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Project Appraisal Guidelines for National Roads Unit 13.0 - Pedestrian and Cyclist Facilities

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Technical

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Contents Table

1. Background

The Department of Transport's "Smarter Travel" policy (DoT, 2009a) commits the Government to supporting walking and cycling and encouraging people to switch to more sustainable modes of travel. An important component of this is providing safe, attractive and well-designed facilities for pedestrians and cyclists.

However, it is important to analyse any proposed infrastructure provided for pedestrians and cyclists and the potential use that might be made of it in order to assess the level of benefits that it provides. This allows the overall benefits of a particular proposal to be compared with other possible designs, as well as comparing the investment required with that required for other types of infrastructure and other types of spending.

This PAG Unit outlines a method for assessing the benefits of proposals to improve pedestrian and cyclist facilities. It can be used for the appraisal of both standalone schemes and road schemes which incorporate pedestrian and cyclist facilities. In the latter case calculated benefits (and costs) are additive to those calculated in line with PAG Unit 6 and the Project Appraisal Deliverables can be extended to incorporate the requirements outlined in this PAG unit.

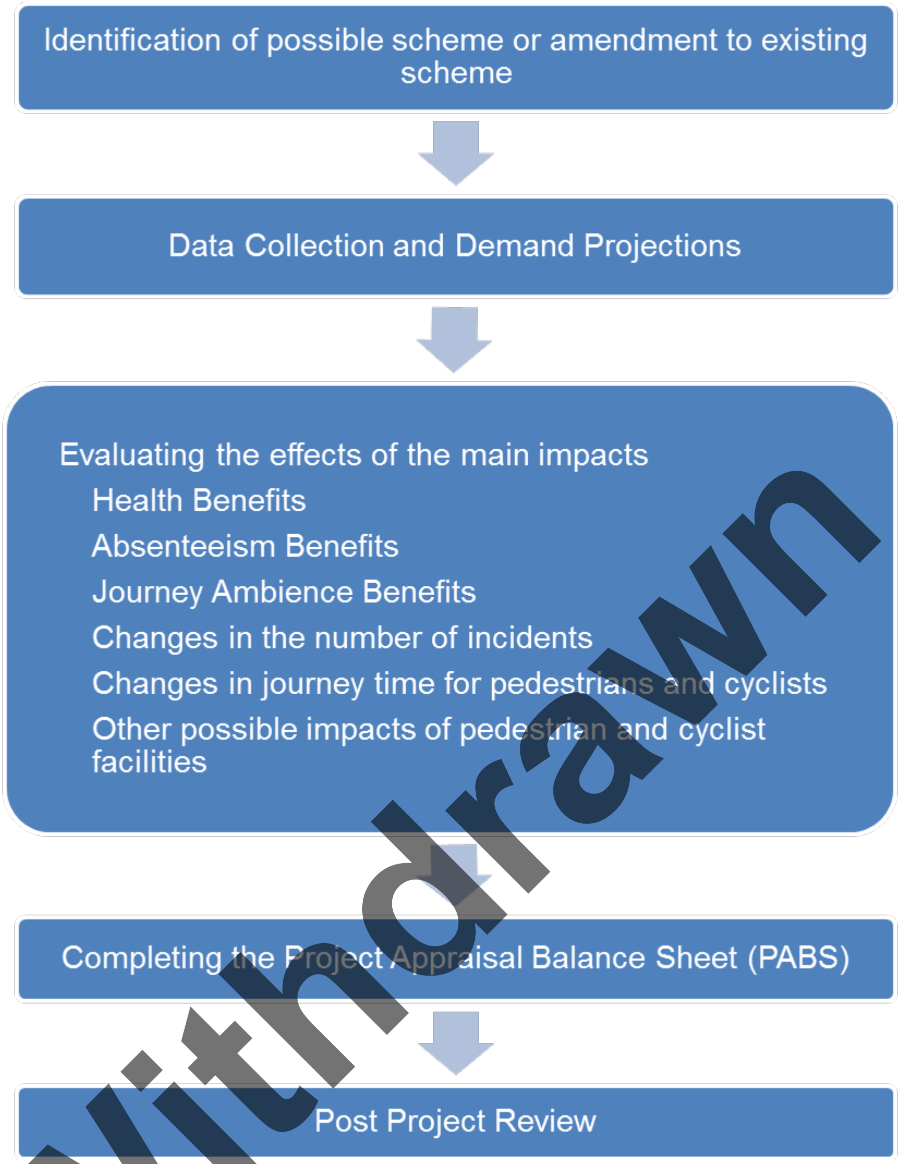
While this PAG Unit does include advice and suggestions for carrying out the appraisal of pedestrian and cyclist facilities, it should not be regarded as definitive. There are still a large number of unknowns and uncertainties about the appraisal of pedestrian and cyclist facilities and users of this guidance should use their own expertise and experience in applying this advice in the most appropriate way. As more is learnt about the potential demand for pedestrian and cyclist facilities and how much value users place on them the guidance in this document will be revised.

