8.09	816	101	1,412
Option 5	13	8.05	882	110	1,424
Option 2-3	12	8.10	786	97	1,164

### 3.4 Consideration of impacts on Sensitive Ecosystems

Ecological receptors can be sensitive to road traffic emissions through subsequent nitrogen deposition, especially on nutrient sensitive species and habitats. None of the options will directly traverse any European Sites so the potential for nitrogen deposition on these sensitive habitats from these routes is low.

The most sensitive ecological receptor within the area is the Derrygolan Esker pNHA which has a nationally important population of the rare Green-winged Orchid. Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids and there are a number of such habitats in the vicinity of the route options as set out in **Table 3-3**.

Option 5 intersects the Derrygolan Esker pNHA and therefore has potential for the greatest impact through nitrogen deposition on this habitat from traffic on this route option. As such, this route has a moderate potential for adverse impact. All other routes avoid the Derrygolan Esker pNHA but intersect with the wider mosaic of esker landscape so these options are classed as having a lower potential for impact on the sensitive ecosystems.

**Table 3-3: Impacts on Sensitive Ecosystems**

<b>Route Option</b>	<b>Proximity to Derrygolan Esker pNHA</b>	<b>Potential for Impact</b>
Management Option	<1km from Derrygolan Esker pNHA	Low
Option 1	<1km from Derrygolan Esker pNHA	Low
Option 2	<500m from Derrygolan Esker pNHA	Low
Option 3	<300m from Derrygolan Esker pNHA	Low
Option 4	<1km from Derrygolan Esker pNHA	Low
Option 5	Intersects the Derrygolan Esker pNHA	Moderate
Option 2-3	<300m from Derrygolan Esker pNHA	Low

## 4 OPTION SUMMARY

**Table 4-1** summarises the impact score matrix for all options proposed for the scheme. Each of the route options can be delivered to meet the project objectives from an air quality potential. Emissions from road traffic on properties within 50 metres are not predicted to have significant adverse impacts and, as such, there is no clear “least preferred” option.

Based on the property counts and supplementary qualitative analysis, the Management Option and Option 1 (Brown) are considered “poor” given the higher number of properties associated with these routes relative to the offline options. The impact level relative to baseline is classed as neutral given the largely identical alignment to the existing and an impact score of 4 is applied.

For the remaining routes the impacts are lower given the significantly lower number of properties impacted. In this regard, the remaining routes are given an impact score of 5 (minor or slightly positive) as a result of the overall reduction in community exposure to air pollution with these options. Each of these options are classed as “good” given the similarity in the number of properties impacted with Option 2-3 classed as the “preferred” option given that this option impacts on the least number of properties.

Option 5 is classed as intermediate as while this route as a similar impact on the human environment to Options 2, 3 and 4, the potential for impact on the natural environment is slightly higher.

**Table 4-1: Air Quality Impact Score Matrix**

Option	Potential for Impact	Impact Level	Impact Score	Preference
Management Option	<ul style="list-style-type: none"> <li>Existing residential properties adjacent to the current alignment will experience limited change in exposure to road traffic pollution.</li> <li>Low potential for impact on sensitive ecosystems</li> </ul>	Neutral	4	Poor
Option 1	<ul style="list-style-type: none"> <li>39 residential properties located within 50m of the existing N52 remain impacted under the proposed alignment.</li> <li>Low potential for impact on sensitive ecosystems.</li> </ul>	Neutral	4	Poor
Option 2	<ul style="list-style-type: none"> <li>A net decrease from Do-Minimum with 17 residential properties located within 50m of route alignment.</li> <li>Low potential for impact on sensitive ecosystems.</li> </ul>	Minor or slightly positive	5	Good
Option 3	<ul style="list-style-type: none"> <li>A net decrease from Do-Minimum with 17 residential properties located within 50m of route alignment.</li> <li>Low potential for impact on sensitive ecosystems.</li> </ul>	Minor or slightly positive	5	Good
Option 4	<ul style="list-style-type: none"> <li>A net decrease from Do-Minimum with 14 residential properties located within 50m of route alignment.</li> <li>Low potential for impact on sensitive ecosystems.</li> </ul>	Minor or slightly positive	5	Good
Option 5	<ul style="list-style-type: none"> <li>A net decrease from Do-Minimum with 13 residential properties located within 50m of route alignment.</li> <li>Moderate potential for nitrogen deposition impact on Derrygolan Esker pNHA orchid habitat.</li> </ul>	Minor or slightly positive	5	Intermediate
Option 2-3	<ul style="list-style-type: none"> <li>A net decrease from Do-Minimum with 12 residential properties located within 50m of route alignment.</li> <li>Low potential for impact on sensitive ecosystems.</li> </ul>	Minor or slightly positive	5	Preferred