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Project Appraisal Guidelines Unit 13.0 - Appraisal of Active Modes

PE-PAG-02036
February 2024

PE Planning & Evaluation

Technical

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Contents

Updates to TII Publications resulting in changes to

Project Appraisal Guidelines Unit 13.0 - Appraisal of Active Modes PE-PAG-02036

Date: December 2021

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Section No:

Amendment Details:

An updated unit that replaces the previous PAG Unit 13.0 - Pedestrian and Cyclist Facilities. This new unit provides updated guidance on the appraisal of active modes schemes. The guidance covers the appraisal of stand-alone active modes schemes or the appraisal of active mode components of wider national roads schemes. The guidance also covers the appraisal of greenway projects, in line with TII's new remit as Approving Authority for certain greenway projects. A key component of this guidance document is a new economic appraisal tool for active modes called TEAM which is available on the "Downloads" section of the TII publications website.

Date: February 2024

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Section No:

Amendment Details:

1. Updated guidelines for carrying out Qualitative Appraisal for active modes (Section 3) in accordance with Transport Appraisal Framework (DoT, June 2023);
2. Updated guidelines for carrying out Quantitative Economic Appraisal for active modes, including Cost Benefit Analysis (Section 4) in accordance with Transport Appraisal Framework (DoT, June 2023);
3. The development/update of Version 3 of the 'Tool for Economic appraisal of Active Modes' (TEAM v0.3), in particular:
4. Updates to the general and economic conversion factors, to take into account growth/inflation from 2021 to 2023 and update to the annualisation factor
5. Update to vehicle operating costs
6. Addition of international visitor benefits
7. Update on the opening year/appraisal year
8. Addition of residual values of the proposal
9. Addition of maintenance costs (resurfacing and reconstruction of the pavement)
10. Addition of function to split the proposed route into different sections, to cater for any differences in the user popularity of (demand for) different sections
11. The addition of a new Excel sheet for the validation of figures, to alert the user to any possible errors or anomalies

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1. Introduction

1.1 Purpose of the Guidelines

Investment in walking and cycling is a key policy objective of the Government. The National Development Plan (NDP) 2021-2030 recognises the importance of active travel not only in reducing carbon emissions, but also in achieving other national strategic outcomes such as compact urban growth and balanced regional development. Other national policy, such as the Climate Action Plan 2021, the Strategy for the Future Development of National and Regional Greenways, and the National Physical Activity Plan highlight the multi-faceted benefits provided by active travel investment, including carbon emission reductions, physical and mental health benefits, income from tourists/visitors and improvements to accessibility and social inclusion.

In recent years, there was a step change in the pace and scale in walking and cycling investment. The 2020 Programme for Government – Our Shared Future, committed 20 per cent of the transport capital budget for cycling and pedestrian infrastructure. This was reaffirmed in the 2021-2030 NDP alongside the development of a National Cycle Network. The Department of Transport's (2021) National Investment Framework for Transport in Ireland (NIFTI) outlines the Department's framework for the prioritisation of future investment, and details a modal hierarchy which prioritises active travel, followed by public transport then private vehicles.

This is echoed in the National Sustainable Mobility Policy (DoT, 2022), which aims to make it easier to walk, cycle and use public transport daily, and which is being delivered through the Sustainable Mobility Action Plan 2022-2025. TII have several actions in this Action Plan, of relevance to these guidelines:

- Action 4 continue to protect and renew road infrastructure for all road users, including sustainable mobility users
- Action 27 develop and implement an active travel infrastructure programme for regional growth centres and key towns
- Action 29 Develop and publish a strategic national cycle network
- Action 30 Expand greenway network establishing linkages with towns and villages in line with the strategic national cycle network

To help deliver on these active travel and sustainable mobility objectives, TII was also designated the Approving Authority for specific greenway projects outside urban areas in September 2021. In TII's recently published National Roads strategy (NR2040), a set of commitments are outlined to address strategic issues associated with the National Roads network including TII's commitment to *"support the provision of segregated or offline active travel infrastructure adjacent to national roads".*

In accordance with central public investment management guidance published by the Department of Public Expenditure, NDP Delivery and Reform any investment project or programme is required to undergo appraisal prior to its implementation, which involves examining options and alternatives for investment, assessing the costs and benefits associated with options, and determining the most appropriate use of public funds.

The Department of Transport's (June 2023) Transport Appraisal Framework (TAF) sets out the broad appraisal requirements for transport projects, while TII's Project Appraisal Guidelines (PAG) sets out the appraisal process and requirements for National Roads, greenway and active travel schemes under its remit, including detailed guidance on the different deliverables and types of analysis required at each stage of the project lifecycle.

A requirement of the appraisal process is the assessment of the desirability of an investment proposal from the perspective of society. Rather than just looking at the financial costs of new active travel infrastructure, an active mode appraisal should attempt to capture the wider benefits provided by active travel infrastructure – such as health benefits, reduction in carbon emissions, or improved connectivity – to assess whether the project would be a worthwhile and prudent investment. There are different methods of appraisal: some types of benefits can be quantified and expressed in monetary terms, which is often referred to as 'Quantitative' appraisal; others can only be described with statements or simple scoring systems, which is referred to as 'Qualitative' appraisal.

The aim of PAG Unit 13 is to provide guidelines for the appraisal of active mode interventions within the overall project lifecycle, and to ensure that appraisers have the resources and tools to do so for both qualitative and quantitative appraisal. The guidelines are intended for those appraising TII-approved walking and cycling schemes, including greenways and road schemes with significant active travel components included.

A new quantitative tool termed 'TEAM' (**T**ool for **E**conomic appraisal of **A**ctive **M**odes) accompanied the 2021 update to the PAG Unit 13. This February 2024 update to PAG Unit 13 accompanies Version 3 of the TEAM tool, with changes to the tool summarised in Section 1.2. These guidelines and supporting tool will prove useful to a wider range of stakeholders and contexts, including the appraisal of active travel schemes by local authorities, the evaluation of completed schemes, as well as the evaluation of policies and targets aimed at encouraging greater levels of walking and cycling.

1.2 Why have the Guidelines been Updated?

Given the changing policy context and the acceleration of active travel investment, it is important that the appraisal process for these schemes is robust enough to capture the wide range of benefits provided by walking and cycling, without placing an undue burden on those carrying out the appraisal.

These guidelines replace a previous version of PAG Unit 13, which was last updated in May 2023. The updated PAG Unit 13 aims to address some of the challenges faced when carrying out active mode appraisals, and to deliver guidelines and tools that make the process easier, more comprehensive, and efficient for the appraiser. It also aims to ensure greater consistency for TII in terms of comparing and prioritising investment due to a streamlined methodology and the newly developed appraisal tool.

The main changes to PAG Unit 13 include:

- Updated guidelines for carrying out Qualitative Appraisal for active modes (Section 3) in accordance with Transport Appraisal Framework (TAF) (DoT, June 2023);
- Updated guidelines for carrying out Quantitative Economic Appraisal for active modes, including Cost Benefit Analysis (Section 4) in accordance with Transport Appraisal Framework (DoT, June 2023);
- The development/update of Version 2 of the 'Tool for Economic appraisal of Active Modes' (TEAM v0.2), in particular:
  1. Updates to the general and economic conversion factors, to take into account growth/inflation from 2021 to 2023 and update to the annualisation factor
  2. Update to vehicle operating costs
  3. Addition of international visitor benefits
  4. Update on the opening year/appraisal year
  5. Addition of residual values of the proposal

6. Addition of maintenance costs (resurfacing and reconstruction of the pavement)
7. Addition of function to split the proposed route into different sections, to cater for any differences in the user popularity of (demand for) different sections
8. The addition of a new Excel sheet for the validation of figures, to alert the user to any possible errors or anomalies. Appraisal Requirements and Thresholds
9. Compliance with Transport Appraisal Framework (DoT, June 2023)

The complexity of an appraisal should be proportionate to the scale of the project, and as such, the PAG sets cost thresholds when different types of appraisal are required, which are consistent with the requirements of TAF. The requirements for active mode appraisal are:

- **Qualitative Appraisal –** Qualitative appraisal must be completed for all projects, regardless of project size. Qualitative appraisal usually takes the form of Multi-Criteria Analysis (MCA) (when assessing multiple options). MCA involves assessing and scoring option(s) against a set of criteria to highlight the relative benefits and costs provided. Guidelines for undertaking qualitative appraisal are contained in Section 2 and 3.
- **Quantitative Economic Appraisal –** Quantitative economic appraisal is only required for projects costing over €30 million including National Road schemes costing over €30 million where active modes infrastructure is also being provided. Quantitative appraisal can take one of two forms:
  - **Cost-Benefit Analysis (CBA)** involves the monetisation of benefits associated with increased levels of walking and cycling (such as health, emissions reductions etc.) and comparing these against the project/programme costs. CBA is the recommended method of quantitative economic appraisal, and TII have developed a 'Tool for Economic appraisal of Active Modes' (TEAM) to simplify the CBA process for appraisers, with additional guidance provided in Section 4. The TEAM tool can be used to complete a CBA for standalone active mode schemes, as well as for estimating active mode benefits for inclusion within the CBA of a National Roads scheme. Given that TEAM provides a user friendly and fast means to undertake CBA for greenway and active travel schemes, it is recommended that TEAM is used on TII funded active travel schemes regardless of value.
  - **Cost-Effectiveness Analysis (CEA)** is a method of economic appraisal which compares the relative costs of options for achieving the same objective. Depending on the objectives of the project, CEA uses cost-effectiveness indicators to compare the relative costs of achieving them, such as 'cost per kilometre', 'cost per user', 'cost per tonne of CO_2 avoided'. CEA is most appropriate in instances where there is one overriding objective for all interventions, such as health, where the goal of interventions is to generally to reduce rates of illness or death. However, active mode projects have a wide range of objectives which often vary from project-to-project, meaning that it is difficult to establish a single cost-effectiveness indicator that is common to all projects and that can be used for comparison purposes. While CEA can be used to meet the economic appraisal requirements of the TAF and PSC, for this reason it is not preferred. If project teams wish to use CEA to appraise a project, the reasoning for this and the proposed cost-effectiveness indicators should be summarised in the Appraisal Plan of the Project/Programme Outline Document and agreed upon with the Approving Authority.

Figure 13.0.1 below provides a schematic to help appraisers identify the appraisal requirements for schemes depending on their size and context. It also indicates where demand estimates are required, as well as recommended approaches to estimating demand.

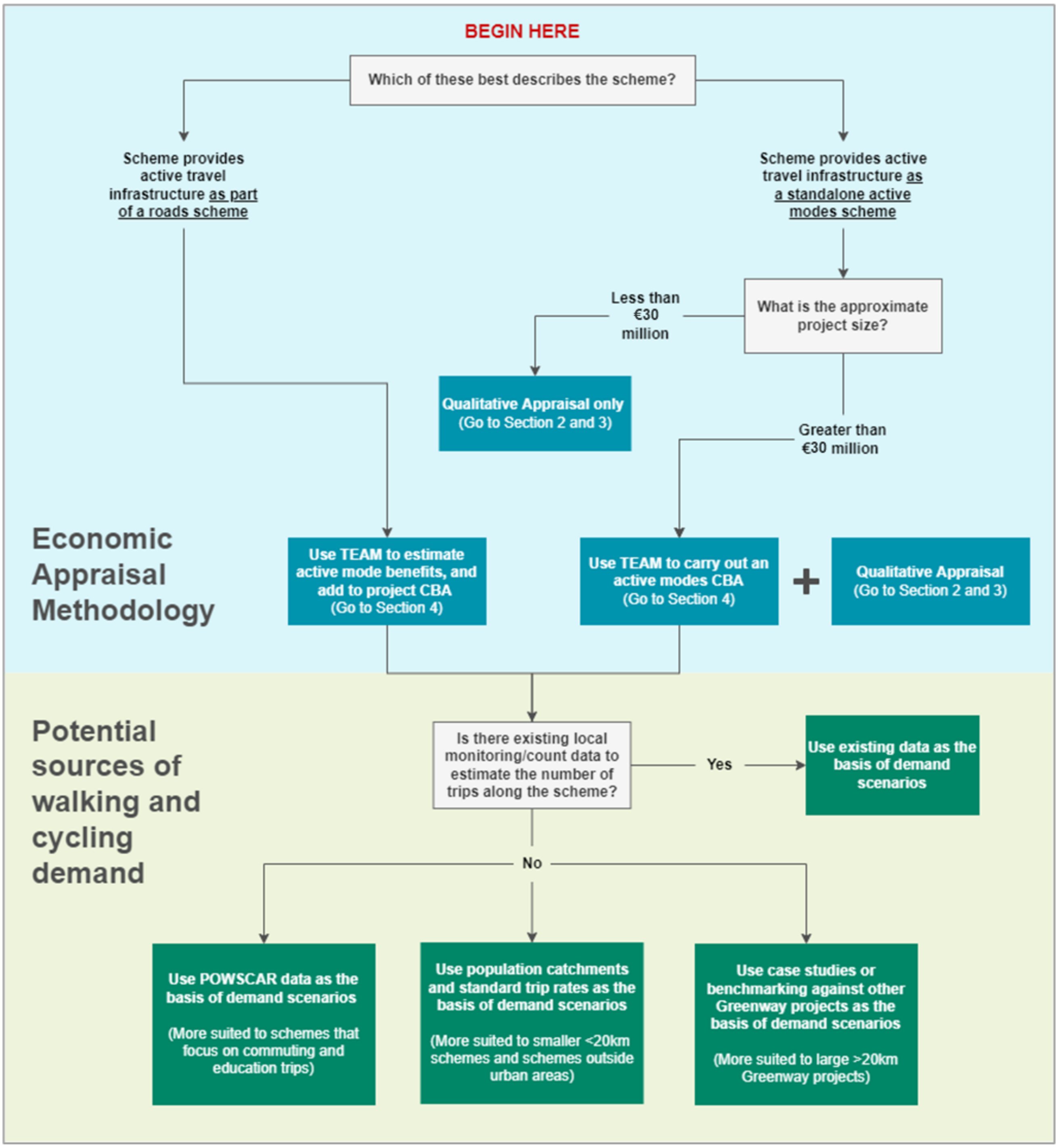

Figure 13.0.1 Recommended Approaches to Active Mode Appraisal[1]

1.3 Reporting and Deliverables

Projects with an estimated cost of €15 million or more are required to develop a Project/Programme Outline Document (POD). A POD is completed during Phase 0, and its purpose is to summarise the strategic need for a project or programme before time or money is spent on in-depth design and planning.

[1] Note that the approach in this Figure reflects DoT TAF guidance regarding qualitative and quantitative appraisal. As explained on Page 3, the use of TEAM is recommended on TII funded active travel projects regardless of value as it is a simple tool to undertake quantitative appraisal (CBA) on these schemes.

Guidance on developing a POD is provided in *PAG Unit 2.1 - Project/ Programme Outline Document*s with additional detailed guidance for active modes provided in *PAG Unit 2.2 - Project/ Programme Outline Document for Active Modes and Greenways.*

For projects over €30 million, a Feasibility Report (FR) is produced at Phase 1, which builds on the work produced in the POD at Phase 0. In the FR, a comprehensive baseline review is produced of the study area which allows for an updated investment rationale. Other key sections of the FR include:

- verify or establish the project need and to verify the underlying assumptions used to previously justify the project need (during Phase 0);
- development of the study area;
- modal/ intervention hierarchy assessments;
- creation of SMART objectives;
- development of options;
- summary of constraints and opportunities; and
- health and safety requirements.

It will also include the identification and development of options including the assessment methodology, findings and conclusions (whether there is a minimum of one feasible option or not). Finally it will make recommendations for refinement of feasible options for advancement to Phase 2. Guidance on developing a FR is provided in *PAG Unit 3.0 – Feasibility Report*.

For active mode schemes with an estimated cost between €5m to €30 million, the main Phase 2 deliverable is the Project Appraisal Report (PAR). The Project Appraisal Report (PAR) is effectively a condensed form of the Business Case which concisely summarises the appraisal process for the proposed scheme. Details of what needs to be provided and addressed in the PAR are discussed in detail in *PAG Unit 12.0 – Projects €5m to €30m*.