The overall structure of the process and this document is outlined in Figure 13.1 which provides a convenient guide to the different sections of this guidance note. It is assumed that the scheme (a stand-alone pedestrian and/or cyclist facility or the pedestrian and/or cyclist element to a larger scheme) has already been identified in sufficient detail for appraisal to proceed (the first box in the flowchart)

Each section or subsection of the guidance includes a discussion of the issues which gives valuable background information about that particular impact or aspect including references to relevant papers (a full reference list is at the end of this note). Following on from this are recommendations (by section or subsection) which give a concise, prescriptive approach which can be followed by the practitioner. In some cases there are also example calculations which illustrate the recommended approach.

Much of the advice is derived from UK DfT Transport Analysis Guidance (UK DfT, 2010a). However, this note is more concise, contains more prescriptive recommendations and uses specific figures for Ireland where possible.

Figure 13.1: Appraisal Process for a Pedestrian or Cyclist Scheme



2. Data Collection and Forecasting

General guidance on the data collection process is provided in PAG Unit 5.2: Data Collection. UK DfT (2010a) also discusses the issues in more detail.

2.1 Discussion

The purpose of data collection is to collect or otherwise obtain input data which is used later in the appraisal process. An important part of this is to evaluate the demand for the facility, which will involve forecasting the number of pedestrians and cyclists who will use the facility and will therefore benefit from the provision of facilities.

There a number of different ways in which this could be done:

- Comparative studies can be carried out on similar facilities in similar locations which are already in use. Ideally, evidence should exist of before and after usage so that these can be estimated for the proposed facility;
- Local surveys can be carried out to discover what the demand for the facility might be;
- Household or other more detailed modelling can be carried out (perhaps informed by the results of local surveys) to estimate demand for the facility; or
- Wider approximate estimates for the change in pedestrian and/or cyclist demand could be derived from correlations observed in other locations between provision and demand at an aggregate level. This is most suited when a significant, area wide, alteration to facilities is being contemplated. Care also needs to be taken in considering the nature of the relationship between observed levels of cyclists and/or pedestrians and the level of facilities provided. High levels of, for instance, cycling provision might be associated with a high levels of cycling, not because the cycling provision created the demand but because the existing high level of demand has led to the provision of better facilities.

2.1.1 Recommendations

Relevant survey data collection and modelling and/or the use of comparative studies and expert judgement must be undertaken to estimate the following for both pedestrians and cyclists:

- Before and after levels of use of the facility in terms of trips per day (or similar);
- The number of people who will take up walking and/or cycling as a result of the new facility;
- The average length of the new trips which use the facility; and
- The proportion of new users of the facility who are commuters.

It should also be noted that census journey to work and education data (POWSCAR) will need to be supplemented with pedestrian and cyclist trips for other purposes such as leisure and retail.

Optionally, the following information can help to make an assessment more accurate:

- How long it will take for demand to change in response to the existence of the facility;
- Any change in the time taken to make trips following the introduction of the facility. For example any changes in journey length and delays;

- The amount that local pedestrians and cyclists might be willing to pay to use the facility. It is unlikely that the facility will be charged for, but the value is useful for monetising the benefit that users enjoy;
- To what extent use of the facility will represent new physical activity by pedestrians and cyclists. This is useful for informing the health benefits calculation; and
- The mean proportion of the local population aged 15-64 who die each year from all causes. Again, this can help to give a more accurate estimate of the health benefits of the new facility.

