



## **Chapter 11**

### Human Health

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## 11 Human Health

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### 11.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) considers the potential human health impacts associated with the Construction and Operational Phases of the BusConnects Galway: Cross-City Link (University Road to Dublin Road) (hereafter referred to as the Proposed Scheme).

The objectives of the Proposed Scheme are described in Chapter 1 (Introduction) of this EIAR. A detailed description of the Proposed Scheme is provided in Chapter 4 (Proposed Scheme Description) followed by a description of the construction stage in Chapter 5 (Construction) of this EIAR.

At a high-level, the Proposed Scheme will form a central route for public transport, cyclists and pedestrians along an east-west corridor through the city centre. It will facilitate increased level of service provision for existing and planned future bus services approaching from the east and west of the city centre. The city bus network routes will be altered to coalesce along this high-quality corridor, providing high-frequency services with journey time reliability and opportunities for interchange.

The corridor will ensure that public transport services can access key areas such as the retail and recreational centre of the city; public transport hubs at the rail and bus stations; City and County Halls; along with the city centre hotels and bed & breakfasts on College Road to the east of the city and key areas such as University Hospital Galway, NUI Galway and the Galway Cathedral.

The Proposed Scheme includes reconfiguration of traffic movements to facilitate improved pedestrian, cyclist and bus accessibility and movement, infrastructural works at certain roads and junctions, and improvements to the public realm at a number of locations within the city centre, including Eyre Square North, Woodquay and in the vicinity of Galway Cathedral.

Key objectives that are relevant to this Chapter are to:

- Enhance the potential for cycling by providing safe infrastructure for cycling, segregated from general traffic wherever practicable; and
- Improve accessibility to jobs, education and other social and economic opportunities through the provision of improved sustainable connectivity and integration with other public transport services.

## 11.2 Methodology

### 11.2.1 Relevant Guidelines, Policy and Legislation

The Guidelines on the Information to be contained in Environmental Impact Assessment Reports, EPA, 2022 state that in an EIAR, the assessment of impacts on human health:

*should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in the EIAR e.g. under the environmental factors of air, water, soil etc.*

and:

*The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment.*

In accordance with this guidance, the assessment impacts on human health is based on the assessment of the impacts on those factors under which human health effects might occur, as addressed elsewhere in the EIAR. Accordingly, this Chapter draws together material presented in, and should be read in conjunction with, the Chapters listed in Table 11.1, particularly the assessments of Air Quality and Noise & Vibration which are the principal vectors through which the scheme has potential to cause likely and significant effects on human health. It also refers to the other topics that are related to human health for the reasons outlined in the table.

**Table 11.1: Relationships of EIAR Topics to Human Health**

Chapter	Relevance
6. Traffic & Transport	Traffic generates noise and air quality emissions which can directly affect Human Health. Changes in emissions due to changes in traffic flows are assessed under the headings of Air Quality and Noise & Vibration as discussed above. Changes to the quality and availability of walking and cycling infrastructure can affect human health by encouragement of physical activity. Reductions in bus journey times improve access to a variety of resources important to health and social inclusion, including travelling to work or school, visiting family and friends, accessing health services, and shopping and leisure.
7. Air Quality	Air quality emissions standards set conformance requirements which determine whether anticipated environmental and associated health effects are likely to be acceptable or not.
8. Climate	Climatic conditions have potential to affect human health, through changes in weather patterns, for example.
9. Noise &	Standards for exposure to noise and vibration set conformance

Chapter	Relevance
Vibration	requirements which determine whether anticipated environmental and associated health effects are likely to be acceptable or not.
10. Population	Effects on accessibility to jobs, education, healthcare, social and economic opportunities can affect human health directly and/or indirectly.
13. Water	Water quality and water supply can affect human health through effects on quality and supply of on drinking waters and bathing waters. Standards for quality of drinking water, groundwater and of bathing waters set conformance requirements which determine whether anticipated environmental and associated health effects are likely to be acceptable or not.
14. Land, Soils, Geology & Hydrogeology	Effects on land, soils, geology & hydrogeology can affect human health indirectly through effects on air quality due to dust or effects on water quality, including groundwater, as a result of mobilisation of sediments or disruption water courses.
16. Landscape (Townscape) & Visual	Effects on landscape including the quality of the public realm can affect human health through encouragement of use of outdoor spaces for regular physical activity.
19. Risk of Major Accidents and/or Disasters	Accidents or disasters can directly affect human health through potential for direct effects on human health through, for example, road accidents and indirectly through release of pollutants into the air or water.

The main objective of the human health assessment is to:

- Confirm that all pathways relevant to human health have been identified within the specialist assessments;
- Confirm that appropriate consideration of the inter relationships of human health impacts is presented in the EIAR; and
- Confirm that the assessments have appropriately considered the need for key mitigation measures.

The main elements of the human health assessment include:

- Gathering of the main statements relevant to human health from the relevant EIAR Chapters and any other separate assessments into one coherent section so that it can be easily read and understood by the public and stakeholders;
- Consideration of issues relating to human health including noise, public realm and cyclist and pedestrian safety, as raised during the consultation process that was carried out in relation to the Proposed Scheme (refer to Section 1.6 of Chapter 1 (Introduction) of this EIAR); and

This approach follows the requirements of the EIA Directive and transposing legislation, as discussed in Chapter 1 (Introduction) of this EIAR.

### 11.2.2 Traffic, Travel Behaviour and Health

The health benefits of regular physical activity are well researched and widely accepted. For most people, the easiest forms of physical activity are those that can be built into daily life, for example, by using walking or cycling as an alternative to motorised transport for everyday journeys such as commuting to work or school. Active forms of travel, such as walking and cycling, are associated with a range of health benefits (Bassett et al., 2008, British Medical Association, 2012 and Irish Government Economic and Evaluation Service, 2021).

There has been growing concern over increasing levels of obesity in Ireland, with the percentage of people in Ireland who are overweight or obese rose from 31% in 1998 (Kavanagh et al. 2005) to 62% in 2017 (CSO 2019b).

Physical inactivity is a key risk factor for obesity and switching from active modes of travel (walking and cycling) to car use has helped to fuel physical inactivity.