The PAR will fulfil the requirements of the TAF in relation to Preliminary Business Case and Final Business Case for the majority of active modes schemes. Project teams working on active modes schemes that are of a significant scale and/or complexity can refer to PAG guidance on the development of an Options Report (PAG Unit 4.0) or a Business Case (PAG Unit 8.0) to assist as required.

2. Overview of Active Mode Appraisal Criteria

Appraisal criteria are essentially a 'checklist' of required considerations when assessing the benefits and costs of a scheme or an option. They provide a standard structure against which appraisers can outline the main impacts of a scheme in an MCA, compare the relative advantages and disadvantages of options, while also highlighting areas that might warrant further thought and consideration.

This section outlines the main appraisal criteria and sub-criteria relevant to active modes projects and programmes. TAF requires that transport projects be appraised against seven key criteria:

- Transport User Benefits and Other Economic Impacts
- Accessibility Impacts
- Social Impacts
- Land Use Impacts
- Safety Impacts
- Climate Change Impacts
- Local Environmental Impacts

Along with other relevant sub-criteria that reflect the nature of the project and its impacts. Based on these seven TAF criteria, TII has developed a list of sub-criteria that reflect the main impacts of active modes, which can also be used as headings when undertaking qualitative appraisal.

2.1 Transport User Benefits and Other Economic Impacts

Within transport appraisal, the 'Transport User Benefits and Other Economic Impacts' criterion was traditionally dominated by user benefits associated with journey time savings, and how a new piece of infrastructure or service would affect journey times. TAF describes six main impacts that should be assessed under this criterion: Transport Efficiency, Journey Quality, Household Impacts, Tourism, Wider Economic Impacts.

Transport efficiency can be a benefit of active travel schemes in some circumstances, particularly when it relates to 'permeability' and reducing the distances that pedestrians and cyclists need to travel, such as providing new bridges, shortcut routes or removing barriers to permeability.

Journey quality, such as the width, gradient, surface of a route, or exposure to poor air quality, can influence users' comfort and likelihood to use the infrastructure.

Other economic benefits beyond transport efficiency need to be considered when it comes to active modes. One potentially significant economic benefit of walking and cycling is the **impact on the economic wellbeing of households**, where active modes reduces the costs of owning and operating vehicles. On average, Irish households spend 15% of household income on transport (90% of which relates to vehicle expenses)[2], meaning that providing alternative transport options to useful destinations can reduce costs and improve household wellbeing, particularly in areas where alternatives to private car are lacking.

Tourism is another significant economic benefit, with several recent examples demonstrating how greenways can attract tourists and encourage increased spending on accommodation, hospitality and other services. This can lead to further investment and job creation and can be successful in spreading tourism and economic activity around the country.

[2] CSO, 2016. 'Household Budget Survey 2015-2016'.

This attraction of investment associated with the tourism impacts of greenways aligns with the NPF National Strategic Outcome of 'Strengthened Rural Economies and Communities'. However, consideration also needs to be given to whether an intervention is likely to attract new tourism, or whether it will simply displace tourists and economic activity from other locations.

Investment in active modes has the potential to result in **other wider economic impacts**, depending on the objectives and location, such as agglomeration effects, imperfect competition and labour market imperfections.

Table 13.0.2 TAF Economy Criteria

Sub-Criteria	Content
Transport Efficiency	User benefits associated with more efficient transport and lower journey times
Journey Quality	Other components of journey quality, such as width, gradient, surface type of setting, that influence users' journey quality and likeliness to use infrastructure
Household Impacts	Impacts on household costs associated with owning and operating vehicles
Tourism	Potential for increased tourism and spending from overseas visitors
Wider Economic Impacts	Other wider economic impacts that may be relevant, such as agglomeration effects, imperfect competition and labour market imperfections.

2.2 Accessibility Impacts

The appraisal should consider physical integration and connectivity. As the purpose of a transport system is to bridge the gap between where people are and where they want to go, assessing the impact on integration requires consideration of how a scheme connects to a range of potential destination types. These kinds of assessments can be done at a high level or using mapping and GIS techniques to quantify the impacts on integration for larger schemes. Accessibility impacts criteria is set out in Table 13.0.3.

Integration between different land uses **(Access to Key Services: Jobs, Residential Areas and Retail Centers)** is one of the most important factors in the usefulness of a transport network. Routes that connect areas where people live, work or shop can cater for a large proportion of a person's daily travel and make modal shift more likely. Consideration of land use integration within the appraisal process is very much influenced by the National Planning Framework objective of 'Compact Growth', which recognises the role of active travel in connecting people to employment, services and their local communities. This integration associated with the accessibility impacts of greenways also aligns with the NPF National Strategic Outcome of 'Strengthened Rural Economies and Communities'.

The integration of active travel routes to schools and places of education **(Access to Key Services: Educational Facilities)** is of particular importance. Children are generally dependent on adults for the commute to school, and as many older students do not own or have access to drive a car, a lack of access to safe and connected facilities for active travel limits their ability to travel independently. The ability to travel independently by active modes can have wider benefits for child and youth development, including ability to make decisions, to interact with their peers, independent problem solving and assessing/managing risk. It also benefits parents and caregivers, freeing up the time that is spent escorting children to school; as well as society through the avoidance of additional car trips near schools.

As people often walk or cycle to and from public transport stations, hubs and interchanges, the integration of active mode routes with public transport interchanges **(Access to International Transport Gateways)** improves the sustainable mobility of people, when public transport is an available option. In urban areas, this integration will be linked to permeability and accessibility, whereas in more rural areas, this integration will be linked to the facilities for bike storage and safe routes that connect to bus, train and ferry stations.

For tourist-focused schemes, the integration of active travel routes with tourism destinations and services is an important consideration **(Access to Recreational Facilities: Tourism Sites)**. A variety of 'things to see and do', such as visitor attractions, historic sites, attractive landscapes and amenities will increase the potential appeal of a route to tourists.

Table 13.0.3 TAF Accessibility Criteria

Sub-Criteria	Description
Access to Key Services: Jobs, Residential Areas and Retail Centres	Improved connectivity between population, employment and retail centres
Access to Key Services: Educational Facilities	Improved connectivity to schools and third-level facilities
Access to International Transport Gateways	Improved connectivity to major transport interchanges, such as rail, bus and ferry stations
Access to Recreational Facilities: Tourism Sites	Improved connectivity to 'things to see and do', such as tourism sites, attractions or activities

2.3 Social Impacts

Social Impacts are fundamental considerations of infrastructure provision. Questions of who uses and benefits from an intervention are fundamental questions that should be explored in appraisal, to ensure that equity considerations are mainstreamed through the provisioning of infrastructure and identify potential unintended consequences early on in the appraisal and design process. Social impacts criteria is set out in Table 13.0.4.

Infrastructure has the power to create opportunities for everyone, but historically the access it enables was not always equal, leaving legacy infrastructure problems, such as severed communities, limited transport options and barriers to infrastructure use due to socio-economic factors.

Disadvantaged geographic areas can be identified using the Pobal HP Deprivation index, which scores each small area in Ireland (defined by 50-200 households) in terms of affluence or disadvantage. The index uses 2022 Census data to calculate this score[3]. Active transport schemes that provide options for disadvantaged communities should be documented in the appraisal process, as it addresses local disadvantage and barriers to mobility from poverty (unaffordability of motor vehicles), fuel poverty or

for different user groups, with any improvement of opportunities for vulnerable groups documented throughout the appraisal process.

Finally, there is a significant **gender** gap in Ireland when it comes to active travel: Census 2022 data shows than men are twice as likely to cycle to work as women, while at secondary school level, boys are nearly eight times as likely to cycle as girls.

[3] Available at: https://www.pobal.ie/pobal-hp-deprivation-index/

TII's *Travelling in a Woman's Shoes* report[4] highlighted many of the barriers faced by women when it comes to cycling, including a lack of safe and high quality routes, concerns over personal security, and difficulties with trip-chaining without using cars (i.e. combining trips to several destinations into one journey). The appraisal process should consider how a scheme or option is likely to contribute to reducing this divide, and how it makes transport more accessible to all users.

Social inclusion also requires consideration of the welfare of communities – how they will benefit from the proposed infrastructure, the opportunities that will arise for them and how it will facilitate participation in community life and offer a sense of belonging.

Physical inactivity is significant risk factor for chronic diseases, and while the link between physical activity and health is known and documented for over fifty years, it is only in more recent times that physical activity is given appropriate consideration in planning and infrastructure provisioning[5]. In Ireland, just one-third of people are currently meeting the National Physical Activity Guidelines, while around 10 per cent are classed as 'sedentary'[6].

Investment in active modes can encourage increased levels of physical activity, resulting in **physical health benefits** not only for the individual, but for wider society in terms of reducing healthcare costs and lower rates of absenteeism. The World Health Organisation provides guidance for the inclusion and monetisation of health benefits of active travel in its Health Economic Assessment Tool[7], based on detailed review of scientific and economic literature, and this is widely used by governments and researchers in quantifying the health benefits of walking and cycling.

Alongside these physical health benefits, being able to engage in recreational walking and cycling can benefit **mental health and wellbeing**. The recreation benefits of walking and cycling are dependent on personal preferences but can range from the enjoyment of being active in nature, the presence of social company or undertaking an activity with friends/family, sense of personal wellbeing and control over personal health.

Table 13.0.4 TAF Social Impacts Criteria

Sub-Criteria	Content
Disadvantaged Geographic Areas	Accessibility for users in disadvantaged areas, usually as identified in the Pobal Deprivation Index
Vulnerable Groups	Accessibility of infrastructure for users of all ages and abilities
Active Travel & Gender	Impact in addressing the transport needs of women and girls and reducing the gender disparity in walking and cycling
Social Inclusion	Improving the potential for interaction and participation in community life and reducing the risk of isolation
Health	Positive health outcomes due to increased levels of physical activity, including reduced risk of premature mortality, as well as lower rates and reduced costs of serious illnesses
Recreation	Improved wellbeing due to access to high quality facilities for outdoor recreation

[4] TII, 2020. 'Travelling in a Woman's Shoes – Understanding Women's Travel Needs in Ireland to Inform the Future of Sustainable Transport Policy and Design'
[5] The Lancet 2012. Special series on physical activity. Volume 380, Issue 9838.
[6] Sports Ireland, 2019. 'Irish Sports Monitor – Annual Report 2019'. Available at: https://www.sportireland.ie/sites/default/files/media/document/2020-09/irish-sports-monitor-2019-report-lower-res.pdf
[7] World Health Organisation, 2017. 'Health Economic Assessment Tool for walking and cycling'. Available at: https://www.euro.who.int/__data/assets/pdf_file/0010/352963/Heat.pdf

2.4 Land Use Impacts

This criterion aims to capture impacts related to changes in public realm, such as streets, footpaths, and public buildings, as a result of a scheme. It also captures connectivity with the existing transport infrastructure in an area and with broader national and regional planning policy objectives. Land use impacts criteria is set out in Table 13.0.5.

Assessment on scheme's impact on access and use of the public realm is crucial **(Change in Quality of Public Realm).** This includes streets, footpaths, parks, squares, bridges and public buildings and facilities. Such amenities and public spaces are an important element in contributing to community and personal wellbeing.

As described in Section 1, active modes are strongly supported by national, regional and local policy, meaning that it is important to outline the integration of a scheme with government policy **(Existing Transport Network and Service Impact)**. While this focuses particularly on spatial and planning policy, the appraisal should also highlight how the intervention supports and aligns with climate, transport, tourism and health policy.

The integration of active travel routes with existing local, regional and national cycling facilities increases the level of connectivity on that network **(Existing Cycling Network)**. Connection with long-distance cycle routes and greenways can improve the attractiveness of a route for recreational and cycle tourists, while connections with local network to homes, businesses and services can improve its usefulness for day-to-day users.

Both type of networks should be considered when appraising an active travel scheme, particularly when utility and recreation networks overlap. A cohesive network ensures clear wayfinding and facilitates cyclists to reach their destination by the route of their choice with minimal interruption. Without this connectivity, there cannot be a cycle network; only a collection of individual cycle routes.

Table 13.0.5 TAF Land Use Impacts Criteria

Sub-Criteria	Description
Change in Quality of Public Realm	Impact on access and use of public realm
Existing Transport Network and Service Impact	Integration with relevant local, regional and national policy
Existing Cycling Network	Improved connectivity to other local. Regional and national cycling facilities
Land Use	Impact on land uses, such as through land-take, excavation and infill, or severance

2.5 Safety Impacts

Pedestrians and cyclists are considered 'vulnerable' road users, a term that is used to describe those who are unprotected by an outside shield and who have a greater risk of injury in a collision with a vehicle. There are several aspects to consider when assessing the impact of an intervention in terms of safety. Safety impacts criteria is set out in Table 13.0.6.

Firstly, the infrastructure type and the degree to which routes/junctions are separated from traffic can have an impact on the risk of collisions (**Collisions and Related Impacts**) and can also encourage new and inexperienced cyclists to take up cycling. Reducing the number of potential conflicts, such as junctions, road crossings and driveways, also has an impact on cyclist exposure to risk and journey quality.

Finally, the users' sense of personal security and factors such as lighting (**Other Safety Impacts**), remoteness and the number of entrances/exits can also influence someone's willingness to use a route. Electronic surveillance (lighting, cameras having an electronic tracking device such as a phone) may make routes more amenable, but passive surveillance and the continuous presence of other people may create a more enduring sense of safety.

It should be noted that there may also be unintended consequences of an increase in pedestrians and cyclists. In some cases, individuals who shift to active travel could increase their exposure to air pollutants and collision risks. Any design measures to mitigate these risks should be included in the appraisal, including the incorporation and use of natural capital such as plants and trees for air filtration/purification and shelter from wind and rain, where possible.

Table 13.0.6 TAF Safety Impacts Criteria

Sub-Criteria	Description
Collisions and Related Impacts	Reduced risk of collisions with traffic associated with safe and segregated walking and cycling infrastructure
Other Safety Impacts	Sense of personal security and safety while using active travel

2.6 Climate Change Impacts

The Government's Climate Action Plan 2021 targets a 51% reduction in greenhouse gas emissions by 2030, and with the transport sector responsible for approximately 20% of total emissions in Ireland, investment in active modes necessary to encourage reduction in private car use. Climate change impacts criteria is set out in Table 13.0.7.

Project teams should consider how likely a scheme is to encourage a modal shift towards walking and cycling, particularly for short trips and regular trips to work, school and retail/services.

Table 13.0.7 TAF Climate Change Criteria

Sub-Criteria	Description
Climate Action Impact	Impact on GHG and GHGe emissions from transport

2.7 Local Environmental Impacts

Air quality from the transport sector is another important consideration, particularly in urban areas and/or in congested smaller towns which may have localised concentration of air pollution from traffic. Replacing car trips with active modes can improve local air quality by reducing the most pervasive pollutants to health and ecosystems, particularly nitrogen oxides (NOX), fine particulate matter (PM), Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs). Local Environmental Impacts criteria is set out in Table 13.0.8.

Private cars also contribute to the **noise pollution** from roads, particularly in busy urban areas. Noise pollution cause a variety of psychological, cardiovascular and other health disorders[8].

[8] EPA, 2020. State of the Environment. Available at: https://bit.ly/3DMgHGD

The European Union's (EU's) Environmental Noise Directive deals with environmental noise from major transport infrastructure including roads, railways and airports and a number of state agencies including TII, Environmental Protection Agency, local authorities developed Strategic Noise Maps to show noise exposure resulting from transport noise sources. The identification and protection of quiet areas is an important component of the Environmental Noise Directive, and a mode shift to active transport modes will alleviate transport-related noise pollution.

However, the development of transport infrastructure can have other - potentially negative - environmental impacts which must be considered, particularly those from the construction phase. These include, for example, potential **impacts on biodiversity, water resources and soil quality, landscape and visual quality and cultural and heritage.** Further guidance on evaluation of these impacts is provided in TAF and the PAG.