2.2 Example 1

In a large study of a significant number of improvements to cyclist and pedestrian provision the approach adopted involved the use of local surveys to estimate demand (Laird et al., 2010). The aim of the surveys was to collect data which could be used to derive a demand model for pedestrians and cyclists and also the "value" that people attached to the facilities (this was used in the calculations of improvements to journey ambience). Data was collected from three different locations, two of which had existing pedestrian and cyclist facilities similar to the type of facilities proposed. A questionnaire was used to carry out both household surveys and intercept surveys on the pedestrian and cyclist facilities themselves. The questionnaire asked about:

- Household pedestrian and cyclist trips on the facility if one existed. In the case where a facility did not exist, more general questions about walking and cycling trips were asked and also whether these would change if a facility did exist;
- How the household's walking and cycling trip making behaviour has or might change in response to the new facility;
- The respondent's propensity to walk and cycle for different types of trip;
- For every respondent who stated that they do or would gain a benefit from the facility, their maximum willingness to pay, per trip, for the use of the facility. This was immediately followed by a question about their certainty about the value they have given; and
- Personal and socio economic details of the respondent.

An analysis of the socio-economic details of the respondents showed that they represented a reasonable cross section of the population. Outlying responses with very large numbers of trips or unreported trip purposes were removed.

An Ordinary Least Squares (OLS) regression model was developed which related to walking and cycling trips to various socio economic factors, location in or near an urban area and distance from the nearest town.

These household-based models were applied to each of the schemes being studied using GIS techniques. GeoDirectory data was used to select, for each scheme, the set of buildings within a radius of 250m from the scheme. This radius was chosen because the survey data had indicated that the majority of people using the surveyed pedestrian and cyclist facilities lived within one quarter of a kilometre of the facility. An uplift factor was applied to account for the small proportion of users living further away.

Each dwelling was then given three attributes by a process of GIS matching of datasets:

- The census enumeration districts in which the dwelling was located;
- The distance from the nearest town (settlement of 1500+ population); and
- A category variable representing type of area (whether the dwelling was within or within walking distance of two different sizes of settlement).

The distance variable was capped at a maximum of 10km, this being the effective maximum distance observed in the survey data.

Using the ED variable, average household characteristics for the ED (number of children, likelihood of having 3+ cars) were imputed to the household, taken from 2011 Census data (or 2016 Census data once available).

This enabled the household model to be applied individually to each household. Numbers of pedestrian and cyclist trips were summed over all households within 250m of the scheme, to give estimates of what pedestrian and cyclist demand would be with a footpath and cycleway facility in place. The results showed these survey-based models to be giving answers of the correct order of magnitude.

In addition, it was felt that a number of the schemes would attract a significant amount of use by cycle tourists. Fáilte Ireland estimate that there are 114,000 cycling visitors to Ireland each year, and that on average they cycle for two-thirds of a two-week holiday. Based on this information, a broad estimate was derived of the additional cycling demand from non-residents of the area around each scheme and added to the modelled local demand.

3. Evaluating the Effects of the Main Impacts

3.1 Reduction in Relative Risk (Health Benefits)

3.2 Discussion

There are the benefits to pedestrians and cyclists who take up or increase their levels of physical exercise as a result of the intervention. The benefits of regular use of a physically active form of travel compared to a more sedentary lifestyle are thought to be substantial (Andersen et al., 2000), so these benefits should be considered if an intervention causes more people to become physically active.

Through the use of active modes physical inactivity, which is a significant public health problem, will be reduced. Evidence from the World Health Organisation (WHO) has shown that by increasing physical activity the relative risk of mortality reduces.

It is assumed that the benefit of using active modes accrues over a five year period, after which new cyclists or pedestrians achieve the full health benefit of their activities (CAF 2016).

It is important to note that the benefit only applies to changes which are a result of the intervention. An existing regular cyclist, even if they use the facility being assessed, will derive no extra health benefit if their level of physical activity remains the same. It is also the case that someone who is already physically active will derive less benefit from additional physical activity than someone who is not.

The methodology only considers mortality and so omits the benefits from improved health which don't result in "lives saved", these include obvious benefits to the individuals concerned, but also the avoidance of wider social costs of, for instance, treating obesity which is associated with lack of physical activity.

Note also that further research is needed to more fully understand the relationship between physical activity and health, so the methodology described below including the figures used should be regarded as indicative.