There is concern that promotion of active travel modes might lead to greater increases in casualties among pedestrians and cyclists. However, evidence suggests that there is 'safety in numbers' for walkers and cyclists. One key study into this concept was reported by Jacobsen (Jacobsen 2003). Jacobsen provided evidence based on analysis of national data from 14 European countries on walking and cycling, as well as data for 47 towns in Denmark, and 68 towns in California. The author concluded that:

- *'there is a relationship between motor vehicle collisions with pedestrians and or cyclists and numbers of pedestrians and or cyclists. For example, in a community where walking doubles it can be expected that there will be a 32% increase in pedestrian injuries, where cycling doubles it can be expected that there will be a 34% increase in cyclist injuries';*
- *'motorists appear to adjust their behaviour in the presence of people walking and cycling which largely controls the likelihood of collisions; as a result'; and*
- *'the relationship between pedestrians or cyclists' exposure and casualties is not linear, that is, there is safety in numbers for these mode users'.*

A number of other studies have provided further evidence to support the safety in numbers principle (Robinson, 2005; Bonham et al., 2007; Pucher and Dijkstra, 2003).

This information provides a human health context to the assessment of the effects of the Proposed Scheme on transport usage as provided in Chapters 6 (Traffic & Transport) and 10 (Population).

### 11.2.3 Access to Healthcare, Employment and Education

Transport is required for access to a variety of resources important to health and social inclusion, including traveling to work or school, visiting family and friends, accessing health services, and shopping and leisure. Poor access to transport results in barriers to these important health resources and can contribute to health inequalities and social exclusion. Key issues for transport are affordability, availability and accessibility.

### 11.2.4 Study Area

As effects on human health are assessed by reference to the assessments of impacts on those environmental factors under which human health effects might occur, the study area for the purposes of Human Health is the amalgamation of the study areas defined in the chapters listed above, particularly Chapter 6 (Traffic and Transport), Chapter 7 (Air Quality) and Chapter 9 (Noise & Vibration) of this EIAR.

## 11.3 Baseline Environment

The information presented in this section is drawn from the chapters listed in Table 11.1. The relationships between the following topics and human health are as outlined in Sections 11.2.1- 11.2.3.

### 11.3.1 Traffic & Transport

The baseline information presented in Chapter 6 (Traffic & Transport) of this EIAR shows that along the whole corridor, based on existing average mode share across a 24hr period, car is the most common form of transport at 59% of the mode share. Pedestrian is the second most common form of transport at 29% and public transport accounts for 9%. Cyclists only make up 3% of the total mode share. The baseline information on the operation of the traffic and transportation network presented hereunder provides a high-level overview of the operation of the network in relation to its operational capacity and journey times, both of which are related to human health for the reasons given in Sections 11.2.1 - 11.2.3.

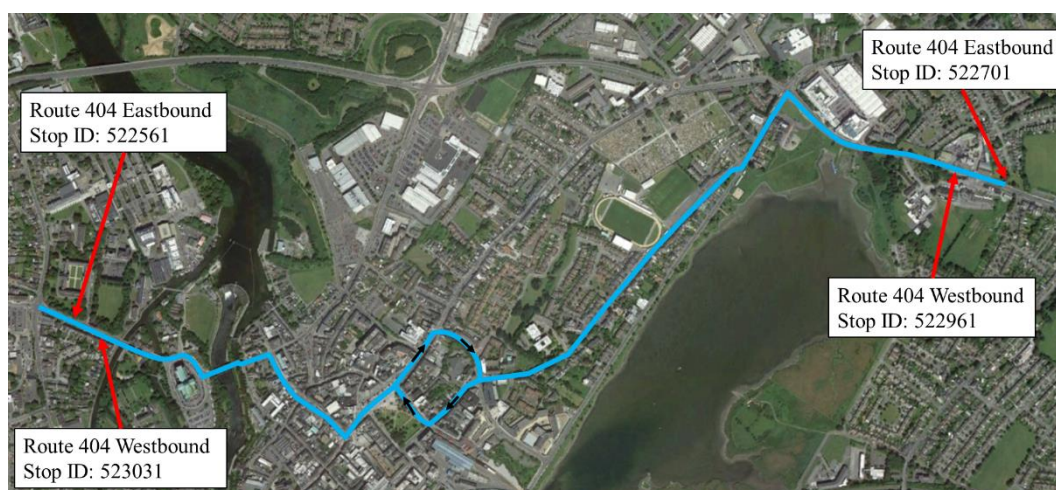
An analysis of capacities of junctions has been carried out. This covers junctions in the study area and junctions outside the direct study area which may be impacted through the addition of the Proposed Scheme, due to the redistribution of general traffic. It focuses on junctions operating with above an 85% volume over capacity (V/C) ratio. It shows that that, during the AM Peak Hour, seven junctions are currently operating over theoretical capacity (>100% V/C ratio). 10 junctions are operating with a V/C ratio of between 85% and 100%. During the PM Peak Hour, nine junctions are currently operating over theoretical capacity (>100% V/C ratio). 12 junctions are operating between 85% and 100% theoretical capacity.



Journey time information has been obtained from Automatic Vehicle Location (AVL) system data. These systems are required for service control of buses, communications with drivers, and the current generation of real-time information for on-street displays, websites, and mobile apps.

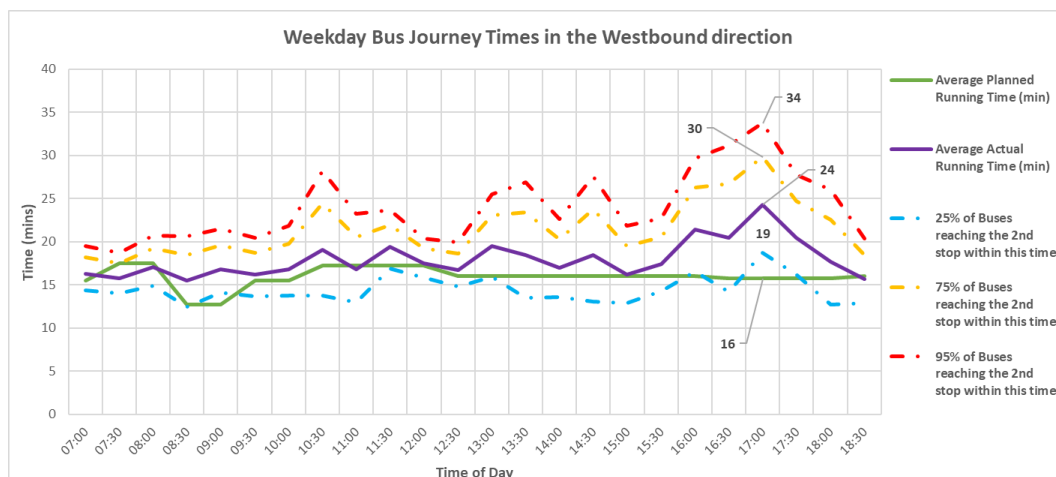
The information recorded by AVL is also central to the tracking of operational performance by following metrics on routes such as punctuality (journey times) and stops serviced. Therefore, by taking a sample of this AVL dataset, a picture can be formed of the average journey times for various services including their reliability.