Table 13.0.8 TAF Local Environmental Impacts Criteria

Sub-Criteria	Content
Air Quality	Impact on non-greenhouse gas emissions from transport that have a negative impact on human health, such as nitrous oxides and particulate matter
Noise	Impact on local noise levels from transport
Biodiversity	Impact on biodiversity and habitats, particularly protected habitats and species.
Water Resources and Soil Quality	Impact on surface waters, ground waters and coastal resources.
Landscape & Visual Quality	Impact on local landscapes and viewpoints
Cultural and Heritage	Impact on areas or structures of cultural importance, including archaeological sites, historic buildings and structures, or culturally-significant landscapes

3. Undertaking Qualitative Appraisal

Qualitative appraisal should be completed for all projects and is the default method of appraisal for projects and programmes costing less than €30 million[9]. Qualitative appraisal is different from quantitative appraisal methods (such as cost benefit analysis or cost effectiveness analysis) as it ranks and scores schemes/options based on qualitative criteria and professional judgement.

3.1 Steps for Carrying out Qualitative Appraisal

At the outset of the appraisal process, an appraisal framework will need to be set up which establishes how options will be assessed and scored. The proposed appraisal framework is usually included within the Project/Programme Outline Document (for projects or programmes costing €15 million or more). Note that this is likely to evolve with the project or programme as more information becomes available.

The steps for carrying out qualitative appraisal are outlined below and are adapted from PAG Units 7.0: Multi-Criteria Analysis and 7.1: Project Appraisal Balance Sheet.

3.1.1 Step 1 – Establish the Decision-Making Context and Project Phase

Central to the appraisal is the decision-making context (i.e. what the project is trying to achieve). This will ultimately stem from the objectives established at the onset of the project.

This also relates to the options that are under consideration at this stage of the project or programme. A variety of potential appraisal techniques including MCA, the Transport and Accessibility Appraisal (TAA) and CBA are used during Phase 2 Preliminary Options to select a preferred option depending on the estimated cost of the project or programme.

3.1.2 Step 2 – Review Active Mode Appraisal Criteria and Sub-Criteria

Firstly, the criteria and sub-criteria outlined in Section 2 should be reviewed and the most relevant criterion for the scheme should be identified. While all criteria should be considered, the relevance of certain criteria will often depend on the scheme objectives. For example, if an objective of the scheme is to attract tourists to a rural area, then the 'Tourism' and 'Strengthening Rural Economies' sub-criteria will be an important part of the appraisal. If it is determined that certain criteria are not relevant and should be excluded, an explanation should be given as to why it is not relevant to the scheme or its objectives.

The list above is not exhaustive: if there are any other relevant criteria not included here or others that might be important, they can be brought into the assessment framework as additional sub-criteria. During Option Selection this could also include more specific design criteria as appropriate.

3.1.3 Step 3 – Establish a Scoring Procedure

Once the list of relevant appraisal criteria has been identified, the next step is to determine how options/schemes should be assessed and scored. Generally, schemes should be assessed against a criterion with a short statement explaining how it will affect the criteria, and a score/rating using a pre-determined scoring scale. The PAG uses a 7-point qualitative scale for scoring options, which is used to rate the extent to which a scheme is likely to represent a positive/negative impact in each criterion. This scale is shown in Table 13.0.9.

[9] As stated in Section 1.2, despite this guidance from the DoT TAF, the use of TEAM is recommended on TII funded active travel projects regardless of value as it is a simple tool to undertake quantitative appraisal (CBA) on these schemes.

Table 13.0.9 TAF Local Environmental Impacts Criteria

1	2	3	4	5	6	7
Major Negative	Moderate Negative	Minor Negative	Neutral	Minor Positive	Moderate Positive	Major Positive

Where feasible, indicators should be introduced to help with scoring and to make the process more objective. This is particularly useful when trying to compare alternative schemes or routes, as it can help to distinguish which options perform better than others. There are two types of indicators:

- **Quantitative Indicators –** Depending on scheme and the data available, use quantitative indicators to help determine how to score or compare options. These indicators are particularly useful for providing objective comparisons between options: for example in the ‘Schools & Education’ sub-criteria, metrics like the ‘number of schools within 500m of the route’ can help to score options and identify the option that performs best.
- **Monetary Indicators (TEAM results) –** If a CBA was carried out using the TEAM, monetary results can also be brought in as an indicator to help score the assessment.

3.1.4 Step 4 – Examine Results and make Recommendations & Conclusions

Based on the previous steps, the results for each scheme/option should be summarised in a performance matrix which highlights their relative strengths and weaknesses, and which can be used to guide and document the choice of a preferred option. There are two ways of summarising the results of the qualitative appraisal:

- For multiple options, this can be summarised in an MCA or TAA performance matrix. MCA/TAA is generally used during Phase 2 Preliminary Options, when the aim is to identify emerging preferred option from a short-list. Further guidance on MCA is provided in *PAG Unit 7.0*.
- Following the selection of an emerging preferred option, the appraisal should be summarised.

The process and results of the appraisal process should be described in the required appraisal deliverables, as outlined in Section 1.3.

4. Undertaking Cost Benefit Analysis for Active Modes

As outlined in Section 1.3, Cost Benefit Analysis is the typical form of quantitative economic appraisal for transport schemes and is required for projects costing over €30 million (as per TAF Guidelines[10]), including National Roads schemes where active modes infrastructure is also being provided. CBA compares the monetised active modes benefits of a proposal (such as health benefits or journey time savings) to its cost and uses this to assess where a project represents good value of money.

4.1 Introducing TEAM - CBA Tool for Active Modes

CBA for road and public transport schemes is usually carried out using dedicated models and software, which results in a streamlined and consistent appraisal process across different schemes. As part of this update to PAG Unit 13, TII have developed an Excel-based tool for undertaking a CBA of active modes schemes: the 'Tool for Economic appraisal of Active Modes' (TEAM).

TEAM is a user-friendly tool that can quickly estimate the main benefits associated with increased levels of walking and cycling or improved infrastructural quality. It can be used to carry out a full CBA for an active mode scheme, as it provides a summary of the benefits and economic outputs required by the PAG and TAF. It can also be used to simply calculate the active modes benefits for inclusion in another economic appraisal (for example, to add to a CBA for a National Roads scheme).

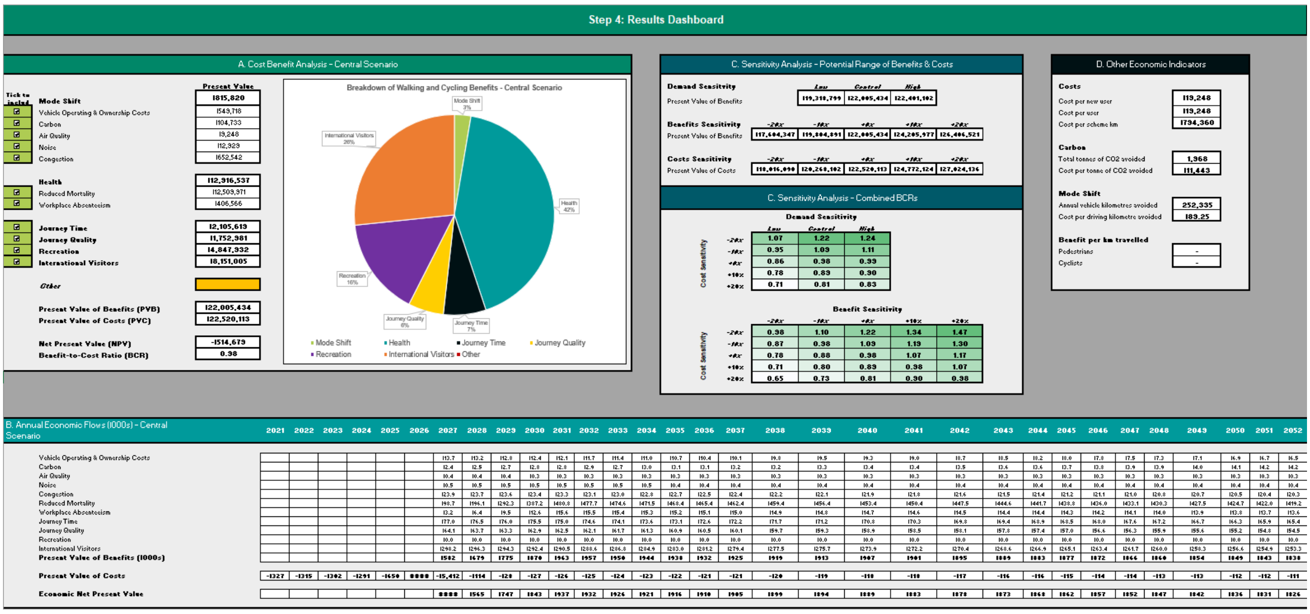

Figure 13.0.2 Example of the Results Dashboard from a TEAM Appraisal

TEAM is based on a series of Excel sheets which combine simple user inputs with background calculations and assumptions to estimate the costs and benefits associated with a proposal, before summarising these results in a results dashboard. There are five main steps to carrying out a CBA using TEAM, each associated with a different Excel sheet in the tool, in Figure 13.0.3.

[10] As stated in Section 1.2, despite this guidance from the DoT TAF, the use of TEAM is recommended on TII funded active travel projects regardless of value as it is a simple tool to undertake quantitative appraisal (CBA) on these schemes.

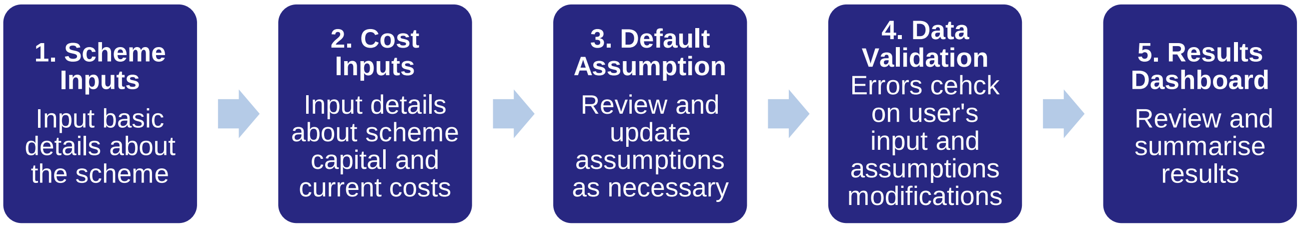

Figure 13.0.3 Example of the Results Dashboard from a TEAM Appraisal

TEAM is designed to be easy-to-use, with most steps explained within the tool itself. The use of standard methodologies and default assumptions reduces the data that project teams are required to gather, meaning that TEAM assessments can be carried out with relatively few user inputs. However, the following sections provide further detailed guidance for each of these steps, as well as the specific purpose and requirements of each input and assumption.

4.2 Quantitative Economic Benefits for CBA

4.2.1 Economic Benefits Included within TEAM

TEAM automatically estimates the main economic benefits associated with active modes schemes, including Health, Mode Shift, Journey Time, Journey Quality and Recreation benefits. These benefits are summarised in Table 13.0.10, along with their alignment with the Walking and Cycling Appraisal Criteria described in Section 2.

Table 13.0.10 Economic benefits included in TEAM

	Description of benefit	Alignment of benefit with MCA criteria (see Section 2)
Mode Shift	Benefits for individuals and society from a reduction in car use. Five benefits are included within this: Vehicle Operating & Ownership Costs, Carbon, Air Quality, Noise, Congestion.	
Vehicle Operating & Ownership Costs	Savings for households due to a reduction in vehicle operating & ownership costs, such as reduced fuel consumption, non-fuel operating costs, and the overall cost of vehicle ownership.	Transport User Benefits (Household Impacts)
Carbon	Reduction in carbon emissions	Climate Change Impacts (Action)
Air Quality	Reduction in emissions of non-greenhouse gases such as nitrous oxides and particulate matter, and improved air quality and health.	Local Environmental Impacts (Air Quality)
Noise	Reduction in noise from vehicles and traffic	Local Environmental Impacts (Noise)
Congestion	Reduction in congestion to reduced car use, particularly in urban areas.	Transport User Benefits and Other Economic Impacts (Wider Economic Impacts)
Health	Benefits for users and society associated with increased levels of physical activity. Two benefits are included within this: Reduced Mortality, Workplace Absenteeism.	
Reduced Mortality	Reduction in the risk of premature mortality.	Social Impacts (Health)

	Description of benefit	Alignment of benefit with MCA criteria (see Section 2)
Workplace Absenteeism	Reduction in costs for employers associated with the number of sick days taken.	Social Impacts (Health)
Journey Time	Benefits for users from a reduction in journey times.	Transport User Benefits and Other Economic Impacts Journey Time)
Journey Quality[11]	Benefit for utility users from high quality cycling infrastructure.	Transport User Benefits and Other Economic Impacts (Journey Quality)
Recreation	Benefits for recreational users of high-quality walking and cycling infrastructure.	Social Impacts (Health)
International Visitors	Benefits arising from direct spend of overseas visitors when using the walking and cycling infrastructure	Transport User Benefits and Other Economic Impacts (Wider Economic Impacts)

These benefits are estimated by TEAM using a range of sources and methodologies, most of which are hidden in background sheets to streamline the process for the appraiser. These sources include:

- Calculation of reduced mortality and carbon benefits is based on the methodology of the World Health Organization's Health Economic Assessment Tool (HEAT)[12] for walking and cycling. Localised parameters from TAF and PAG were used where necessary, including for vehicle emissions factors and the Shadow Price of Carbon.
- Methods and values currently contained in PAG and TAF are used to calculate air quality benefits, vehicle operating and ownership costs, and journey time savings[13].
- The methodology for 'Workplace Absenteeism' benefits has been updated from the previous PAG Unit 13 and is based on research from the WHO[14].
- The marginal external costs of noise and congestion were sourced from the UK Transport Appraisal Guidance, and value transfer techniques were used to convert these into Irish values based on relative exchange rates and real GNP[15].
- Journey quality values are an update of 'Journey Ambience' values from the previous PAG Unit 13, which were originally based on a willingness-to-pay study from the United Kingdom[16]. However, the tool now provides similar willingness-to-pay values for Irish recreational trips (referred to as 'Recreation' benefits), which are based on a literature review of willingness-to-pay for recreational walking and cycling trails from Ireland[17].

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[11] Journey Quality was referred to as 'Ambience' in the previous PAG Unit 13
[12] WHO, 2017. 'Health Economic Assessment Tool (HEAT) for Walking and Cycling'. Available at: https://www.euro.who.int/__data/assets/pdf_file/0010/352963/Heat.pdf
[13] See PAG Unit 6.11 for vehicle operating costs and emissions parameters.
[14] World Health Organisation (WHO), 2003, Health and development through physical activity and sport, WHO/NMH/NPH/PAH/03.2, Geneva, Switzerland
[15] Values adapted from Department for Transport, 2019. 'TAG Data Book – Table 5.4.2. Available at: https://www.gov.uk/government/publications/tag-data-book
[16] Original research from Hopkinson & Wardman (1996) and Wardman et. al. (1997); values adapted from Department for Transport, 2019. 'TAG Data Book – Table 4.1.7'. Available at: https://www.gov.uk/government/publications/tag-data-book
[17] Values based on a 'Travel Cost method' estimate of willingness to pay for day trips on the Waterford Greenway, as estimated from AECOM, 2018. 'Waterford Greenway Intercept Survey'. Available at: https://www.waterfordcouncil.ie/media/greenway/WaterfordGreenway-BaselineSurveyReport-Jan2018.pdf.

- International visitors spend is calculated using Fáilte Ireland's per diem rate per visitor[18], applied to the estimates of demand from international visitors, and adjusted according to the seasonality evident in the tourism sector and the location where the active mode infrastructure will be provided. Technical methodologies for TEAM and the benefits contained therein are contained in Appendix B.

4.2.2 Additional Economic Benefits not Included within TEAM

While TEAM provides estimates of the main economic benefits associated with active mode schemes and can be used to carry out a standalone CBA, certain benefits have been excluded from the current version of the tool where national-level data was not available. The most notable of these is 'Collision Reduction', for which guidance was provided in the previous version of PAG Unit 13; and 'Healthcare Costs'. While TEAM currently includes health benefits in the form of reduced mortality and improved workplace productivity, there is potential to include additional benefits in terms of reduced public and private healthcare costs due to improved health.