It is assumed that the new pedestrians and cyclists using the facility are using it for transport or recreational reasons and not using it solely to obtain the health benefits as calculated above. This seems likely – they may not even be fully aware of these benefits. This is similar to the assumption made when calculating the collision/incident reduction benefits (as opposed to the danger reduction benefits which are perceived by the individual). This means that these health benefits should not be subject to the "rule of a half" which is similar to the treatment of collision/incident reduction benefits.

3.2.1 Recommendations

The health benefits should be calculated using the forecasts of the numbers of new pedestrians and cyclists (people who would not otherwise have walked or cycled in the absence of the scheme) and the kilometres or minutes or activity involved.

For new cyclists, an average increase in physical activity of 41.8 minutes per work day should equate to a risk of all-cause mortality of 0.79 times the normal figure (CAF 2016). For an increase in cycling less than this, the risk reduction should be reduced in a linear manner. For increases in cycling, there is likely to be an additional benefit, but a conservative assumption should be used that the 0.79 figure is a maximum benefit.

For new pedestrians, the risk of all-cause mortality should be 0.89 times the normal figure (so a smaller benefit than for cycling). This should correspond to physical activity levels of 38 minutes walking per weekday. For an increase in walking less than this, the risk reduction should be reduced in a linear manner. For increases in walking, there is likely to be an additional benefit, but a conservative assumption should be used that the 0.89 figure is a maximum benefit.

The number of lives saved is calculated by multiplying the proportion of the population expected to die per year from all causes by the number of new cyclists or pedestrians to give the expected deaths in this population. This is then multiplied by the risk reduction resulting from the levels of physical activity undertaken by the cyclists or pedestrians.

This gives a number of lives “saved” which can be combined with the value of a statistical life (the value used for the calculation of a fatality in a road collision/incident (PAG Unit 6.11: National Parameter Values Sheet)) to produce a monetised benefit.

If they are available, local figures for the proportion of the adult population suffering all-cause mortality could be used instead of the average figures for the whole of Ireland used in the example.

Note that normal appraisal accounting rules apply, so growth factors apply to the value of a statistical life and discount factors should also be used

3.3 Example 2

Table 13.1: Health Benefits (Cycling)

The calculation of the health benefits of cycling (2011 prices and values)	
Calculate the amount of cycling per cyclist	
Mean distance travelled by new cyclists per weekday	5 km
Estimated cycling speed	20 kph
Estimated mean time spent cycling per weekday (= 60 * 5 / 20)	15 mins
Calculate relative risk reduction	
Relative risk for cycling 41.8 mins/day (CAF 2016)	0.79
Relative risk reduction (= 1 - 0.79)	0.21
Mean risk reduction in this example (= 0.21 * 15 / 41.8)	0.075
Calculate benefit of reduced mortality	
Mean proportion of population in Ireland aged 15-64 who die each year from all causes (CAF 2016)	0.0019
Value of Prevented Fatality (2011 prices and values, CAF 2016)	€2,077,589
Number of new cyclists encouraged by the scheme	1000

Began Cycling		2007	2008	2009	2010	2011
Years Benefit	A	5+	4	3	2	1
No. of Cyclists	B	200	200	200	200	200
Average Mortality	C	0.0019	0.0019	0.0019	0.0019	0.0019
Expected Deaths	B*C=D	0.38	0.38	0.38	0.38	0.38
Reduction in RR (based on above)	E	0.075	0.075	0.075	0.075	0.075
% of Total Benefit Accrued	F	100%	80%	60%	40%	20%
Potential Lives Saved	(D*E)*F=G	0.029	0.023	0.017	0.01	0.006
Value of a Prevented Fatality (€)		60,250	47,785	35,319	20,776	12,467
TOTAL	**€176,597**					

3.4 Example 3

Table 13.2: Health Benefits (Walking)