A sample of AVL data was taken for the 404 bus route in the month of November in 2019 between two stops which correspond to the start and end points of the Proposed Scheme as shown in Diagram 11.1 (to the west on University Road, near the junction with Newcastle Road and to the east on the Dublin Road via the Lakeview School).



**Diagram 11.1: 404 Bus Route covered by AVL Data**

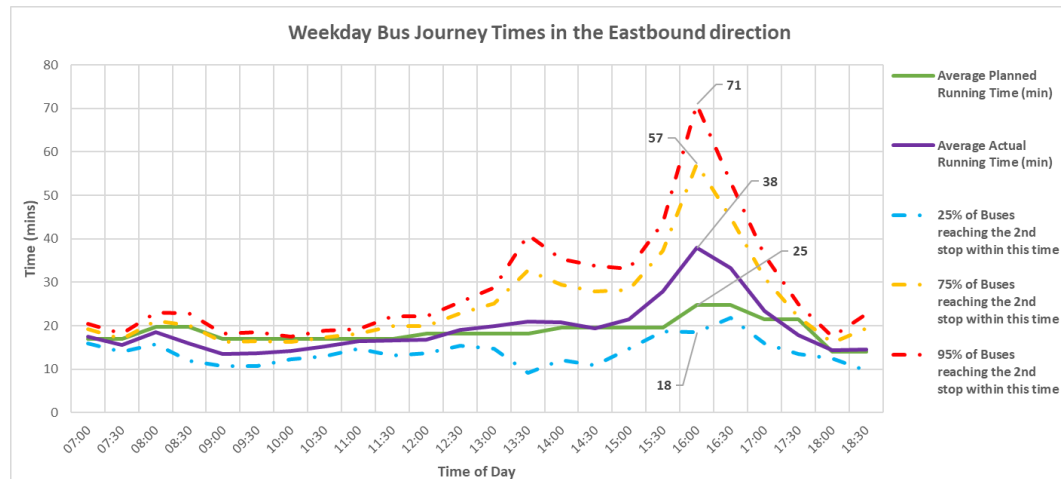
The data was analysed for the average weekday in November 2019 for both eastbound and westbound services and a profile across the 7:00 – 19:00 period was generated. Summaries of this information for the eastbound and westbound directions is given in Diagram 11.2 and Diagram 11.3.





**Diagram 11.2: Average Weekday Bus Journey Time Profile (Westbound Services)**

For the westbound services, the AVL data shows a high degree of variability in journey times across the entire day with the worst periods occurring around 10:30 A.M. and from midday onwards with the peak occurring in the evening peak hour around 17:00 P.M. At this time, we see the average running time is expected to be 16 minutes between the two stops (on the Dublin Road and on University Road) but the average is actually 24 minutes (a 54% increase), with 75% of buses reaching the 2<sup>nd</sup> stop within 30 minutes (89% increase) and 95% of buses reaching the 2<sup>nd</sup> stop within 34 minutes (114% increase).

**Diagram 11.3: Average Weekday Bus Journey Time Profile (Eastbound Services)**

For the eastbound services, the AVL data shows a high degree of variability in journey times from midday onwards with the peak occurring in the evening around 16:00 P.M. At this time, we see the average running time is expected to be 25 minutes between the two stops (on University Road and on the Dublin Road) but the average is actually 38 minutes (a 53% increase), with 75% of buses reaching the 2<sup>nd</sup> stop within 57 minutes (131% increase) and 95% of buses reaching the 2<sup>nd</sup> stop within 71 minutes (187% increase).

### 11.3.2 Air Quality

Galway City is located within air quality Zone C (cities and towns with population greater than 15,000 per Air Quality in Ireland Reports, EPA). The average concentrations of air pollutants measured in Zone C were all below the annual mean limits under the Air Quality Standards in 2020 (the year of the most recent report available at time of preparation of this EIAR). The data covers NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>.

Site specific NO<sub>2</sub> monitoring also found that concentrations were below the applicable standards (refer to Section 7.3 of Chapter 7 Air Quality of this EIAR).

*Nitrogen oxides – or NO<sub>x</sub> – are the gases nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>). Both pollutants are emitted during high temperature combustion processes. However, NO<sub>2</sub> is more important from an ambient air quality perspective due to its increased impact on health... In terms of*

*ambient air quality, the main source of NO<sub>2</sub> in our towns and cities is road transport. (Air Quality in Ireland 2020, EPA, 2021)*

*Particulate matter (PM) consists of very small particles which can be solid or liquid. Some of these particles occur naturally, and many are man-made. The EPA monitors two types of PM and compares levels to limit values in the CAFE (Cleaner Air for Europe) Directive and WHO guidelines. These are PM<sub>10</sub> and PM<sub>2.5</sub>. ... In Ireland the main source – especially of the smaller and more impactful PM<sub>2.5</sub> particles – is solid fuel burning for home heating. PM<sub>10</sub> can be made up of several sources, many of which can be natural sources such as pollen, or wind-blown sea salt and others are man-made sources such as pollution from road transport or construction activities. (Air Quality in Ireland 2020, EPA, 2021).*

Section 7.3 of Chapter 7 (Air Quality) of this EIAR provides further air quality baseline details.