While not included within TEAM, in some circumstances, project teams/appraisers may have sufficient local-level data to estimate additional benefits. Where this is the case, these additional benefits may be calculated separately and added to the benefits calculated by TEAM, but only if supported by a strong rationale and robust local data. Any calculations and assumptions for additional benefits must be documented as part of the reporting process.

The methodology for calculating one of these additional benefits – i.e. 'Collision Reduction'– has been provided in Appendix B.6. A cell has also been provided in the Results Dashboard to allow for the Net Present Value of any benefits calculated offline to then be entered into the TEAM CBA. If applicable, the NPV of these benefits should be calculated using the same assumptions as the main TEAM assessment, including the appraisal period, discount rates, demand scenarios, and future growth rates.

4.3 Detailed Steps for Carrying out a CBA using the Tool for Economic Appraisal of Active Modes (TEAM)

4.3.1 Sheet 1 – Scheme Inputs

The first step of a TEAM appraisal allows the input of basic details about a scheme, as well as details of the scenarios being tested.

4.3.1.1 Section A - Scheme and Infrastructure Details

The first set of questions aims to provide basic details regarding the scheme, including:

- **Scheme Area Type –** Choose between five area types that best describe the location of the scheme:
  - Dublin City (the area administered by Dublin City Council)
  - Greater Dublin Area (counties Dublin, Kildare, Wicklow, Meath)
  - Regional Cities (Cork, Limerick, Galway, Waterford)
  - Other towns / urban districts (with a population greater than 1,500)
  - Rural (areas with a population of less than 1,500).

[18] Fáilte Ireland, 2021. *Key Tourism Facts 2019.*

The location should reflect the location where the majority of users are based. For example, if a scheme passes through a rural area but is primarily aimed at connecting two nearby towns, choose ‘Other towns / urban districts’. The chosen location will affect the ‘diversion rates’ that are used by the tool, which refers to the modes new users are assumed to have shifted from. This is explained in greater detail in Section 4.3.3.2.

- **Scheme Geographical Region –** The region in which the scheme is being delivered. Choose between seven administrative regions in Ireland:
  - Dublin
  - East / Midlands
  - South East
  - South West
  - Shannon (Sometimes referred to as ‘Mid West’)
  - West
  - North West (Sometimes referred to as ‘Border’)

This information is required to consider the likelihood that an international visitor will visit a particular region. This captures an element of regional preferences of international visitors when engaging in walking and cycling during their time in Ireland[19]. Regional choice reflects the location of where the majority of users are based. Further details are available in Section B.5.

- **Scheme Opening Year –** Input the year that the scheme/intervention is expected to be complete and open to users.
- **Scheme Length –** Input the total length of the scheme / route corridor in question in kilometres.
- **Demand Split –** This should only be used where there are significant differences in demand across various sections of a scheme. Demand may vary in terms of users (commuters, recreational users, or international tourists) and demand values (higher or lower) for each section length. See Figure 13.0.4 for hypothetical example of an extension to an existing scheme.

[19] In 2019 Ireland received 9.674 million overseas visitors, and 361,000 took part in cycling, which equates to 3.7%.
https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/KeyTourismFacts_2019.pdf?ext=.pdf Accessed March 2023

How long is the scheme in question? (in kilometres)	**50.00**
Is there different type of demand for different sections on the new scheme?	**Yes**

Break down the total scheme length into different types of infrastructure (in kilometres):	*Existing infrastructure*	*SECTION A*	*SECTION B*	*SECTION C*	*SECTION D*
Off-road segregated cycle trails (e.g. Greenways, Cycle Trails, Cycleways)	**10.00**	10			
On-road cycle-track with physical separation from traffic (e.g. kerbs, verges, bollards)	**7.50**		7.5		
On-road cycle lane without physical separation from traffic (e.g. painted lanes)	**0.00**				
Wider lane	**0.00**				
Shared bus lane	**0.00**				
No dedicated facilities	**0.00**				
	17.50	10	7.5		

Break down the total scheme length into different types of infrastructure (in kilometres):	*Proposed infrastructure (with exisiting infrastructure)*	*SECTION A*	*SECTION B*	*SECTION C*	*SECTION D*
Off-road segregated cycle trails (e.g. Greenways, Cycle Trails, Cycleways)	**20.00**	20			
On-road cycle-track with physical separation from traffic (e.g. kerbs, verges, bollards)	**30.00**		30		
On-road cycle lane without physical separation from traffic (e.g. painted lanes)	**0.00**				
Wider lane	**0.00**				
Shared bus lane	**0.00**				
No dedicated facilities	**0.00**				
	50.00	20	30		

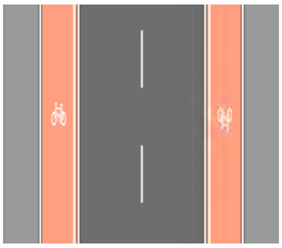
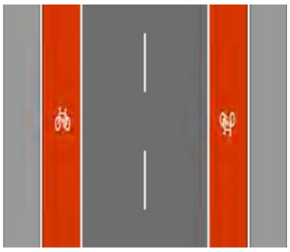
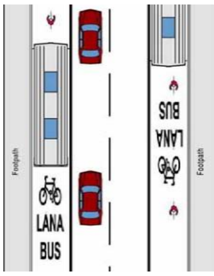
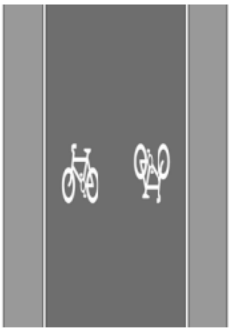
Figure 13.0.4 Example of Inputting Route Infrastructure Details

- **Infrastructure Breakdown –** Provide a breakdown of the types of infrastructure along the route/corridor under the existing situation, and under the proposed situation/option. This should break down the total scheme length in kilometres across six potential types of infrastructure, as follows:
  - Off-road segregated cycle trails, (e.g. Greenways, Cycle Trails, Cycleways)
  - On-road cycle-track with physical separation from traffic (e.g. kerbs, verges, bollards)
  - On-road cycle lane without physical separation from traffic (e.g. painted lanes)
  - Wider lane
  - Shared bus lane
  - No dedicated facilities

It is important to differentiate between infrastructure types, as there are different benefits that are calculated for each type. If the scheme is a new route, the 'Existing infrastructure' field should describe the infrastructure type of the nearest alternative route, which in most cases, is likely to be 'no dedicated facilities'. Examples of different types of cycling infrastructure are displayed below from the NTA's (2023) Cycle Design Manual[20] in Figure 13.0.5.[21]

- **Journey Time Savings –** This should only be used in the case of interventions that remove detours or improve permeability along specific routes, such as bridges, under/overpasses, or the provision of shortcut routes. If a route does so, the user will be asked to provide an estimate of how many minutes the average pedestrian and/or cyclist will save, which will be used to calculate the journey time savings benefit.

[20] Available from: https://www.nationaltransport.ie/publications/cycle-design-manual/
[21] These types of cycling infrastructure are for the purposes of example only. TII standards for cycling infrastructure can be found in DN-GEO-03047 Rural Cycleway Design (Offline & Greenway).

Cycle Link	Road Design	Example of Facility
Off-Road Two way cycle route, typically shared with pedestrians, but segregation is also possible. Typically located off-line (away from vehicular carriageway) or sometimes adjacent to a rural roads.		
On-Road Cycle Track Segregated cycle facilities with generally no buffer between cycle track and carriageway.		
On-Road Cycle Lane Mandatory Cycle lanes are marked on carriageways by a continuous white line and not physically separated from motor traffic. Motor traffic is legally prohibited from entering mandatory cycle lanes, except for access purposes.		
Shared Bus Lane Cyclists are usually permitted to use with-flow and contraflow bus lanes. Whilst not specifically a cycle facility, bus lanes can offer some degree of protection for cyclists as they significantly reduce the amount of interaction with motor traffic.		
No dedicated facilities / mixed traffic Cyclists share the carriageway with vehicular traffic. Only suitable for roads with low traffic speeds and volumes such as quiet residential or access streets. Traffic management or calming measures are likely required to ensure low traffic speeds and/or volumes.		

Source: NTA, 2023. 'Cycle Design Manual'

Figure 13.0.5 Cycle Link Types

4.3.1.2 Section B – Demand Scenarios

One of the most important inputs to the tool is the demand scenario, meaning the numbers of pedestrians/cyclists using a scheme before and after an intervention. This demand scenario is used to calculate the benefits associated with a change in the number of pedestrians and cyclists, and it is the most important driver of the appraisal results.

Under this field, the user is asked to input the number of daily pedestrian and/or cyclist trips in the existing situation, as well as in the future demand scenarios. There are spaces for three demand scenarios: a low, central, and high scenario. The number of trips entered should reflect the total number of trips in an area or along a route corridor, in both directions.

In many cases, it will be difficult to predict how many users are likely to use a scheme, or how an intervention (such as adding segregated facilities) will affect walking and cycling user numbers. Additional guidance has been provided in Section 5 to help estimate demand, particularly in instances where there is little existing data.

This section also seeks four additional pieces of information:

- **Annualisation –** An annualisation factor is used to convert average daily demand scenarios to annual values. A default value of 300 (i.e. 300 days per year) is provided, which is based off estimates from cycle counter data in Dublin. Cycle counter data was used to create an accurate assumption for typical travel patterns. If, for example, the annualisation scenario is based on weekday demand, the number of 'working days' may be appropriate to use (i.e., 265 days per year). Alternatively, a simple annual conversion factor of 365 days can be used.
- **Recreational users –** When calculating benefits, TEAM distinguishes between 'recreational users' (i.e., people walking or cycling for exercise/fun, and with no specific destination in mind), and 'utility users' (i.e., those travelling for a specific purpose or to reach a specific destination such as work, school, shopping etc.). This split affects how benefits are calculated: while 'Mode Shift', 'Journey Quality' and 'Journey Time Savings' are only calculated for utility users, 'Recreation' benefits are limited to recreational users. Benefits arising from domestic visitors are captured within recreational benefits in TEAM.

Appraisers are asked to estimate what proportion of users are likely to be 'recreational users', with the remaining users assumed to be 'utility users'. This is likely to be a high-level judgement based on the location or context of the scheme. For example, a rural greenway is likely to have a high proportion of recreational users, while an urban scheme connecting to lots of workplaces and shops is likely to be more weighted towards utility users.

This can also depend on the source of demand estimates: for example, estimates that are derived from transport models will generally exclude recreational users, while estimates that come from count or survey data include all user types.

- **International visitors** – Appraisers are asked if the scheme will be used by international visitors. Spending by international visitors is an additional benefit of cycle schemes and some schemes have the potential to attract international visitors. This will generally apply only to schemes of a certain scale, located in certain areas or have unique characteristics that will attract overseas visitors. Justification for the inclusion of benefits associated with international visitors should be provided in the appraisal reporting for the scheme.
- **Proportion of international visitors** – Appraisers can input the estimated percentage of overall daily trips that are likely to be taken by international visitors.

This is calculated as a percentage of the total users inputted in 'Section B - Demand Scenarios'. If unsure, this section can be left blank, and a default assumption will be inputted by TEAM.

Consideration needs to be given to whether an intervention is likely to attract new tourism, or whether it will simply displace tourists and economic activity from other locations in the country. One caveat to be noted when including international visitors benefits within TEAM are given below, to avoid overestimating the impact of the proposal.

Only spending from overseas visitors should be included as a benefit within a CBA. While greenways can result in an economic stimulus for local businesses, there is a strong risk of 'displacement' when it comes to domestic spending: for example, a domestic visitor spending money in a café along a greenway would likely have otherwise spent that money in their home county or another part of the county, meaning that the economic benefit is simply being displaced or redistributed from one area to another. Benefits arising from domestic visitors are captured within recreational benefits in TEAM.

4.3.2 Sheet 2 – Cost Inputs

The second sheet allows the appraiser to input details regarding the capital and current costs of the proposals.

4.3.2.1 Capital Costs

Capital costs are once-off costs, such as construction costs or planning/design, and are the main costs associated with projects. When inputting capital costs in the tool, the following information is requested:

- **Total Cost (excluding VAT and inflation) –** The total cost in each of the main capital cost categories (e.g. construction, design, land & property etc.) should be entered here. This total should <u>not include</u> Value-Added Tax (as this ultimately returns to the government); nor future inflation (as all prices are converted back to a base year). It should however include any risk associated with this particular cost category. A separate line is provided for general programme risk (sometimes also referred to as optimism bias or contingency).
- **Percentage provided by public funds –** In most cases, all of the project's budget will be supplied by public funds, and this should be kept at 100 per cent. If any private funding is being provided, reduce this value to reflect the non-public fund component for this.
- **Percentage that relates to labour –** Provide an estimate of the proportion of each cost that is spent on labour (i.e. wages, salaries etc.). This percentage is used later for calculating the Shadow Price of Labour. Default percentages have been provided for each cost category.
- **Year of the Cost estimate –** This refers to the price year in which the original cost estimates are based. The tool will then convert these costs into the base year that is being used.
- **Apportionment –** Apportionment relates to the percentage of each cost that is spent in each year. The timeframe for projects often lasts for several years, and different costs can be incurred at different times.
- **If the spending profile of the scheme <u>is not known / not relevant</u>:** Simply keep the yellow 'Don't Know' box checked, and the tool will automatically apportion costs to the two years before opening.
- **If the spending profile of the scheme <u>is known:</u>** Make sure the yellow box is unchecked and put percentages under each year indicating what percentage of that cost will be spent. Make sure that each row adds to 100%.

Figure 13.0.6 provides an example of cost inputs for a project with a specific annual profile.

Base Capital Costs	Total Cost (excl. VAT and inflation)	What percentage of this cost is provided by public funds?	What percentage of this cost relates to labour?	What is the year of this cost estimate?	How are capital costs apportioned annually? (in percentages) *Don't know*	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
Main Contract Construction	€5,000,000	100%	30%	2020	☐					50%	50%					*100%*
Main Contract Supervision	€500,000	100%	50%	2020	☐					50%	50%					*100%*
Archaeology	€250,000	100%	50%	2020	☐					75%	25%					*100%*
Advance works and other contracts	€100,000	100%	30%	2020	☐					100%						*100%*
Land & Property	€500,000	100%	10%	2020	☐					100%						*100%*
Residual Network	€0	100%	30%	2020	☐						100%					*100%*
Planning & Design	€1,500,000	100%	60%	2020	☐			40%	40%	20%						*100%*
TII Programme Risk / Contingency Allowance	€1,650,000	100%	36%	2020												

Figure 13.0.6 Example of Inputting Capital Costs

4.3.2.2 Operating & Maintenance Costs

The tool also asks for annual Operating & Maintenance Costs, such as those associated with staffing or day-to-day maintenance. The field also asks for some of the same information as above, including the percentage provided by public funds, the labour percentage and the price year. Once these are inputted, this annual cost is automatically apportioned for each year of the appraisal period, after the scheme opens. Figure 13.0.7 displays these costs in the tool.

Operating and Maintenance Costs				
Annual Operating and Maintenance Costs	€5,000	100%	50%	2020

Figure 13.0.7 Example of Inputting O&M Costs

4.3.2.3 Refurbishments Costs

When calculating the residual value, it is important to consider potential end of life costs or scrappage fees. Lifetime infrastructure refurbishments are included between mid-refurbishment and full refurbishment of infrastructure along with the years that these would be inputted. Decommission costs refer to the expenses associated with the removal and dismantling of infrastructure or operational assets when they reach the end of their useful and safe operating lives. Figure 13.0.8 displays these costs in the tool.

According to DN-PAV-03024, well designed roads may offer on average between 15 to 20 years of service life before needing **resurfacing**. By ticking the ‘Don’t know’ checkbox for the scheduled year of resurfacing, the TEAM tool will automatically add resurfacing every 20 years.