The calculation of the health benefits of walking (2011 prices and values)						
Calculate the amount of walking per pedestrian						
Mean distance travelled by new pedestrians				3 km		
Estimated walking speed				5 kph		
Estimated mean time spent walking per weekday (= 60 * 3 / 5)				36 mins		
Calculate relative risk reduction						
Relative risk for walking 38 mins/day (CAF 2016)				0.89		
Relative risk reduction for pedestrians (= 1 – 0.89)				0.11		
Mean risk reduction in this example (= 0.11 * 36 / 38)				0.10		
Calculate benefit of reduced mortality						
Mean proportion of population in Ireland aged 15-64 who die each year from all causes (CAF 2016)				0.0019		
Value of Prevented Fatality (2011 prices and values, CAF 2016)				€2,077,589		
Number of new pedestrians encouraged by the scheme				1000		
Began Walking		2007	2008	2009	2010	2011
Years Benefit	A	5+	4	3	2	1
No. of Pedestrians	B	200	200	200	200	200
Average Mortality	C	0.0019	0.0019	0.0019	0.0019	0.0019
Expected Deaths	B*C=D	0.38	0.38	0.38	0.38	0.38
Reduction in RR (based on above)	E	0.1	0.1	0.1	0.1	0.1
% of Total Benefit Accrued	F	100%	80%	60%	40%	20%
Potential Lives Saved	(D*E)*F=G	0.038	0.030	0.023	0.015	0.008
Value of a Prevented Fatality (€)		78,948	62,328	47,785	31,164	16,621
TOTAL	**€236,845**					

Note: These calculations must then be repeated for both cyclists and pedestrians for each year of the appraisal period. For year 2012-2015 similar tables with graduated benefits must be calculated (year 2012, 40% at 5 year benefits, year 2013, 60% at 5 year benefits, year 2014, 80% at 5 year benefits and year 2015 100% at 5 year benefits). From 2015 on, full benefits are assumed for all cyclists. Benefits should be calculated to include real growth in the value of a prevented fatality in line with forecast GDP/capita, then summed and discounted to give a total benefit in 2011 present values.

3.5 Absenteeism Benefits

3.6 Discussion

An increase in physical activity has been shown to have a beneficial effect on work absenteeism; this is an additional benefit to employers on top of the health benefits calculated above. This reduction in short-term sick leave increases productivity in the economy.

WHO (2003) suggests that 30 minutes of exercise a day can result in a reduction in short term sick leave by between 6% and 32%. The lower figure should be used with a calculation of the increase in cycling and walking for commuting purposes to calculate the value of a reduction in absenteeism. This should use an assumption of a 7.5 hour working day, the value of working time (PAG Unit 6.11: National Parameter Values Sheet) and the existing levels of 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 weighting the relative proportions of private and public sector employment gives an overall estimate of 4.9 days per year.

Using the lowest (6%) figure in WHO (2003) suggests that the expected reduction in absenteeism from employees who become active by walking or cycling to work as a result of an intervention is about 0.3 days per employee per year (= 4.9 * 0.06). The number of employees who will take up walking or cycling to work in response to the proposed intervention needs to be estimated, either by a local survey or another method. For the purposes of the calculation of benefit the numbers of new commuting pedestrians and cyclists are taken as the number of newly active employed people.

The absenteeism benefits are accrued by the employer rather than the employee, so it seems unlikely that the absenteeism benefits are fully perceived by the individual. This means that the absenteeism benefits should not be subject to the “rule of a half”.

3.6.1 Recommendations

The absenteeism benefits should be calculated for new commuting pedestrians and cyclists (people who walk or cycle to work and who would not otherwise have walked or cycled in the absence of the scheme). This is taken to be the number of employees affected.

The total number of hours saved is the product of the number of employees affected, the expected reduction in absenteeism (0.3 days per year) and an estimate of the length of the working day (7.5 hours).

This gives a total number of working hours saved which can be combined with the value of working time (PAG Unit 6.11: National Parameter Values Sheet) to produce a monetised benefit.

Note that for the purposes of calculating absenteeism benefits, time spent walking is valued in the same way as time spent cycling. This is in line with the recommendations in UK DfT (2010a).

Note that normal appraisal accounting rules apply, so growth factors apply to the value of time and discount factors should also be used (refer to CAF 2016 for further details).

Real growth in GNP per person employed should be used to adjust the benefits of reduced absenteeism from increased amounts of active travel between one year and another.

This method could optionally be enhanced to use local data on the wage rates of pedestrians and cyclists with an appropriate overhead for employer related costs (instead of the value of time) and through the use of local data on average hours worked per day by pedestrians and cyclists.