### 11.3.3 Climate

The region where the Proposed Scheme will be located has a temperate, oceanic climate, resulting in mild winters and cool summers. The recent weather patterns and extreme weather events recorded by Met Éireann have been reviewed. A noticeable feature of the recent weather has been an increase in the frequency and severity of storms with notable events including Storm Darwin in February 2014, Storm Emma in March 2018, and Storm Ophelia in October 2018. Heavier historical rainfall events have also been recorded in recent years including heavy rainfall and pluvial.

The transport sector accounts for approximately 20% of Ireland's total GHG emissions, which is the second largest contribution after the agricultural sector. In relation to transport GHG emissions, the dominant source is road transportation. In terms of modal split, private cars accounted for 73.7% of all road trips in 2019 whilst public transport accounted for 6.5% (DOT 2020). Compared to 2018, there was a 3% increase in the number of public transport passenger journeys in 2019 whilst the total kilometres driven by private cars reduced by 1.5% (DOT 2020). Private cars also remain the largest source of GHG emissions in the transport sector accounting for 50.4% of total transport emissions.

Section 8.3 of Chapter 8 (Climate) of this EIAR provides more details of the climate baseline.

### 11.3.4 Noise & Vibration

Section 9.3 of Chapter 9 (Noise & Vibration) of this EIAR sets out baseline noise levels as recorded during survey work for the Proposed Scheme. The typical measured daytime baseline noise levels are from 58 to 77 dB L<sub>Aeq,T</sub> at distances within 1 m to 20 m of the road edge (refer to Table 9.15 in Chapter 9 (Noise & Vibration) of this EIAR). At the closest properties impacted by the Construction Phase (typically between 1 m and 30 m of construction activities), the average daytime baseline noise level is 67 dB L<sub>Aeq,T</sub>. Based on review of baseline survey results, the average evening noise level is 2 dB lower than the daytime noise level.

This information is used as the baseline against which predicted changes in noise are assessed. It is notable that there are parts of the existing network along the Proposed Scheme area which already experience high noise levels due to the existing traffic in the area and general urban sources. Criteria used for rating of significance of changes in noise and vibration levels during construction and operation of the Proposed Scheme are described in Section 9.2.4 of Chapter 9 (Noise & Vibration) of this EIAR.

### 11.3.5 Population

Information presented in Chapter 10 (Population) of this EIAR shows that there is a range of different types of receptor types along the Proposed Scheme. These include residential areas, shopping centres, numerous schools and NUI Galway, transportation hubs, recreational facilities, places of worship, tourism assets and University Hospital Galway.

Nearly half of commuters in the study area travel by foot or by bike to work (49%), while slightly fewer commuters choose to take a car or van to work (40%), with travel by bus, minibuss or coach being the next most popular form of transport (10%). The urban character of the study area is reflected by the fact that nearly half of all commuters travel to work by foot or by bike.

### 11.3.6 Water Quality

#### Drinking Water Supply

There are no Geological Survey Ireland (GSI) Public Supply Source Protection Areas or National Federation of Group Water Schemes (NFGWS) Source Protection Areas within the study area. None of the river segments within the study area are designated as a Drinking Water River (refer to Section 13.3 of Chapter 13 (Water) of this EIAR).

#### Bathing Waters

As described in Chapter 13 (Water) of this EIAR, there are four designated bathing water locations within the jurisdiction of Galway City Council. The bathing water quality classifications are given in Table 11.2. These locations are all downstream of and hydraulically connected to the area of the Proposed Scheme however, none of them are within the study area defined for the purposes of the assessment of effects on water quality. This area extends 500 m from the boundary of the Proposed Scheme (refer to Chapter 13 (Water) of this EIAR).

**Table 11.2: Bathing Water Classification (EPA, 2021)**

Identified Bathing Water	Bathing Water Classification			
	2017	2018	2019	2020
Ballyloughane Beach	Poor	Sufficient	Poor	Sufficient
Grattan Road Beach	Good	Sufficient	Sufficient	Sufficient
Salthill Beach	Excellent	Excellent	Excellent	Excellent
Silverstrand Beach	Excellent	Excellent	Excellent	Excellent

### 11.3.7 Land, Soils, Geology & Hydrogeology

#### Groundwater

Based on available data sources from the GSI there are no Public Water Supply or National Federation of Group Water Scheme groundwater source protection areas within the regional study area.

According to the GSI database, there is one groundwater well record within the study area. This is a group water supply scheme abstraction well located 50 m North East of the Proposed Scheme. It is classed of medium importance using standard NRA guidance (refer to Chapter 14 (Land, Soil Geology and Hydrogeology) of this EIAR for further details).

#### Contaminated Land

The information contained in Chapter 14 (Land, Soil Geology and Hydrogeology) of this EIAR shows that there are seven potential sources of existing contamination relevant to the Proposed Scheme of which six are classed as being of medium importance (classified as per NRA Guidelines).

### 11.3.8 Landscape (Townscape) & Visual

The baseline section of Chapter 16 (Landscape (Townscape) & Visual) of this EIAR refers to the current availability of recreational infrastructure. It notes that there is a network of well used pedestrian walkways along the embankment between the lower River Corrib and waterways, amenity and park spaces including Millennium Park, Waterside, Dyke Road, Eyre Square, the Sportsground on College Road and Lough Atalia.

It further states that Galway City Centre is negatively influenced by busy vehicular traffic, with congestion affecting the character of the urban environment, impacting on quality of life of residents and the safety of all roads. In places, there is an overdominance of vehicular traffic and parking, with narrow footpaths for pedestrians and limited space for cyclists.

### 11.3.9 Risk of Major Accidents and/or Disasters

There is no baseline *per se* in relation to this topic (refer to Chapter 19 Major Accidents and Disasters) of this EIAR.

## 11.4 Potential Impacts

The information presented in this section is drawn from the chapters listed in Table 11.1, particularly from the residual impacts sections as these are the most relevant for purposes of the assessment of the overall human health effects on the Proposed Scheme. Those chapters should be consulted for further information on any topic.

### 11.4.1 Characteristics of the Proposed Scheme

A detailed description of the Proposed Scheme and the construction strategy is provided in Chapter 4 (Proposed Scheme Description) and Chapter 5 (Construction) of this EIAR, respectively.

The characteristics that have potential relevance to human health are described both in Chapters 4 (Proposed Scheme Description) and Chapter 5 (Construction) of this EIAR and in the chapters that are directly or indirectly related to human health (refer to Table 11.1).