According to DN-PAV-03021, the design period for a new pavement is 40 years and thereafter an entire **pavement reconstruction** is recommended to be performed. By ticking the ‘Don’t know’ checkbox for the scheduled year of full reconstruction of infrastructure, the TEAM tool will automatically add reconstruction every 40 years.

Refurbishments Costs					When are the refurbishments scheduled for (years)? *Don't know*					
Resurfacing	€20,000	100%	30%	2020	☐	2040				
Full Reconstruction of Infrastructure	€50,000	100%	30%	2020	☐	2070				

Figure 13.0.8 Example of Inputting Refurbishments Costs

4.3.2.4 Shadow Pricing

The TAF in line with central government guidance specifies three types of shadow prices[22], which have been applied by default in the tool, as follows:

- **Shadow Price of Public Funds (SPF)** – When the government raises funds through taxation, it can introduce economic distortions: taxes such as VAT or income tax raise the price paid for goods and services, which can discourage economic activity that would have otherwise occurred. The purpose of the SPF is to account for the opportunity cost of raising money through taxation, and it should be applied to all publicly-funded expenditure associated with a project or programme. As of October 2021, the SPF is set at 130% of all publicly-funded expenditure.
- **Shadow Price of Labour (SPL) –** Spending on some projects, particularly when they are located in an area with high rates unemployment, can have a stimulus effect, creating jobs and reducing the number of people claiming social welfare payments. The purpose of the SPL is to account for this impact by reducing the effective cost any labour-related spending. As of October 2021, the SPF is set at 80%, which the tool automatically applies to any schemes located in rural areas.
- **Shadow Price of Carbon (SPC) -** Greenhouse gas emissions from activity in the transport sector contribute to climate change which imposes indirect costs on society. The Shadow Price of Carbon (SPC) is a monetary value that is based on the estimated abatement cost to Ireland of removing carbon and carbon equivalent emissions from the atmosphere in order to meet climate targets and mitigate against the adverse climate impacts. The SPC values are set by the Department of Public Expenditure, NDP Delivery and Reform.

The Shadow Price of Carbon is built in into the TEAM Tool. The Results Sheet in the TEAM tool contains an indicator for the amount of carbon avoided with the proposed scheme, and the SPC is applied to this figure to get the cost per tonne of CO_2 avoided. SPF and SPL are applied by default in Cost Inputs, as shown in Figure 13.0.9.

Shadow Pricing	Include?	Applicable Shadow Price
Include Shadow Price of Public Funds?	☑	130%
Include Shadow Price of Labour?	☑	80%

Figure 13.0.9 Example of Shadow Pricing

4.3.3 Sheet 3 – Default Assumptions

The calculations in the tool rely on a series of default assumptions, which are listed on Sheet 3 of the Excel-based tool. These default assumptions have been developed by TII to reflect the best available data at a national level and aim to make the process of calculating benefits easier and more consistent across schemes. They also aim to reduce the data that project teams are required to gather when appraising a scheme.

[22] In economics, market prices refer to the actual cost that is paid for a good or service in the market, such as the salary that someone is paid to work on constructing an active travel scheme. However, market prices can distort the true economic costs or benefits associated with these activities, such as the fact that spending on labour can reduce unemployment and its associated economic costs. In these instances, shadow prices are used to convert market prices to a value that more closely reflects its true economic cost.

The default assumptions should be reviewed and adjustments can be made if necessary. While appraisers should generally keep the pre-populated value for each assumption, there may be specific circumstances or areas where better data is available and more reflective of the local area. In these cases, this sheet provides the opportunity to replace any default assumption. For example, a scheme will mainly cater for cycling trips between two towns located 8km apart, there may be a justification for using an average journey length of 8km, rather than the default value of 5km. However, any changes to default assumptions should only be made with specific supporting evidence; evidence which should be documented in the report.

4.3.3.1 Section A – Journey Lengths and Assumptions

Most benefits increase with the length of time someone spends walking or cycling, as well as the length of car trips replaced by active travel.

This means that assumptions around the length, speed, and direction of a journey can have a significant impact on benefits, particularly health and mode shift benefits. Default assumptions around journey length and duration are shown in Table 13.0.11, along with the source/basis of the assumption.

Table 13.0.11 Journey Lengths and Assumptions

Variable	Default Assumptions	Source / Basis
Average non-recreational walking journey length (km)	1.4 km	Analysis from the NTA 'National Household Travel Survey 2017'
Average non-recreational cycling journey length (km)	5 km	
Average walking speed (km/h)	5 km/h	Standard all-purpose walking and cycling speeds
Average cycling speed (km/h)	16 km/h	
Average recreational walking trip length (mins)	45 mins	CSO Quarterly National Household Survey 'Special Module on Sport' 2013
Average recreational cycling trip length (mins)	60 mins	
Proportion of people making return journeys (%)	90%	Analysis from the NTA 'National Household Travel Survey 2017'

4.3.3.2 Section B – Diversion Rates

When a new pedestrian or cyclist switches to walking or cycling when making a journey, diversion rates are used to estimate what mode they are likely to have switched from. This mainly affects the mode shift benefits, but it also has an impact on other benefits.

Outside of formal transport models, there are generally two approaches that could be taken to developing diversion rates. One is to take diversion rates from published studies of substitution rates between transport modes, while the other is to base it off of the typical modal split of an area. Due to a lack of relevant studies for Ireland or for non-metropolitan areas, diversion rates in TEAM were developed using the NTA 'National Household Travel Survey 2017' and are based on the typical modal split of each area type; reweighted to exclude the mode of transport in question. These differ according to area type, not least because of the different transport options currently available in different parts of Ireland.

Default diversion rates for each area type are shown in Table 13.0.12 for walking and Table 13.0.13 for cycling. Using Table 13.0.11 as an example, this means that for every 100 new walking trips in a 'rural' area, 20 are assumed to be brand new trips (i.e. they did not shift from any other mode), 74 will be trips diverted from driving, 4 from bus, 1 from cycling and 1 from rail.

Table 13.0.12 Default Walking Diversion Rates

New walking trips from	Dublin City	Greater Dublin Area	Regional Cities	Other towns / urban districts	Rural
Did not previously travel / new trip	15%	15%	15%	15%	20%
Private Car	52%	68%	73%	80%	74%
Walking	0%	0%	0%	0%	0%
Cycling	11%	5%	6%	2%	1%
Bus	20%	10%	6%	3%	4%
Rail/Luas	2%	2%	0%	0%	1%

Source: Based on NTA, 2017. 'National Household Travel Survey 2017. (Reweighted all-purpose mode shares excluding walking.)

Table 13.0.13 Default Cycling Diversion Rates

New walking trips from	Dublin City	Greater Dublin Area	Regional Cities	Other towns / urban districts	Rural
Did not previously travel / new trip	15%	15%	15%	15%	20%
Private Car	40%	57%	56%	62%	67%
Walking	28%	18%	24%	21%	9%
Cycling	0%	0%	0%	0%	0%
Bus	15%	8%	5%	2%	3%
Rail/Luas	2%	2%	0%	0%	1%

Source: Based on NTA, 2017. 'National Household Travel Survey 2017. (Reweighted all-purpose mode shares excluding cycling.)

4.3.3.3 Section C - Other Travel Assumptions

Other miscellaneous travel assumptions have an impact on a range of benefits, such as the background journey growth rate (mainly affecting the future number of users), vehicle occupancy rates (mainly affecting mode shift benefits), and demographic data (mainly affecting health benefits, which are only calculated for adult users). These are shown in Table 13.0.14.

Table 13.0.14 Other Travel Assumptions

Variable	Default Assumption	Source
Annual background journey growth rate (%)	1.0%	Based on general population growth
Private Car Occupancy rate	1.5 passengers	PAG Unit 6.11, Table 6.11.34
Bus occupancy rate	12.2 passengers	HEAT (2017)
Percentage of trips made by adults (18-70)	75%	Analysis of NTA 'National Household Travel Survey 2017'
Percentage of adult population in labour force	70%	Analysis of 'Labour Force Survey' data

4.3.3.4 Section D - Appraisal Assumptions

This set of assumptions are appraisal assumptions, which are used for setting the general rules and boundaries of the economic appraisal. These are mostly based on guidance in the central government guidance and TAF and should not be changed unless for a specific reason associated with a particularity of the scheme. These assumptions are shown in Table 13.0.15.

The 30-year appraisal period is defined with reference to the Opening Year. If the opening year is in the future, the latter years calculated by TEAM will be discounted at 3.5% per annum instead of 4% per annum. Therefore, the opening year and the appraisal year must be differentiated.

The default assumption does not include Residual Value due to the recommendation by PAG/TAF to limit the appraisal period to 30 years for active mode projects (given the uncertainty of long-term forecasting for active modes).

Table 13.0.15 Appraisal Assumptions

Variable	Default Assumption	Source
Appraisal Start Year	Current Year	-
Discount Rate	4.0%	TAF Module 8 – Detailed Guidance on Appraisal Parameters
Residual Discount Rate	3.5%	
Price Base Year	2016	
Appraisal period (years)	30	
Residual Value Period (years)	30	
Residual Value Consideration	No	
Real GNP per capital annual growth rate (2016-2021)	3.6%	
Real GNP per capital annual growth rate (2021-2025)	2.2%	
Real GNP per capital annual growth rate (2025+)	2.3%	

4.3.3.5 Section E ‑ International Visitors Assumptions

This set of assumptions are associated with the economic impacts arising from spending by international visitors when using walking and cycling infrastructure. International visitors, on average, spend more per trip than domestic and local visitors in an area.

Therefore, the direct spending (i.e., expenditure on overnight accommodation, restaurants and activities) arising from their presence on the scheme should be captured.

There are a number of default assumptions included to quantify the international visitors component within TEAM. A regional factor captures the likelihood of international visitors being drawn to the scheme based upon the regional distribution of cycling undertaken by international visitors. Default regional demand values for cycling is outlined in Table 13.0.16, indexed to the region with the highest proportion of international cyclists in the West.

Table 13.0.16 Weighted likelihood adjustment factor for international cycling tourist per region Assumptions in Regional Demand for International visitors

Regional Demand for Cycling Tourism	Dublin	East & Midlands	South East	South West	Shannon	West	North West
(%) Factor of Regions visited by international visitors	76%	66%	58%	98%	60%	100%	56%

The default daily spend for international visitors is calculated by using Fáilte Ireland's *per diem* spending rate of €96 per visitor[23]. This rate is the average daily spend of international visitors nationally. The *per diem* rate is adjusted in line with projected real GNP growth per capita to 2011 values as per the TAF Guidelines. If, for example, the user finds the scheme will attract a higher or lower average daily spend, this can be inputted accordingly as long as specific evidence is given to justify an increase or decrease in the assumption.

An annualisation factor is applied as a default assumption to capture the seasonal component of international visitors in Ireland. A value of 120 days corresponds to a four-month annual tourism season, based upon month of arrive data of cycle holidaymakers provided by Fáilte Ireland[24]. This includes the peak summer season of three months (June, July and August), and an extra month to account for the shoulder periods of April, May and September. If the appraiser determines that the scheme will have international visitors, a default assumption of 2% of total users is automatically in-built into the TEAM tool. This is taken from the Waterford Greenway Intercept Survey,[25] which estimated the number of users on the scheme which were international visitors. This is included to avoid overestimation of international visitors on a given scheme.

These assumptions are summarised in Table 13.0.17.

[23] Fáilte Ireland, 2021. *Key Tourism Facts 2019.*

[24] Modelled from Fáilte Ireland 2013. Profile of Overseas Visitors who Cycled in 2011, Table 6 Month of Arrival (%). Peak three-month season June, June and August with the addition of an extra month to account for the shoulder seasons in April, May and September.

[25] Published by Waterford City and County Council in December 2017

Table 13.0.17 International Visitor Assumptions

Variable	Default	Variable
Daily international visitor spend	€96	Fáilte Ireland Key Visitor Facts 2019 (2019 values)
Annualisation factor for seasonality	120	Fáilte Ireland, Profile of Overseas Visitors who Cycled in 2011
International visitor demand	2%	The Waterford Greenway Intercept Survey 2017

4.3.4 Sheet 4 – Data Validation

The Data Validation is designed to check for errors in the inputs provided by the user in sheets "1. Scheme Inputs" and "2. Costs Inputs". It also verifies any modifications made to the default assumptions in sheet "3. Default Assumptions". The Data Validation contains three main sections:

A. Errors Verification

B. Warnings

C. Default Assumptions Modifications

4.3.4.1 Section A – Errors Verification

Any errors that have occurred in the calculations and are preventing results being produced will be listed in the errors verification output as shown in Figure 13.0.10. These errors are in relation to scheme inputs (Sheet 1. Scheme Inputs) and cost inputs (Sheet 2. Cost Inputs). These primary errors result in no outcomes until they are amended.

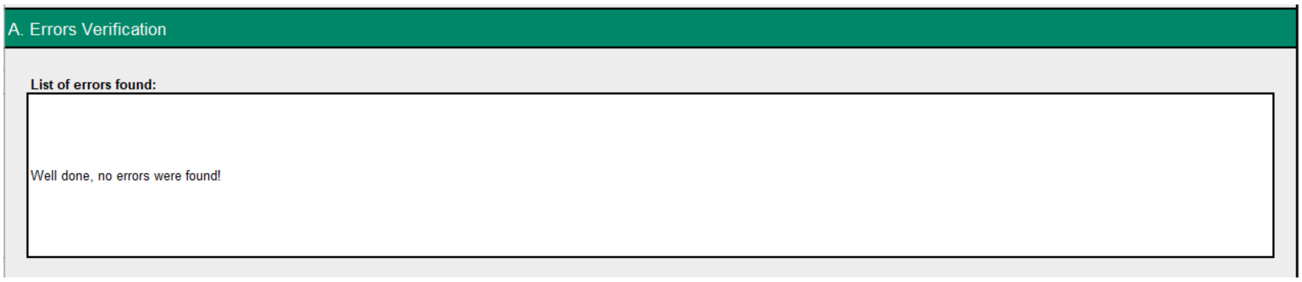


Figure 13.0.10 Data Validation Dashboard - Example of Errors Verification Output

4.3.4.2 Section B – Warnings

A list of warnings is displayed to check user inputs in scheme inputs (Sheet 1. Scheme Inputs) and cost inputs (Sheet 2. Cost Inputs), i.e., a value may be an input error. Once notified, it is important to review and correct the errors listed and then recalculate the tool to yield. If inputs are in fact correct and required, an explanation is required to justify these changes, as shown in Figure 13.0.11. Supporting evidence from reliable sources should accompany such modifications.

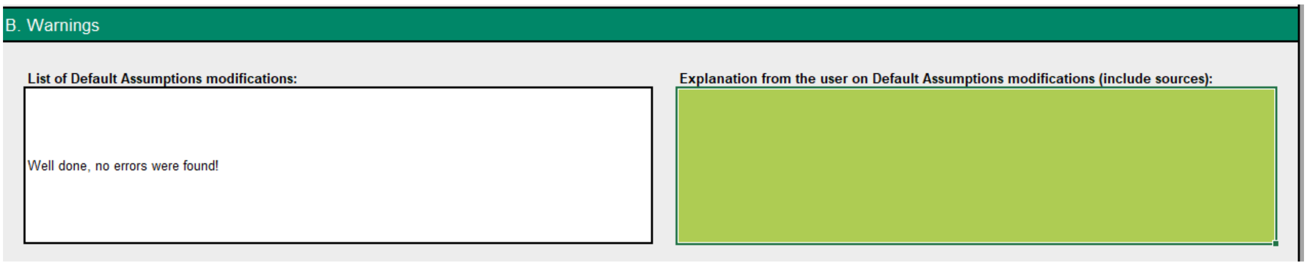


Figure 13.0.11 Data Validation Dashboard - Example of Warnings Output

4.3.4.3 Section C – Default Assumptions Modifications

The tool will output a list of changes in relation to modifications made to the default assumptions (Sheet 3. Default Assumptions). An explanation is still required to justify the changes, as shown in Figure 13.0.12 (green box), and must be supported by evidence from reliable sources.