3.7 Example 4

Table 13.3: Absenteeism Benefits Example

Example calculation of the absenteeism benefits of walking and cycling (2011 prices and values)	
Calculate the number of existing cycle trips and the total cycle time on facility	
Number of new (one-way) commuting trips on foot per day	10
Number of new (one-way) commuting trips by bicycle per day	6
Divide by two to get number of employees affected (= (10+6)/2)	8
Calculate relative total number of hours saved through reduced absenteeism	
Total number of days saved (= 0.3 * 8)	2.4
Total number of hours saved (= 2.4 * 7.5)	18
Value of work time per hour (2011 prices and values, PAG Unit 6.11: National Parameter Values Sheet)	€34.33
Total 2011 benefit (2011 prices) (= 18 * 34.33)	€617.94

Note that values should then be calculated with graduated benefits to 2015, and full benefits from 2016 on, including real growth in the value of work time per hour in line with forecast GNP per person employed, then summed and discounted to give a total benefit in 2011 present values.

3.8 Journey Ambience Benefits

3.9 Discussion

Journey ambience benefits are the users' perception of reduced danger (a reduced fear of potential collisions/incidents) and improved quality of journey as a result of the proposal being considered. Existing users will experience these improvements as well as any new users who are attracted to the facility. Care should be taken to attribute the journey ambience benefit only to the elements of trips that actually use the proposed facility (usually a shorter distance than the total trip length). An average speed factor (e.g. 20 kph for cycling or 5kph for walking) can be used to convert distance on the facility to time on the facility.

Assessing the journey ambience benefit is challenging as different users will have different sensitivities to danger and environmental quality. However, the benefit is potentially large, especially for cyclists, because surveys suggest that existing and potential users of this mode attach great importance to the perceived safety and quality benefits of improved facilities (in particular facilities segregated from motorised traffic) (Wardman et al., 2007).

Some suggested values for cycling are given in Table 13.4, but great care should be used in applying these and judgement should be used, for instance by considering the quality of the facilities being proposed/replaced. Local figures could be used if it is possible to collect data on the willingness of potential users of a new facility to pay for the use of the facility.

Table 13.4: Journey Ambience Values (2011 market prices and values)

Scheme Type	UK values in Euros[1]	From survey on National Secondary Road network[2]	Trip Duration[3]	Value per trip
Cycle trail (off-road segregated cycle track)	17.50 cents/min	-	15 minutes	262.50 cents
Cycleway (on-road segregated cycle lane)	7.41 cents/min	-	15 minutes	111.15 cents
Cycleway (on-road segregated cycle track shared with pedestrians)	-	2.25 cents/min	15 minutes	33.75 cents
Pedestrian footway (shared with cyclists)	-	2.08 cents/min	29.8 minutes	61.98 cents

3.9.1 Recommendations

The total amount of time spent by cyclists and pedestrians on the facility should be calculated for both existing (before the intervention) and new users (those attracted by the facility).

The value of the benefits they enjoy should be calculated by multiplying these times by relevant willingness to pay values, taken from Table 13.4 or local surveys or elsewhere. The benefit to new users is obviously perceived by them, so is subject to the "rule of a half".

Note that normal appraisal accounting rules apply, so growth factors apply to the value of journey ambience and discount factors should also be used.

3.10 Example 5

Table 13.5: Journey Ambience Example

Example calculation of the journey ambience of walking and cycling (2011 prices and values)	
Calculate the number of existing cycle trips and the total cycle time on facility	
Existing cycle trips per year	3,000
Average length of cycle trips	5.2 km
Average proportion of cycle trip on cycleway facility	0.7
Average distance on facility (= 0.7 * 5.2)	3.64 km

[1] Derived from values given in UK DfT (2010a). These are given as 4.73 p/min and 2.01 p/min for "Off-road segregated cycle track" and "On-road segregated cycle lane" respectively. Converting these to 2002 values gives 5.46 p/min and 2.32 p/min. A further conversion to 2009 value of time using a purchasing power parity method and a conversion to 2011 values using CPI values (CSO) gives the values shown.
[2] Carried out in connection with the National Secondary Roads Needs Study (Laird et al., 2010). Converted to 2011 values using CPI values (CSO).
[3] Average UK bicycle trip length in 2014 was 3.1 miles (UK DfT, 2014), trip times assume 20kph.