### 11.4.2 Do Nothing Scenario

The ‘do nothing’ scenario for each of the topics that relate to human health is described in the chapters listed in Table 11.1. In general, it is anticipated that there will be no significant changes in effects in this scenario, that is, if the Proposed Scheme were not to be implemented, except in relation to Traffic and Transport and Noise. Key findings in relation to these two topics are:

- The streetscape would continue to be based around the movement and parking requirements of private cars instead of people. Traffic congestion could be expected to remain the same or to worsen, discouraging pedestrian and cyclist activity.
- Congestion and journey time reliability issues for buses would also be expected to continue, and potentially be exacerbated over time as traffic congestion increases in line with travel demand growth.
- Noise levels in the do-nothing scenario are predicted to vary in response to changes in traffic levels and modal shifts, taking account of a range of committed developments and transport plans within the study area for the year of opening (2023) and the design year (2038) (refer to Section 9.4.2 of Chapter 9 (Noise & Vibration)) of this EIAR.

### 11.4.3 Construction Phase

#### 11.4.3.1 Traffic & Transport

The effect of the Construction Phase on traffic and transportation is predicted in Section 6.5.6.2 of Chapter 6 (Traffic & Transport) of this EIAR to be Negligible and Short-term.

#### 11.4.3.2 Air Quality

With the implementation of the mitigation measures outlined in Section 7.6 of Chapter 7 (Air Quality) of this EIAR, no significant adverse residual effects on air quality are envisaged during the construction phase of the Proposed Scheme. Overall, it is considered that the residual effects as a result of the Proposed Scheme’s construction are negative, slight, and short-term.

### 11.4.3.3 Climate

When the Construction Phase GHG mitigation measures detailed in Section 8.6 of Chapter 8 (Climate) of this EIAR are implemented, GHG emissions from the Proposed Scheme are predicted to be negligible and long-term. This impact rating aligns with IEMA guidance on the basis that the Proposed Scheme replaces existing development that has a higher GHG profile, and that the significance of a project's emissions should be based on its net impact over its lifetime, refer to Section 8.3 of Chapter 8 (Climate) of this EIAR for further details.

### 11.4.3.4 Noise & Vibration

Once the various mitigation measures are put in place, noise impacts associated with the Construction Phase will be of negative, not significant to slight, temporary impact during all key construction phases, with the exception of road widening and utility works which are negative, slight to moderate and temporary within 15m distance to the works during daytime periods.

During evening periods, noise impacts associated with the Construction Phase will be of negative, not significant to slight, temporary impact during general road works, urban realm and quiet street treatment works at distances greater than 15m from the works. During this period, noise impacts associated road widening and utility diversion works will be of negative, moderate to significant, temporary impact at distances between 15m to 20m from the works. At distances within 10m of road widening / utility diversion works, the noise impact is negative, significant to very significant and temporary. As per DMRB Noise and Vibration (UKHA 2020) in cases of moderate to major magnitude of impacts, the duration of works determines the overall significance rating.

As part of the mitigation measures, the durations advised in the DMRB Noise and Vibration (UKHA 2020) will be followed, where feasible, to reduce overall significance effects (i.e. scheduling works to occur for periods of less than ten days/nights over 15 consecutive day/night periods and less than 40 days over six consecutive months where significant effects are identified). Once the CNL and duration of works is considered in line with the DMRB Noise and Vibration (UKHA 2020) all key Construction Phase residual noise levels are not significant, whilst meeting the scheme objectives set out in Chapter 1 (Introduction) of this EIAR.

The assessment has indicated that the use of standard construction activities can operate comfortably within the recommended vibration limits for standard residential and other light-framed buildings. With the adoption of best practice methodologies, vibration impacts at the most sensitive premises can be adequately mitigated to within acceptable levels relating to disturbance, whilst meeting the scheme objectives set out in Chapter 1 (Introduction) of this EIAR.

### 11.4.3.5 Population

The most relevant construction phase effects on population that have potential to affect human health are effects on vectors through which human health may be affected, as mainly addressed under the headings of Noise and Air Quality. Effects on accessibility including access to places of employment, healthcare, education etc are mainly as assessed under the heading of Traffic and Transport. These effects are summarised elsewhere in this chapter.

### 11.4.3.6 Water Quality

Following implementation of the mitigation measures outlined in Section 13.5.1 of Chapter 13 (Water) of this EIAR and the SWMP within the CEMP (refer to Appendix 5.1 of Volume 4 of this EIAR), no significant impacts are anticipated on any of the receptors in the study area.

### 11.4.3.7 Land, Soils, Geology & Hydrogeology

With the effective implementation of the proposed mitigation measures, there will be no significant residual impacts on land, soils, geology or hydrogeology as a result of the construction of the Proposed Scheme.

### 11.4.3.8 Landscape

The loss of 59 early mature and mature trees during construction works will give rise to localised negative, significant and short-term townscape and visual effects. The planting of 186 new street trees will give rise to positive, significant, and long-term effects.

### 11.4.3.9 Risk of Major Accidents and/or Disasters

There are no identified incidents and / or major accidents and / or disasters risk events that present a sufficient combination of risk and consequence that would lead to significant residual environmental impacts.