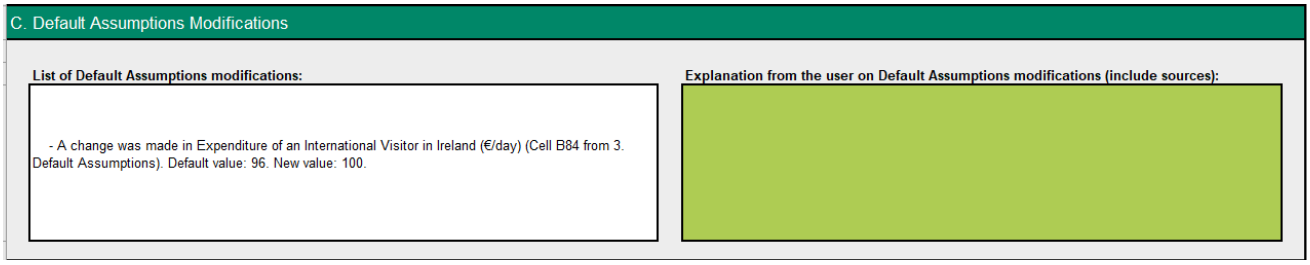


Figure 13.0.12 Data Validation Dashboard - Example of Default Assumptions Modifications Output

4.3.5 Sheet 5 – Results Dashboard

The Results Dashboard summarises the results of the TEAM assessment, based on the inputs and assumptions used in previous sheets. The Results Dashboard contains four main sections:

A. Cost Benefit Analysis

B. Annual Economic Flows

C. Sections Distribution

D. Sensitivity Analysis

E. Other Economic Indicators.

4.3.5.1 Section A – Cost Benefit Analysis

This section shows the main results of the CBA, including the present value of economic benefits for each benefit category. Several outputs are displayed in this section:

- **Present Value of Benefits (PVB)** – The PVB is the sum of monetised economic benefits over a project's appraisal period. This section shows the PVB for each individual benefit, as well as for the entire project. It is also accompanied by a pie chart to show how benefits compare. If undertaking an active modes CBA as part of a National Roads scheme, then the PVB from TEAM can simply be added into the overall project CBA.

A cell (highlighted in yellow) is provided where the value of any additional benefits calculated outside of TEAM be added to the overall PVB. This process in described further in Section 4.2.2.

- **Present Value of Costs (PVC) –** This is the total sum of capital and operating costs over the project's appraisal period, which have been adjusted to take the Shadow Prices (described previously) into account. An annual breakdown of the present value of costs is also calculated / provided at the bottom of the sheet.
- **Net Present Value (NPV) –** The NPV is the PVB minus the PVC and represents the additional or net economic benefit provided by the scheme.
  A positive NPV indicates that the measured economic benefits are greater than the costs, while a negative NPV indicates that the costs are greater than the benefits.
- **Benefit-to-Cost Ratio (BCR) –** The ratio of economic benefits to economic costs. A BCR of at least 1 means that the benefits outweigh the costs, while a BCR of less than 1 indicates that the costs outweigh the benefits.

These outputs and the results of the CBA should be summarised within the Appraisal section of the Project Appraisal Report. It should be noted that even if the NPV is negative or the BCR is less than one, this does not mean that the project is not worthwhile. The tool only includes benefits that are possible to monetise in Ireland, and there are many additional benefits provided by walking and cycling that are not reflected in the CBA, such as the creation of an integrated transport network or improvements in accessibility and social inclusion. These non-monetised benefits should be captured within the Qualitative Appraisal process described in Sections 2 and 3 and considered as part of any recommendations or conclusions.

A. Cost Benefit Analysis - Central Scenario

Tick to include:		Present Value
	Mode Shift	**€815,820**
	Vehicle Operating & Ownership Costs	€549,718
	Carbon	€104,733
	Air Quality	€9,248
	Noise	€12,929
	Congestion	€652,542
	Health	**€12,916,537**
	Reduced Mortality	€12,509,971
	Workplace Absenteeism	€406,566
	Journey Time	**€2,105,619**
	Journey Quality	**€1,752,981**
	Recreation	**€4,847,932**
	International Visitors	**€4,570,657**
	Other	
	Present Value of Benefits (PVB)	**€22,005,434**
	Present Value of Costs (PVC)	**€22,520,113**
	Net Present Value (NPV)	**-€514,679**
	Benefit-to-Cost Ratio (BCR)	**0.98**

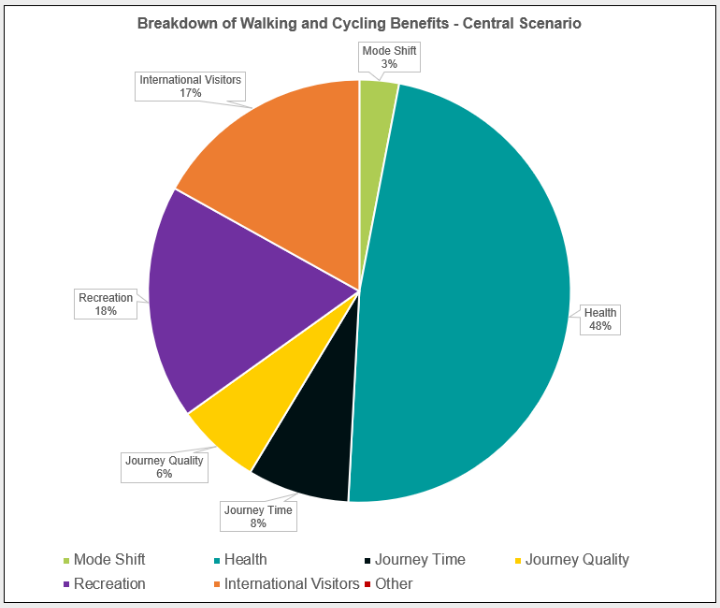


Figure 13.0.13 Results Dashboard - Example of CBA Outputs

4.3.5.2 Section B – Annual Economic Flows

This section provides the annual present value of costs and benefits over the appraisal period. This will show how the costs and benefits of the project change over time.

B. Annual Economic Flows (€000s) - Central Scenario	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vehicle Operating & Ownership Costs							€13.7	€13.2	€12.8	€12.4	€12.1	€11.7	€11.4	€11.0	€10.7
Carbon							€2.4	€2.5	€2.7	€2.8	€2.8	€2.9	€2.7	€3.0	€3.1
Air Quality							€0.4	€0.4	€0.4	€0.3	€0.3	€0.3	€0.3	€0.3	€0.3
Noise							€0.5	€0.5	€0.5	€0.5	€0.5	€0.5	€0.5	€0.5	€0.4
Congestion							€23.9	€23.7	€23.6	€23.4	€23.3	€23.1	€23.0	€22.8	€22.7
Reduced Mortality							€98.7	€196.1	€292.3	€387.2	€480.8	€477.7	€474.6	€471.5	€468.4
Workplace Absenteeism							€3.2	€6.4	€9.5	€12.6	€15.6	€15.5	€15.4	€15.3	€15.2
Journey Time							€77.0	€76.5	€76.0	€75.5	€75.0	€74.6	€74.1	€73.6	€73.1
Journey Quality							€64.1	€63.7	€63.3	€62.9	€62.5	€62.1	€61.7	€61.3	€60.9
Recreation							€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
International Visitors							€298.2	€296.3	€294.3	€292.4	€290.5	€288.6	€286.8	€284.9	€283.0
Present Value of Benefits (€000s)							**€582**	**€679**	**€775**	**€870**	**€963**	**€957**	**€950**	**€944**	**€938**
Present Value of Costs	**-€327**	**-€315**	**-€302**	**-€291**	**-€650**	**-€12,659**	**-€5,412**	**-€114**	**-€28**	**-€27**	**-€26**	**-€25**	**-€24**	**-€23**	**-€22**
Economic Net Present Value							**-€4,830**	**€565**	**€747**	**€843**	**€937**	**€932**	**€926**	**€921**	**€916**

Figure 13.0.14 Results Dashboard – Example of Annual Economic Flows

4.3.5.3 Section C – Sections Distribution

This section provides the monetised benefits attributed to the different mode types if a demand split has been incorporated into the scheme inputs. The walking and cycling benefits are broken down into their contributing factors including mode shift, health, journey time, journey quality, recreation, and international visitors. It should be noted that the tool must be 'calculated' to process the inputs and provide the correct results. This can be done by clicking the "Calculate" button in sheet 5 – Results Dashboard.

C. SECTIONS DISTRIBUTION - Discounted Annual Economic Flows (€000s)

	SECTION A	SECTION B	SECTION C	SECTION D
Mode Shift	**€25**	**€16**	**€0**	**€0**
Vehicle Operating & Ownership Costs	€16	€10	€0	€0
Carbon	€4	€3	€0	€0
Air Quality	€1	€0	€0	€0
Noise	€0	€0	€0	€0
Congestion	€4	€3	€0	€0
Health	**€391**	**€261**	**€0**	**€0**
Reduced Mortality	€378	€252	€0	€0
Workplace Absenteeism	€13	€8	€0	€0
Journey Time	**€2,907**	**€1,938**	**€0**	**€0**
Journey Quality	**€1,103**	**€735**	**€0**	**€0**
Recreation	**€2,274**	**€1,516**	**€0**	**€0**
Int. Visitors	**€4,434**	**€2,956**	**€0**	**€0**
Present Value of Benefits (€000s)	**€11,134**	**€7,423**	**€0**	**€0**

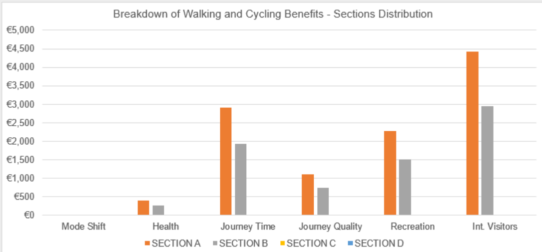


Figure 13.0.15 Results Dashboard – Example of Sections Distribution

4.3.5.4 Section D – Sensitivity Analysis

The PAG and TAF require sensitivity analysis to be done when carrying out CBA. The purpose of sensitivity analysis is to demonstrate how changes in demand, benefits or costs would affect the overall CBA results, and to show the potential range of values. TEAM facilitates three types of sensitivity analysis as a default:

- **Demand –** The range of the PVB under the low, central and high demand scenarios.
- **Benefits –** The range of the PVB when benefits are adjusted by ± 20%
- **Costs –** The range of the PVC when costs are adjusted by ± 20%

The combined impacts of these sensitivity tests on the BCR are also displayed in this section, showing the potential range of the BCR in a number of different scenarios. For example, the figure below shows the maximum range of the BCR between 1.03 and 3.95 when both demand and costs are varied.

C. Sensitivity Analysis - Potential Range of Benefits & Costs

Demand Sensitvity

	Low	Central	High
Present Value of Benefits	€2,510,484	€4,450,943	€6,391,401

Benefits Sensitivity

	-20%	-10%	+0%	+10%	+20%
Present Value of Benefits	€3,560,754	€4,005,849	€4,450,943	€4,896,037	€5,341,131

Costs Sensitivity

	-20%	-10%	+0%	+10%	+20%
Present Value of Costs	€1,619,919	€1,822,409	€2,024,898	€2,227,388	€2,429,878

C. Sensitivity Analysis - Combined BCRs

Demand Sensitivity

Cost Sensitivity	Low	Central	High
-20%	1.55	2.75	3.95
-10%	1.38	2.44	3.51
+0%	1.24	2.20	3.16
+10%	1.13	2.00	2.87
+20%	1.03	1.83	2.63

Benefit Sensitivity

Cost Sensitivity	-20%	-10%	+0%	+10%	+20%
-20%	2.20	2.47	2.75	3.02	3.30
-10%	1.95	2.20	2.44	2.69	2.93
+0%	1.76	1.98	2.20	2.42	2.64
+10%	1.60	1.80	2.00	2.20	2.40
+20%	1.47	1.65	1.83	2.01	2.20

Figure 13.0.16 Results Dashboard – Example of Sensitivity Analysis

While these three sensitivity tests should satisfy the PAG and TAF requirements, sensitivity tests on other variables can be carried out if required by saving a version of the tool, adjusting the variables of interest (for instance, variables in the default assumptions tab), and comparing the results with the original TEAM assessment.

4.3.5.5 Section E - Other Economic Indicators

This section includes some other useful economic indicators provided by the tool, including:

- **Costs –** This provides an estimate of the present value of costs per kilometre, and per user. This can be useful when trying to compare routes in terms of their cost-effectiveness.
- **Carbon –** This provides an estimate of the total tonnes of CO_2 avoided by the scheme, based on the estimated shift from private cars to walking/cycling.

It also shows the ‘Cost per tonne of CO_2 avoided’ which is an indicator of the cost-effectiveness of the scheme in terms of reducing carbon emissions.

- **Mode Shift –** This provides an estimate of the total driving kilometres shifted to walking/cycling by the scheme. It also shows the ‘Cost per driving kilometre avoided’, which is an indicator of the cost-effectiveness of the scheme in terms of shifting car users to active modes.
- **Benefit per km –** The benefits for users and society for each kilometre walked or cycled.

5. Methods of Estimating Demand

A significant input to quantitative economic appraisal is the user demand scenarios (i.e. how many walking/cycling trips are expected before and after the intervention). As most benefits of walking and cycling are based on a change in the number of trips made by walking and cycling, this can have a major impact on the economic benefits estimated for the scheme. Demand is something that project appraisers often find difficult to estimate. Data for estimating the current level of walking and cycling demand is often unavailable in Ireland, and even when available, it can be difficult to forecast how walking and cycling levels might change after an intervention.

This section provides some general guidance and resources for estimating cycling demand. It summarises the potential sources of demand data, and also provides standard trip rates for situations where no local data is available to the appraiser. The appraiser could also consult the Department of Transport's 2020 Public Spending Code Lifecycle for Greenway Projects under €20m guidance, for suggested methods of demand analysis specifically for greenways under the Public Spending Code €20 million threshold.

5.1 Setting Demand Scenarios

Given the uncertainty surrounding walking and cycling demand, traditional traffic 'forecasts' are generally unsuitable for walking and cycling schemes. There are many factors that influence users' decisions to walk and cycle, including safety, infrastructure quality, levels of physical activity, settlement, climate and commuting patterns, meaning that even using formal models, single 'forecasts' are generally not suitable for active travel projects.

Active travel scenarios can be used to explore possibilities such as 'what if the proportion of active travel doubled?' or 'what if half of all trips generated were by active modes?'. While extrapolation from historic trends tend to be linear in nature, it is impossible to forecast the future, particularly if there is envisaged step-changes in society. This change may be incremental, in response to changing attitudes or change prices of transport, or it may be sudden, brought about by an unanticipated shock (e.g. Covid). Demand scenarios enable the appraiser to explore resilience in future demand.

Economic appraisal for walking and cycling schemes should therefore be based on 'demand scenarios', which allows for uncertainty by testing the outcomes associated with a range of demand levels. Each appraisal should include a current estimated level of walking and cycling demand; as well as three scenarios, reflecting three levels of potential demand: a 'low scenario', a 'central scenario', and a 'high scenario'.

5.2 Incorporating Demand Split

In the case where there are significant differences in demand across various sections of a scheme, for example, significant variations in users (commuters, recreational users, or international tourists) and demand values, this must be incorporated within the tool under sheet 1 – Scheme Inputs. Justification should be given in the appraisal report on why scheme is divided into sections. Where the difference in demand is not substantial, it can be negated from the scheme inputs. Demand

5.3 Scenarios with Existing Count Data

In some cases, a scheme will be located in an area or along a route where there is existing data for walking and cycling levels from counts or surveys. Different forms of count data may be available, including continuous cycle counters which count the daily number users passing a certain location, or (more commonly) traffic surveys measuring flows over a short period. Some examples of publicly available walking and cycling count data include:

- The annual Dublin Canal Cordon Count and Quays Count.
- Permanent cycle counters at select locations in Dublin City and Dún Laoghaire-Rathdown.
- The IDASO database of historic NTA traffic counts[26], which may include walking and cycling in some instances.