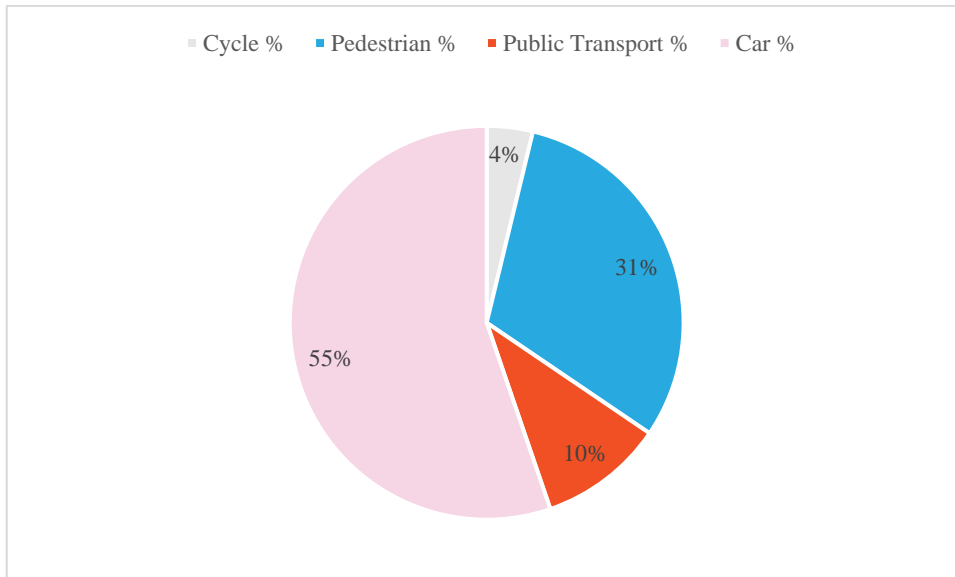
## 11.4.4 Operational Phase

### 11.4.4.1 Traffic & Transport

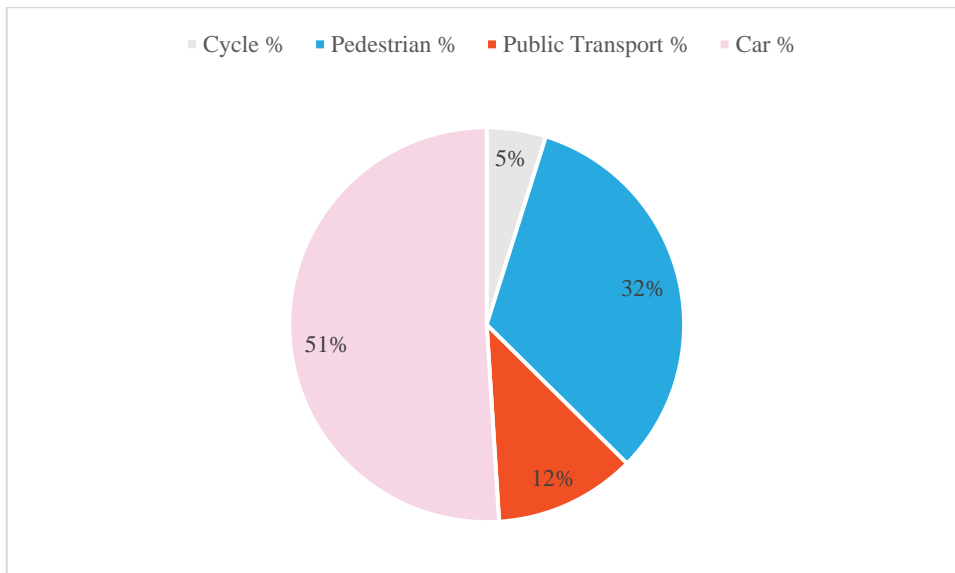
#### Modal Shares

The predicted mode shares in 2023 and 2038 are presented in Diagram 11.4 and Diagram 11.5 below. In general, car use is expected to decrease from 55% to 51% between 2023 and 2038. Pedestrian, cyclist and public transport trips are all expected to increase.





**Diagram 11.4 Predicted 2023 Mode Share**



**Diagram 11.5: Predicted 2038 Mode Share**

### People Movement Assessment

A People Movement Assessment has been undertaken comparing the Do Minimum and Do Something peak hour scenarios for the years 2023 and 2038. This People Movement Assessment takes account of traffic modelling outputs and the following metrics:

- The average number of people moved by each transport mode (i.e., Car, Bus, Walking and Cycling) along the corridor in the eastbound and westbound direction. This metric is compared for the Do Minimum and Do Something scenarios in the AM and PM peak hours for each forecast year (2023, 2038). This metric provides an estimate of the modal share changes along the route as a result of the Proposed Scheme measures; and
- People movement by bus:

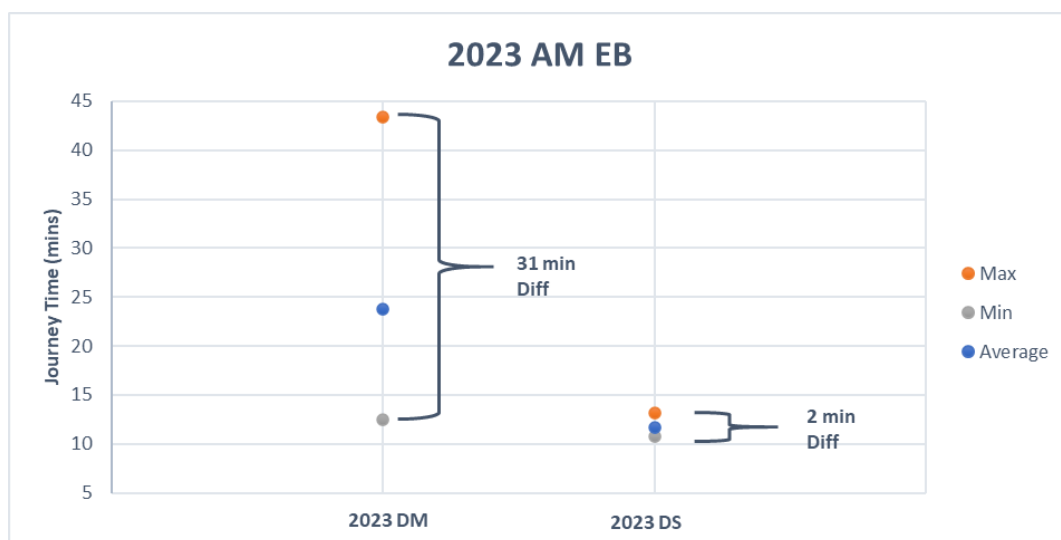
- AM and PM peak hour Bus Passenger Loadings along the Proposed Scheme for each forecast year (2023, 2038); and
- Total Passengers Boarding Buses on bus routes that use any part of the Proposed Scheme for each forecast year (2023, 2038).

In summary, the People Movement Assessment predicts increases in sustainable modes in both 2023 and 2038 as a result of the Proposed Scheme. Despite general growth in traffic levels between 2023 and 2038, general traffic along the corridor is predicted as either reducing or increasing at marginal levels. Sustainable modes on the other hand are predicted to experience significant increases between 2023 and 2038. This predicts that car trips – unlike public transport, walking and cycling - will not grow in line with population. Therefore, the Proposed Scheme is predicted to provide a substantial opportunity for growth of sustainable modes whilst it discourages car usage along the corridor.

The Proposed Scheme will potentially deliver a positive, very significant and long-term impact in terms of People Movement by sustainable modes, particularly by bus.

### Bus Journey Times

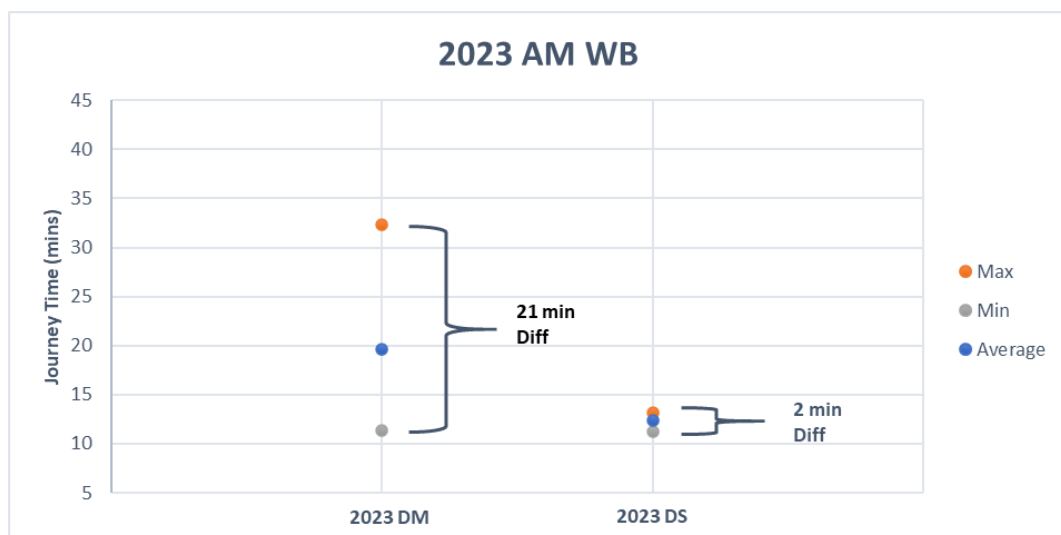
Effects of the Proposed Scheme on bus journey times is summarised in Diagram 11.6 to Diagram 11.9 below which shows the predicted Do Minimum (DM) and Do Something (DS) peak hour bus journey times along the full length of the Proposed Scheme in each direction. The Min, Max and Average journey times are represented as a dot in the graphs for buses in each scenario. A larger range of journey times are an indication of lower levels of reliability in a given scenario. Refer to Chapter 6 (Traffic & Transport) of this EIAR for discussion of the significance of the predicted changes in bus journey times.



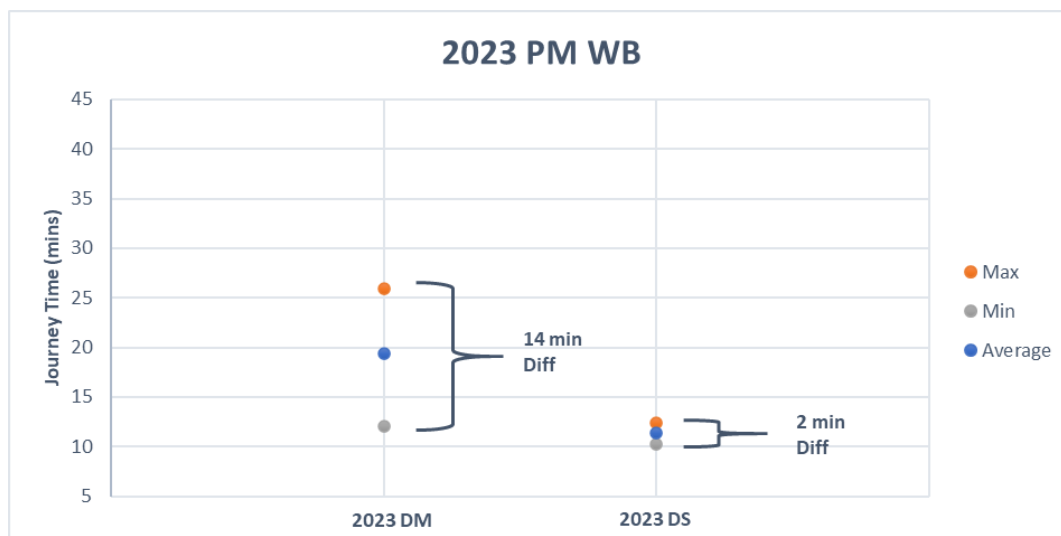
**Diagram 11.6: AM Bus Journey Times (Eastbound Services)**



**Diagram 11.7: PM Bus Journey Times (Eastbound Services)**



**Diagram 11.8: AM Bus Journey Times (Westbound Services)**



**Diagram 11.9: PM Bus Journey Times (Westbound Services)**

## **General Traffic Impact Assessment**

### **AM Peak Period, 2038**

Overall, redistributed traffic associated with the Proposed Scheme in is expected to result in a negligible impact at 59 out of 77 junctions assessed and the effect is deemed Not Significant and Long-term. Five junctions will potentially experience Imperceptible and Long-term effects. A Negative, Slight and Long-term effect will potentially be at four junctions, with a Negative, Moderate and Long-term effect at nine junctions.

### **PM Peak Period, 2038**

Overall, redistributed traffic associated with the Proposed Scheme in is expected to result in a negligible impact at 55 out of 68 junctions assessed and the effect is deemed Not Significant and Long-term. Three junctions will potentially experience Imperceptible and Long-term effects A Negative, Moderate and Long-term effect will potentially be experience at six junctions. A Negative, Slight and Long-term effect will potentially be experience at four junctions.

#### **11.4.4.2 Air Quality**

The air dispersion modelling assessment has found that all receptors will be in compliance with ambient air quality standards for the Do Something (and Do Minimum) scenario. There are no substantial or moderate adverse effects expected as a result of the operational phase of the Proposed Scheme.

Therefore, it is considered that the residual effects as a result of the Proposed Scheme's operation are neutral and long-term (refer Section 7.6.2 in Chapter 7 (Air Quality) of this EIAR).