Count data may be for a location directly along the route, or for nearby location with similar traffic flows. Additional count and traffic survey data may be available from local authorities.

If there is existing count data for the route / location of a scheme, this is the generally the most accurate method of estimating current demand, although for longer routes, it may require count data from multiple locations. Future demand scenarios should be then estimated by applying three levels of cycling growth/uplift to represent a low, central and high scenario. The levels of cycling growth can be established by reviewing other schemes that have seen increases in cycling following an intervention, or to reflect policy targets.

5.4 Demand Scenarios without Existing Count Data

Existing count data will often not be available, and other sources must be used to estimate current and future demand. There is no one preferred source of demand scenarios, and different sources may be suitable for different locations and project contexts.

5.4.1 Case Studies and Benchmarking

Case studies of other routes that share similar characteristics can be a useful data source to estimate potential levels of demand. Benchmarking and setting demand targets can be appropriate in instances where there are no existing pedestrians or cyclists along a route (i.e. when the scheme generates the demand, such as for greenways or new off-line routes), and is commonly used for larger recreation- or tourism-focused greenway projects. For instance, a 'High' Scenario for a greenway may to be achieve the same level of walking and cycling seen by other greenway projects, with other scenarios based around this.

Studies that have been carried out for the Great Western Greenway in Mayo[27] and the Waterford Greenway[28] are the most prominent examples, although as more cycle schemes undergo ex-post evaluation in future years, this will likely in additional case studies being published.

5.4.2 POWSCCAR Data

The Place of Work, School, College or Childcare – Census of Anonymised Records (POWSCCAR) data from the Central Statistics Office provides detailed data on commuting and educational trips between different statistical areas, including the mode of transport people take. This information can be used to estimate how many people are currently travelling between two zones for work and education by active modes, as well as the total numbers travelling by all modes to estimate the future potential for a shift to active modes. Low, central and high scenarios can be established using different targeted active mode shares, for instance.

[26] IDASO, 2021. Available at: https://mytrafficcounts.com/
[27] See Fitzpatricks, Failte Ireland (2011). Economic Impact of the Great Western Greenway. Department of Transport, Tourism and Sport, June 2011.
[28] See AECOM (2017). Waterford Greenway Intercept Survey 2017. Waterford City and County Council, December 2017. Available at: https://www.waterfordcouncil.ie/media/greenway/WaterfordGreenway-BaselineSurveyReport-Jan2018.pdf

POWSCCAR only provides commuting and education data, meaning that it would only suit schemes that have a high commuting potential. POWSCCAR data can be requested from the Central Statistics Office.

5.4.3 Population Catchments and Standard Trip Rates

In situations where there is no reliable baseline data, basic population catchments can be combined with standard trip rates to estimate current demand for different area types. This is likely to be most appropriate for smaller schemes outside of large urban areas (i.e. less than <20km long). Trip rates are given below for two types of journeys: utility and recreation.

Table 13.0.18 below shows standard trip rates for **utility purposes** (i.e. journeys to work, school, shops etc.) across different geographical area, expressed as 'daily trips per 100 residents'. This data is based on patterns of travel observed in the NTA 'National Household Transport Survey'. For example, if a scheme serves a rural electoral division with 450 residents, these rates suggests that one could expect an average of 107 utility walking trips[30] and 12 utility cycling trips[31] to be currently made each day among that population. If the total population catchment was 1,000 residents, one could expect 238 walking trips and 27 cycling trips to be made each day in total among that population.

Table 13.0.18 Standard Baseline Trip Rates for Walking and Cycling for Utility Purposes

Trips per week for utility purposes	Daily trips per 100 people		% of all trips by mode	
	Walking	Cycling	Walking	Cycling
Dublin City (Dublin City Council administrative area)	46.0	14.1	29%	9%
Greater Dublin Area (counties Dublin, Kildare, Meath and Wicklow)	38.1	8.8	20%	5%
Regional Cities (Cork, Limerick, Galway and Waterford cities)	64.7	12.8	27%	5%
Large Urban Towns (Towns with a population over 10,000)	61.7	4.2	27%	2%
Other urban districts (Towns with a population of between 1,500 and 10,000)	63.1	4.3	29%	2%
Rural (all other areas and towns with a population of less than 1,500)	23.8	2.7	11%	1%

Source: Trip rates derived from NTA, 2017. 'National Household Travel Survey 2017'.

Table 13.08.19 displays local walking and cycling trip rates at a national level for **recreation and exercise purposes**, based on data from the QNHS Sports Module 2013. As above, this shows how many recreational walking and cycling trips are typically each day made in a population of 100 people.

30 (450/100) x 23.8
31 (450/100) x 2.7

For example, if the scheme serves a local population of 450 people, one might expect 167 recreational walking trips and 23 recreational cycling trips to be currently made per day among that population.

Table 13.0.19 Standard Baseline Trip Rates for Walking and Cycling for Recreational Purposes

Trips per week for recreation purposes	Daily Trips per 100 people	
	Walking	Cycling
National	37	5

Source: Trip rates derived from CSO, 2013. 'QNHS Sports Module 2013'.

It should be noted that these trip rates reflect all current walking and cycling journeys among the local population, and not necessarily just the trips along the specific scheme in question. If there are several other alternative routes within the catchment area, it may be necessary to make an additional assumption as to what proportion of walking and cycling trips in the area will take place along the scheme (i.e. 50% of local trips will use the scheme).

These standard trip rates can be used to estimate current levels of demand along a route or in an area: using the example above, the current level of cycling among a rural population of 450 is assumed to be 12 utility trips per day (equating to a 1% mode share), and 23 recreational trips per day. As above, low, central and high rates of growth or modal share targets should be used as the basis of future demand scenarios. Further guidance on setting demand scenarios may be provided in a future update to this Unit.

Appendix A:

Review of International Practice for Active Mode Appraisal

This section summarises the results of an international review of active mode appraisal practices that was carried out in advance of this update to PAG Unit 13. This review examined appraisal guidelines and practices in several locations and organisations, including the United Kingdom, Netherlands, Copenhagen, Australia, the World Health Organisation and New Zealand, and identified different types of benefits that are typically included in active mode appraisals.

Table A.1 summarises the results of this review. It shows and describes different categories of benefits that have been identified, as well as the typical significance of the benefit within Cost Benefit Analyses for active mode schemes (as indicated by examples that were reviewed). The chart shows how frequently each benefit appears across the different examples of appraisal guidance, as well as an assessment as to whether the data and methods existed in Ireland to introduce it widely into active mode appraisal guidance.

Table A.1 Review of International Active Mode Appraisal Practices and Benefits

Impact		Description	Significance*	Ireland (PAG Unit 13)	UK (AMAT / TAG A5.1)	Netherlands	Copenhagen	Australia (ATAP)	WHO (HEAT)	New Zealand	Include in updated PAG Unit 13?
User	Journey Time	Impacts of reductions in journey time	+++								Yes
	Journey Quality (WTP)	Perceived safety & comfort provided by different infrastructure types	++								Yes
	Vehicle Operating Costs^	Reduced costs of vehicle ownership & operation	+								Yes
Economy	Decongestion^	Reduction in the external costs of congestion	++								Yes
	Road Maintenance^	Reduced maintenance costs on public roads	+								
	Tourism	Tourism impacts of walking & cycling	+++								Yes
	Agglomeration	Productivity benefits from increased interaction and effective density	+								
Health & Wellbeing	Collisions^ (-)	Change in collisions	++								Yes
	Reduced mortality	Benefits of physical activity in terms of reduced mortality	+++								Yes
	Cost of Illness	Benefits of physical activity in terms of lower healthcare costs	+++								
	Absenteeism	Benefits of physical activity in terms of improved workplace productivity	++								Yes
	Recreation	Wellbeing benefits associated with access to recreational infrastructure	++								Yes
Environment	Air Pollution^ (-)	Exposure and contribution to airborne pollutants	+								Yes
	Climate Change^	Impact on greenhouse gas emissions	+								Yes
	Noise^	Impact on noise pollution	+								Yes

Appendix B:

Technical Methodology for Parameters and Benefit Calculation

This Appendix details the methodologies and sources used for calculating the benefits used in TEAM. It also provides methodologies for 'Collision Reduction' not currently included within TEAM. This appendix includes:

- B.1 – Mode Shift Benefits, including Carbon, Air Quality, Noise, Congestion, and Vehicle Operating & Ownership Costs
- B.2 – Health, including Reduced Mortality and Absenteeism
- B.3 – Journey Time
- B.4. – Journey Quality and Recreation
- B.5 – International Visitors
- B.6 – Collision Reduction (not currently included in TEAM)

B.1 Mode Shift Benefits

As mode shift benefits are based on the shift from private vehicles to walking or cycling, the first step is to estimate this shift; or the amount of vehicle kilometres 'diverted' from private cars. This diversion can be expressed either 'per vehicle-kilometre' or 'per passenger kilometre', although most factors are expressed per vehicle kilometre.

Table B.1 Daily Private Car kilometres Diverted

Code	Calculation	Variable	Value	Source / Basis
A		Number of new non-recreational daily trips		Based on user estimates of the number of daily trips, and the proportion that are 'utility' trips.
B		% of trips assumed to be diverted from private cars	Location-specific diversion factors for private cars.	Default assumption based on location modal splits from NTA 'National Household Travel Survey' 2017 data. 15-20% of trips assumed to be new trips
C	A x B	Number of daily trips diverted from cars		
D		Average length of diverted trips (mins)	16.3 min (Walking) 22.6 min (Cycling)	TAF, 2023. Module 8.13.6
E	C x D	Daily car passenger minutes diverted (min)		
F		Average walking/cycling speed (km/h)	5 km/h (Walking) 16 km/h (Cycling)	Walking value based on NTA 'RM Spec4 Active Modes Model Specification Report'. Cycling value based on research carried out on users of urban greenways in Dublin (O'Driscoll, 2019)
G	E/60 x F	Daily car passenger kilometres diverted (km)		

Code	Calculation	Variable	Value	Source / Basis
H		Average car occupancy	1.5 people	Default assumption based on non-commuting occupancy rates from PAG Unit 3.11.
I	G / H	Daily car vehicle kilometres diverted (km)		

To estimate mode shift benefits, the diverted passenger/vehicle kilometre should be multiplied by the relevant factors for carbon, air quality, vehicle operating / ownership costs, noise and congestion. These factors are derived from a variety of sources and are shown in the tables below.

For estimating future values, 2016 carbon emissions should be increased in line with the Shadow Price of Carbon specified in the TAF, while 2016 values of air quality, noise and congestion should be increased in line with real GNP growth per capita. As vehicle operating and ownership costs are assumed to increase in line with the general rate of inflation, future values should remain in 2016 prices in the CBA. Daily mode shift values should be converted to annual values using appropriate annualisation factors.

Table B.2 Carbon Emissions

Code	Calculation	Variable	Value	Source / Basis
A		Daily car vehicle kilometres diverted (km)		
B		Daily car trips diverted		
C	A / 1.5	Daily car passenger kilometres diverted (km)		
D		Vehicle GHG operational emissions factors (g/vkm)	Grams per vehicle km by vehicle, year and area type	TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 16
E		'Cold-start' emissions factors (g/trip)	150.4 grams (Urban) 122 grams (Rural)	WHO, 2017. 'Health Economic Assessment Tool (HEAT) for walking and cycling – Methods and user guide on physical activity, air pollution, injuries and carbon impact assessment'. Tables 3, 4 and 5.
F		Energy supply factors per passenger kilometre	28.4 grams (Urban) 23 grams (Rural)	
G		Vehicle manufacturing emissions per passenger kilometre	19.9 grams	
H	(A x B) + (B x E) + C x (F+G)	Daily carbon emissions avoided (g)		
I		Shadow Price of Carbon	Annual price per tonne specified.	TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 6.11.6
J	C x D	Daily value of CO_2 emissions avoided		

Table B.3 Air Quality

Code	Calculation	Variable	Value	Source / Basis
A		Daily car vehicle kilometres diverted (km)	Intermediate Calculation	
B		Vehicle non-GHG emissions factors (g/vkm)	Grams per km for PM and NOx by vehicle, year and area type	TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 17-18
C	A x B	Daily non-GHG emissions avoided (g)		
D		Other non-GHG costs (€/tonne)	Annual costs for non-GHG gases in 2016 values, assumed to continue to increase in line with real GNP growth per capita.	TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 6.11.7.
E	C x D	Daily value of non-GHG emissions avoided (€)		

Table B.4 Vehicle Operating & Ownership Costs

Code	Calculation	Variable	Value	Source / Basis
A		Daily car vehicle kilometres diverted (km)	Intermediate Calculation	
B		Fuel costs (€ per litre)		TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 6.11.15.
C		Forecast fuel consumption (litres per 100km)		TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 6.11.16.
D		Non-fuel costs (€ per km)		TII, 2016. 'PAG Unit 6.11 – National Parameters Values Sheet'. Table 6.11.17.
E	D + (B x C/100)	Vehicle Operating Costs per km (€)		
F		Vehicle Ownership Costs per km	€0.140 (Urban) in 2016 prices €0.159 (Rural) in 2016 prices	Estimate based on CSO, 2016. 'National Household Budget Survey 2015-2016'.
G	(A x (E + F)) x 50%	Daily value of vehicle operating & ownership costs avoided (€) (subject to the 'rule of a half')		

Table B.5 Marginal External Cost of Noise

Code	Calculation	Variable	Value	Source / Basis
A		Daily car vehicle kilometres diverted (km)	Intermediate Calculation	
B		Marginal external cost of noise per km (€)	€0.0029 (Urban) €0.0015 (Rural) In 2016 values and prices	Adapted from Department for Transport, 2020. 'WEBTAG Data Book v1.13.1 – Table A 5.4.2a. Values for urban and rural roads transferred to Irish values and prices.
C	A x B	Daily value of external cost of noise avoided (€)		

Table B.6 Marginal External Cost of Congestion

Code	Calculation	Variable	Value	Source / Basis
A		Daily car vehicle kilometres diverted (km)	Intermediate Calculation	
B		Marginal external cost of congestion per km (€)	€0.156 (Dublin and cities) €0.029 (Other urban) €0.019 (Rural) In 2016 values and prices	Adapted from Department for Transport, 2020. 'WEBTAG Data Book v1.13.1 – Table A 5.4.2a. Values for 'Inner and Outer Conurbations', 'Other Urban' and 'Rural' adjusted for Irish road volumes and Level of Service, and transferred to Irish prices.
C	A x C	Daily value of external cost of congestion avoided (€)		

B.2 Health

Improved health outcomes associated with greater levels of physical activity has many health benefits for users, society and businesses. Two benefits associated with health are included in TEAM and the PAG Unit 13 guidance: 'reduced mortality' and 'absenteeism'.

B.2.1 Reduced Mortality

'Reduced mortality' refers to the change in the relative risk of early death due to increased levels of physical activity. TEAM uses the World Health Organisation's (2017) *Health Economic Assessment Tool*[32] methodology to estimate the benefits associated with a reduction in relative mortality risk due to increased levels of walking and cycling. This methodology has been updated using Irish-specific parameters where necessary.

[32] WHO, 2017. 'Health Economic Assessment Tool (HEAT) for walking and cycling – Methods and user guide on physical activity, air pollution, injuries and carbon impact assessment'. Available at: https://www.euro.who.int/__data/assets/pdf_file/0010/352963/Heat.pdf

'Reduced mortality' benefits are based on the number of new users and the time spent walking or cycling. The steps involved are summarized in Table B.7 below, although more detailed guidance can be found in the HEAT guidance.