#### **11.4.4.3 Climate**

The operational traffic GHG emissions associated with the operational phase of the Proposed Scheme will potentially be neutral and long-term.

Thus, the residual impact from operational phase traffic as a result of the Proposed Scheme will be neutral, long-term.

The proposed infrastructural works will also support the delivery of government strategies, outlined in Section 8.1.6 of Chapter 8 (Climate) of this EIAR, by enabling sustainable mobility and delivering a sustainable transport system. Its aim is to provide enhanced walking, cycling and bus infrastructure on key access corridors in Galway City. This will subsequently enable and deliver an integrated sustainable transport movement along these corridors. The proposed infrastructural works will provide connectivity and integration with other public transport services leading to more people availing of public transport.

By creating a resilient, accessible public transport network, the proposed infrastructural works will provide an attractive alternative to private car travel, encouraging more passenger travel by more sustainable modes.

As a result, a greater share of the demand will be by sustainable modes (public transport, walking and cycling), which aligns with the project objectives.

#### 11.4.4.4 Noise & Vibration

Once operational, there will be a positive to neutral direct impact along the Proposed Scheme due to a reduction in traffic volumes during both the year of opening and the design year.

During the year of opening 2023, there is expected to be an increase in traffic noise levels along a small number of roads adjacent to the Proposed Scheme as a result of traffic re-distribution during daytime periods. During this initial short to medium-term phase, residual indirect impacts are calculated as negative, slight to moderate, with three roads predicted to have a negative, significant impact (Presentation Road, Cross Street Lower, and Lough Atalia Road). Along the remaining road network within the study area, a positive, imperceptible to slight, short to medium-term impact to negative, slight to moderate, short to medium-term impact is calculated. The overall prevailing short to medium-term impact associated with the Proposed Scheme is positive to negative, moderate.

During the design year, 2038, increased traffic noise levels will occur along a small number of roads as a result of traffic re-distribution during daytime periods. During the long-term phase, indirect impacts are calculated as negative, moderate to significant, long-term along Riverside, and negative, significant, long-term along Presentation Road and Lough Atalia Road. Along the remaining road network within the study area, a positive, imperceptible to slight, long-term, indirect impact to negative, not significant to slight, long-term, indirect impact is calculated. The overall prevailing long-term impact associated with the Proposed Scheme is positive to negative and slight.

The results of the noise assessment for the Operational Phase confirms that with the introduction of the various measures included as part of the Proposed Scheme, a reduction in traffic noise can be achieved along the Proposed Scheme where highest existing traffic noise levels are experienced. The various design measures associated with the Proposed Scheme also align with the various intervention measures recommended within the WHO Environmental Noise Guidelines (WHO 2018) to reduce traffic noise exposure across populations.

#### 11.4.4.5 Population

The most relevant operational phase effects on population that have potential to affect human health are effects on vectors through which human health may be affected, as mainly addressed under the headings of Noise and Air Quality. Effects on accessibility including access to places of employment, healthcare, education etc are mainly as assessed under the heading of Traffic and Transport. These effects are summarised elsewhere in this chapter.

#### **11.4.4.6 Water Quality**

No operational residual significant impacts are anticipated for any waterbody in the study area.

#### **11.4.4.7 Land, Soils, Geology & Hydrogeology**

It is expected that there will be no significant residual impacts on land, soils, geology and hydrogeology as a result of the operation of the Proposed Scheme.

#### **11.4.4.8 Landscape (Townscape) & Visual**

Once operational the Proposed Development will have a Positive, Significant and Permanent effect on this sensitive urban townscape setting in Galway City. The improved connectivity and accessibility for pedestrians and cyclists linking the Galway City Centre to western and eastern city environs will improve people's experience of moving through this part of the city.

#### **11.4.4.9 Risk of Major Accidents and/or Disasters**

There are no identified incidents and / or major accidents and / or disasters risk events that present a sufficient combination of risk and consequence that would lead to Negative and significant residual environmental impacts.

### **11.5 Mitigation and Monitoring Measures**

Any mitigation or monitoring requirements in relation to effects on human health are properly addressed by the measures set out in the chapters which assess effects on the vectors through which the scheme has potential to cause likely and significant effects on human health. These mitigation and monitoring measures are described in the chapters listed in Table 11.1.

### **11.6 Residual Impacts**

Overall effects on traffic and transport are predicted to be generally positive. As detailed above and in Chapter 6 (Traffic & Transport) of this EIA, these include positive effects on modal share, positive, very significant and long-term impact in terms of People Movement by sustainable mode with significantly reduced bus journey times. Long term effects on junctions are predicted to be imperceptible/negligible to insignificant at the majority of junctions and to range from slight to moderate at 13 out of 77 junctions assessed in the AM peak period and at 10 out of 58 junctions assessed in the PM peak period.

During the initial short to medium term phase, the overall noise effects of the Proposed Scheme are predicted to range from positive to negative moderate. The long-term noise effects are predicted to range from positive to negative slight.

Effects on air quality are predicted to be neutral and long term.

Long-term landscape effects on the urban townscape of the scheme area are predicted to range from significant and negative in the short-term to positive, permanent and significant in the long-term.

The Proposed Scheme will improve opportunities and convenience for walking and cycling, which will support people in the area in achieving recommended levels of weekly physical activity, for example as part of an active travel commute to work or education. It will also increase safety and the perception of safety for pedestrians and cyclists.

The significant positive impacts which are expected to arise in the operational phase align with the relevant objectives of the Proposed Scheme as set out in Chapter 1 (Introduction) of this EIAR.

As no mitigation or monitoring measures are proposed as a result of this assessment of effects on human health, no further assessment of residual effects on human health is required.

**Table 11.3: Summary of Significant Residual Effects**

Item	Residual effect
Increases in physical activity due to improvements in walking and cycling provisions	Positive and Significant, Long-term
Landscape effects on urban townscape	Positive and Significant, Long-term
Improvements in People Movement by sustainable mode	Positive, Very Significant, Long-term

On the basis of the above (Table 11.3) it can be seen that overall, the significant residual Long-term effects of the Proposed Scheme on human health can be expected to be Positive and Significant to Very Significant.



## 11.7 References

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