Table B.7 Reduced Mortality Benefit Calculation

Code	Calculation	Variable	Value	Source / Basis
A		Risk of all-cause mortality	0.0019	DoT, 2020. 'Common Appraisal Framework'
B		Relative risk	0.886 (walking) 0.903 (cycling)	WHO, 2017 'Health Economic Assessment Tool'.
C		Reference volume of physical activity	168 minutes / week (walking) 100 minutes / week (cycling)	WHO, 2017 'Health Economic Assessment Tool'.
D		Risk reduction cap	30% (walking) 45% (cycling)	WHO, 2017 'Health Economic Assessment Tool'.
E		Weekly time spent walking / cycling per user (minutes)		Estimated based on assumptions regarding average journey lengths/speeds for recreational and non-recreational users.
F	(1–B) x (E/C)	Relative risk reduction (capped at values contained in D)		
G	A x F	Absolute risk reduction per user (i.e. no. of fatalities 'prevented per person).		
H		Value of avoided fatality	€2,310,500 in 2011 prices (3,140,046 in 2016 prices)	DoT, 2020. 'Common Appraisal Framework'
I	G x H	Relative mortality benefit per adult user (€)		

The relative mortality benefit per user should be multiplied by the total number of *adult* users of the scheme. By default, TEAM assumes that on average 75% of trips are made by adults. It should also be noted that the number of unique users can differ from the number of trips, particularly if the same user makes a return journey on the scheme. This should be taken into account in the calculation if necessary.

Reduced mortality benefits are assumed to be phased in over five years, with 20% of the annual benefit occurring in Year 1, 40% in Year 2, 60% in Year 3, 80% in Year 4, and 100% in the years thereafter.

The value of a future avoided casualty should be updated in line with real GNP growth per capita.

B.2.2 Absenteeism

Increasing physical activity increases productivity in the economy by reducing short-term sick leave. The median absenteeism rate for short terms sick leave is 4.6 days and 5.8 days for the private and public sector, respectively.

The number of employees in public sector employment is about 21% of total employment in Ireland, based on CSO employment tables. Calculating average sick leave taken in Ireland by weighting the relative proportions of private and public sector employment gives an overall estimate of 4.9 days per year.

A cycling or walking intervention of 30 minutes per day reduces absenteeism in a reduction in short-term sick leave by between 6% and 32% per annum[33].The lower bound of 6% is to be applied in appraisals to estimate the reduction in absenteeism per employee per year.

Table B.8 Absenteeism

Code	Calculation	Variable	Value	Source / Basis
A		Daily time spent walking / cycling per user (minutes)		Estimated based on assumptions regarding average journey lengths/speeds for recreational and non-recreational users.
B		Reference volume of physical activity	30 minutes per day	WHO, 2003. 'Health and development through physical activity and sport'.
C		Risk reduction cap	6%	TAF, 2023. Based on WHO, 2003.
D	6% x (A/B)	Relative risk reduction		
E	D x 7.5 x 4.9	Average hours saved per employed user		Average of 4.9 sick days per year, and assuming 7.5 hours in a working day.
F		Value of in-work time per hour	€30.35 in 2016 prices and values	TAF, 2023.
G	E x F	Absenteeism benefit per employed user		

The relative mortality benefit per user should be multiplied by the total number of *adult* users of the scheme *who are in employment*. TEAM assumes that on average 75% of trips are made by adults, and that of those adult users, 70% are in the labour force – meaning that absenteeism benefits only apply to around half of all users.

As with reduced mortality benefits, it should also be noted that the number of unique users can differ from the number of trips, particularly if the same user makes a return journey on the scheme. This should be taken into account in the calculation.

Absenteeism benefits are also assumed to be phased in over five years, with 20% of the annual benefit occurring in Year 1, 40% in Year 2, 60% in Year 3, 80% in Year 4, and 100% in the years thereafter. The value of a future absenteeism benefits should be updated in line with real GNP growth per capita.

[33] World Health Organisation, 2003. 'Health and development through physical activity and sport', WHO/NMH/NPH/PAH/03.2, Geneva, Switzerland.

B.3 Journey Time

The methodology for estimating journey time savings is contained within the *Common Appraisal Framework*. Journey time savings associated with active mode schemes are typically only applied when the scheme results in a direct and visible reduction in average journey times, such as:

- Bridges and under/overpasses that provide a shorter and more direct route along a corridor;
- New routes or shortcuts offering a more direct route along a corridor;
- Upgrades to signal timings for pedestrians and cyclists that reduce the time they must wait.

The average minutes saved by pedestrians and cyclists should be estimated manually based on the circumstances, with journey time saving benefits estimated using the values contained in TAF. Future values should be updated in line with real GNP growth per capita. New users of the scheme are subject to the 'rule of a half', meaning that they only receive half of the benefits as existing users.

B.4 Journey Quality & Recreation

Journey quality benefits refer to the value that users perceive from improved cycling infrastructure, such as the value that they place on safety or the potential for recreation. Journey Quality benefits were previously referred to as 'ambience' in the previous version of PAG Unit 13, while this update of PAG Unit 13 also provides new 'recreation' values for recreational users of greenways.

For non-recreational users of a scheme (i.e. commuting, education, shopping trips etc.), the values for Journey Quality are based on willing-to-pay values for different types of infrastructure, as estimated in TAF. The total number of minutes spent on each section of the scheme should be estimated based on the section lengths, average speeds and total number of trips, and then journey quality values applied to the minutes spent on each type of infrastructure, using the rates contained in Table B.9.

Table B.9 Incremental Journey Quality values per minute (compared to no dedicated infrastructure)

Value of journey ambience benefit of cycle facilities relative to no Facilities (2016 prices & 2016 values)		
Scheme type	**2016 €/min**	**Value Year**
Off-road segregated cycle track	€0.084	2016
On-road segregated cycle lane	€0.036	2016
On-road non-segregated cycle lane	€0.035	2016
Wider lane	€0.022	2016
Shared bus lane	€0.009	2016

Source: TAF

For recreational users of walking and cycling infrastructure, similar willingness to pay values were estimated by TII based on recreational users of the Waterford Greenway[34]. This analysis used a 'Travel Cost Method' to value trips on high-quality recreational infrastructure, which assigns a value to non-market goods by estimating the cost to users of accessing it.

[34] Based on AECOM, 2018. 'Waterford Greenway Intercept Survey'. Available at: https://www.waterfordcouncil.ie/media/greenway/WaterfordGreenway-BaselineSurveyReport-Jan2018.pdf

When applied to other greenways or high quality recreational infrastructure, this provides an estimate of users' willingness to pay to use the infrastructure and is a proxy for the benefits that they perceive in using it.

Using data from the *Waterford Greenway Intercept Survey,* recreational day-trip users (i.e. those who specifically travelled to use the Waterford Greenway for 'leisure' or 'exercise') were divided into distance bands based on their stated origin, and the average cost associated with their travel to the Greenway was estimated using operating cost parameters contained in Section B.1 and time parameters from TAF. For cyclists, the average cost of bicycle hire was also included. To avoid overestimating the benefits when applied to other greenways, only users travelling from the south-east region were included in this analysis. Users with overnight stays were also excluded, as it is not possible to definitively attribute their trips to the Greenway and may double count with the general benefits they receive from a holiday.

These costs per user were aggregated across the different user groups and expressed as a willingness-to-pay value per minute spent on the Greenway (based to the average time spent). As Table B.10 shows, this resulted in values per minute of approximately €0.024 for pedestrians and €0.076 for cyclists in 2016 values.
Similar recreational WTP values were estimated for other types of infrastructure, based on data from the National Cycle Network market research findings regarding users' preferences for different types of infrastructure. These values are in a similar range to other studies of active mode willingness to pay, including the values contained in Table B.10, and a 2005 study of the economic values of trails and forest recreation in Ireland[35].

Table B.10 Incremental Recreation values per minute (compared to no dedicated infrastructure)

Value per minute	Pedestrians (€/min)	Cyclists (€/min)	Value Year
Greenway / off-road segregated	€0.024	€0.076	2016
On-road segregated cycle lane	€0.000	€0.051	2016
On-road non-segregated cycle lane	€0.000	€0.022	2016
Wider lane	€0.000	€0.0112	2016
Shared bus lane	€0.000	€0.010	2016

These values can be applied to *recreational* users using a similar methodology as journey quality. However, as these values are associated with a high-quality off-road greenway, they should only be applied to the time spent on *segregated* infrastructure.

Future values for both Journey Quality and Recreation should be updated in line with projected GNP growth per capita. New users of the scheme are subject to the 'rule of a half', meaning that they only receive half of the benefits as existing users.

B.5 International Visitors

TEAM includes 'Recreation' benefits which captures the local use of high-quality greenway/cycling infrastructure for leisure or exercise, associated with domestic tourism.

[35] Coillte and Fitzpatrick's Associates, 2011.,Economic Value of Trails and Forest Recreation in the Republic of Ireland'. The study estimated a WTP value of between 2.1 cent and 3.2 cent per minute among visitors to several walking trails.

The international visitors benefit encompasses the value associated with increased levels of spending by international visitors *whose primary reason is to visit the greenway.* International visitors spend significantly more than domestic and local users (e.g., on accommodation, food and entry fees for attractions) and therefore should be included within the CBA.

Consideration needs to be given to whether an intervention is likely to attract new tourism, or whether it will simply displace tourists and economic activity from other locations.

Depending on the scheme, the tourism benefits can be significant, particularly for a tourism-focused greenway project, or a project that links to an existing popular tourism attraction.

Data from existing greenways was used as the primary source of data for tourism demand analysis, and studies from the Waterford Greenway[36] and Fáilte Ireland's tourism statistics regarding visitor trends and spending[37] were used to develop the parameters included in the TEAM tool.

To calculate the international visitor benefits, a *per diem* spending rate is the basis of the value per visitor, which is adjusted for the regional attractiveness of walking and cycling, the seasonality of the tourism sector. Appraisers are required to estimate and justify what proportion of users on a scheme are from overseas. Table B.11 provides a breakdown of how the international visitors variables were inputted into TEAM.

Table B.11 International Visitors Calculation

Code	Calculation	Variable	Value	Source / Basis
A		International visitor expenditure per day in Ireland	€96	Fáilte Ireland, 2021. 'Key Tourism Facts 2019'
B	Internal calculation	Conversion Factor	€94.3	Conversion to 2016, as per TAF
C	B x (A / 100)	International visitor expenditure *per diem* in Ireland (adjusted for inflation)	€62.2	
D	4 months x 30 days	Cycle tourism seasonality factor	120	Fáilte Ireland Profile of Overseas Visitors who Cycled in 2011, Table 6 Month of Arrival
E		International visitor demand	2%	Waterford Greenway Intercept Survey' WCCC, 2017
Fn		Regional distribution of international cycle tourists	Further details outlined in Table B.12	Fáilte Ireland 'Key Tourism Facts 2019' Table 18.
Gn	F6 x Fn) / 100%	Weighted regional distribution of international cycle tourists		
H	0.5 x (Gn + 0.5)	Weighted regional distribution of international cycle tourists adjusted		

[36] AECOM, 2018. 'Waterford Greenway Intercept Survey 2017'. Available at: https://www.waterfordcouncil.ie/media/greenway/WaterfordGreenway-BaselineSurveyReport-Jan2018.pdf

[37] See Fáilte Ireland, 2021. 'Key Tourism Facts 2019'. Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/KeyT ourismFacts_2019.pdf?ext=.pdf

The calculations used to determine the regional distribution of international visitors were indexed to the region with the highest proportion of international visitors that cycled while on holiday in that region. A value of 100% was assigned to the West region which received the highest proportion of visitors and is used to index the relative likelihood or attractiveness of cycling per region. A lower bound fixed value of a minimum of 50% is applied to the regional percentages to produce a final weighted percentage for each region, taking into account the level of attractiveness of other regions. This adjustment recognises the regional differences in likelihood of cycling, based on preferences revealed in 2011.

Table B.12 Regional Distribution of Cycle Tourists from Overseas in Ireland (Fáilte Ireland, 2011)

Codes for Fn	Description	Value	Source
F1	Proportion of international visitors who cycled in Dublin region	21%	Regions cycling engaged in - overseas visitors (%)", according to the Fáilte Ireland 'Cyclists 2011', Table 18
F2	Proportion of international visitors who cycled in East & Midlands region	13%	
F3	Proportion of international visitors who cycled in South East region	6%	
F4	Proportion of international visitors who cycled in South West region	38%	
F5	Proportion of international visitors who cycled in Shannon region	8%	
F6	Proportion of international visitors who cycled in West region	40%	
F7	Proportion of international visitors who cycled in North West region	5%	

B.6 Collision Reduction

A new or upgraded facility for pedestrians and cyclists is likely to affect the rate of collisions or incidents compared to the previous situation. For existing cyclists, well-designed walking and cycling facilities are likely to reduce their risk of collisions, particularly where they remove or reduce interactions with vehicle traffic. On the other hand, a facility that attracts new users to walking or cycling may increase their exposure to the general risks of walking and cycling, and may lead to an overall increase in collisions. 'Collision reduction' impacts are the net impact of the two effects and can be either positive (i.e. the scheme results in less collisions than the Do Minimum) or negative (i.e. more collisions).

Estimating collision rates requires three main data types: current count and collision data for the site in question, along with a factor to estimate the impact of the proposed intervention on collisions. Due to a lack of reliable and widespread collision data at a national level for Ireland, collision reduction benefits have not been included within the current version TEAM. However, in some instances, project teams will have access to monitoring and collision data for their scheme, meaning that it would be possible to estimate the impact of their scheme on collisions and add this to the CBA.

Estimating collision reduction impacts involves the following steps:

- **Estimate the current collision rate for the facility / route –** Collision rates are expressed as a rate per million/billion cycling kilometres, and separate rates are generally estimated for fatal, serious and minor collisions.

To estimate the current collision rate, it is necessary to estimate the current annual cycling-kilometres on the route using count or other data, as well as the number of fatal, serious or minor cycling collisions using data from the Road Safety Authority[38].

- **Estimate the 'Crash Reduction Factor' associated with the proposed intervention –** 'Collision Reduction Factors' (CRF) are used to estimate the expected impact of a particular intervention on collision rates.

  CRF are generally expressed as percentages; for example, a 25% CRF means that the particular intervention is expected to reduce collisions by 25%. CRF vary by intervention type (i.e. segregated cycle track, junction improvements etc.), location (i.e. urban, rural etc.), and the incident type (i.e. fatal, serious, minor), and are usually obtained from studies regarding similar interventions in other locations. The 'CMF Clearinghouse' database[39] from the US Federal Highways Administration provides a searchable database of CRF associated with many different interventions from a wide range of studies and is a useful source of CRF for schemes.

- **Estimate future collision rates by applying an appropriate CRF –** After applying the CRF to the current collision rates**,** apply this future collision rate to the future annual cycling kilometres (based on demand scenarios for the project) to estimate the future number of collisions per annum. This should be repeated for fatal, serious and minor collisions as data allows.

- **Compare current and future collisions and monetise –** Comparing the current annual collisions with the future estimated number of collisions will indicate whether there is a net increase or decrease in collisions as a result of the scheme.

The table below provides an example of a typical calculation for collision reduction impacts. This process should be repeated as necessary for each type of collision. Annual collision reduction values should be converted to future values using forecast real GNP growth per capita and discounted using the social discount rate of 4% per annum.

[38] See RSA, 2016. 'Online Map of Collisions'. Available at: https://www.rsa.ie/road-safety/statistics/collisions
[39] Federal Highway Administration, 2021. Available at: http://www.cmfclearinghouse.org/index.cfm

Table B.13 Methodology for Collision Reduction Impacts

Code	Formula	Variable	Value
Estimating current collision rates using count and collision data			
A		Route Length	5km
B		Current daily cycling count	100
C	A x B x 365 days	Current annual cycling kilometres	182,500
D		Current annual number of serious collisions along route	3
E	D / (C *.000001)	Current serious collision rate per million cycle kilometres	16.4
Estimating future collision rates using Collision Reduction Factors			
F		Estimated Crash Reduction Factor for a particular intervention type (example)	25%
G	E x (1-F)	Future serious collision rate per million cycle kilometres	12.3
Annual change in collisions			
H		Future daily cycling count from demand projections	120
I	A x H x 365	Future annual cycling kilometres	219,000
J	G x (I x .000001)	Predicted annual number of serious collisions using future collision rate	2.7
K	D - J	Annual reduction in serious collisions	0.3
Annual value of collision impacts			
L		Value of a serious collision (2016 prices & values)	€318,373
M	L x K	Annual collision reduction benefits (2016 prices & values)	€95,512

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