Example calculation of the journey ambience of walking and cycling (2011 prices and values)	
Average trip time on facility (assuming 20 kph) (= 60 * 3.64 / 20)	10.92 minutes
Total time on facility (existing cyclists) (= 10.92 * 3,000)	32,760 minutes
Total existing cyclist benefit (assuming Cycleway survey journey ambience valuation) (= 32,760 * 2.25 / 100)	€737.10
Calculate the number of existing pedestrian trips and the total walk time on facility	
Existing pedestrian trips per year	5,000
Average length of pedestrian trips	2.1 km
Average proportion of pedestrian trip on new facility	0.8
Average distance on facility (= 0.8 * 2.1)	1.68 km
Average trip time on facility (assuming 5 kph) (= 60 * 1.68 / 5)	20.16 minutes
Total time on facility (existing pedestrians) (= 20.16 * 5,000)	100,800 minutes
Total existing pedestrian benefit (assuming Pedestrian footway survey journey ambience valuation) (= 100,800 * 2.08 / 100)	€2096.64
Calculate the number of new cycle trips and the total new cycle time on the facility	
New cycle trips per year	1,000
Average length of cycle trips	5.2 km
Average proportion of cycle trip on cycleway facility	0.7
Average distance on facility (= 0.7 * 5.2)	3.64 km
Average trip time on facility (assuming 20 kph) (= 60 * 3.64 / 20)	10.92 minutes
Total time on facility (new cyclists) (= 10.92 * 1,000)	10,920 minutes
Total new cyclist benefit (assuming Cycleway survey journey ambience valuation), reduced by rule of a half (= 0.5 * 10,920 * 2.25 / 100)	€122.85
Calculate the number of existing pedestrian trips and the total walk time on facility	
New pedestrian trips per year	2,000
Average length of pedestrian trips	2.1 km
Average proportion of pedestrian trip on new facility	0.8
Average distance on facility (= 0.8 * 2.1)	1.68 km
Average trip time on facility (assuming 5 kph) (= 60 * 1.68 / 5)	20.16 minutes
Total time on facility (new pedestrians) (= 20.16 * 2,000)	40,320 minutes
Total new pedestrian benefit (assuming Pedestrian footway survey journey ambience valuation), reduced by rule of a half (= 0.5 * 40,320 * 2.08 / 100)	€419.33
Total 2011 benefit (2011 prices) (sum of the above)	**€3375.92**

3.11 Changes in the Numbers of Collisions/Incidents

3.12 Discussion

If a new or upgraded facility for cyclists and pedestrians is well designed then it would be expected to have a lower cyclist and pedestrian incident risk associated with it than in the previous situation. In order to lower the cyclist and pedestrian collision/incident risk the facility should remove or significantly reduce the interaction with general traffic. For existing cyclists and pedestrians there is therefore likely to be a collision/incident reduction benefit. On the other hand, if a facility encourages more people to walk or cycle, there will on that account be an increase in the number of collisions/incidents, because these people have shifted from other modes with a lower collision/incident risk, or are making new trips. The overall outcome will be the net of the two effects.

It is difficult to give definitive advice about the collision/incident rates associated with particular types of facility, especially cycle facilities. This is because these are likely to depend on the detailed design of a facility and the local circumstances. For a facility segregated from motorised traffic the number and design of the points where users come into conflict with motorised traffic (e.g. junctions and other locations where a cycle facility has to leave or join the roadway) are likely to be important. In addition, conflicts between cyclists and pedestrians could be an issue where facilities are shared.

Possible methods for estimating collision/incident rates (and therefore the number of collision/incident) could include comparative studies of the performance of existing similar schemes combined with expert judgment. The detail of the design is likely to be crucial, as the scale and sensitivity of cycling and pedestrian use is likely to be very different to use by motorised modes. Clearly, the monitoring and evaluation of existing pedestrian and cyclist schemes can inform the collision/incident rate which might be associated with future schemes.

There is clear evidence that suggest that overall increases in pedestrian and cyclist trips result in a decrease in collision/incident risk for cyclists (Jacobsen, 2003). Jacobsen suggested that the increase in collisions/incidents would only be equivalent to the increase in cycling or walking raised to the power 0.4, thus a 30% increase in cycling would only result in an 11% increase in collision/incident (1.300.4 = 1.11 (to 2 d.p.)). This may be because an increased density of cyclists might result in more careful driver behaviour due to added awareness of the presence of cyclists.

The evaluation of the health benefits for new cyclists discussed above is net of the mortality impacts of an increase in the number of cycle collisions/incidents, but only for the location where the study on which the evaluation of the health benefits took place.

In the absence of killed and seriously injured cycle collision/incident rates for Ireland, Table 13.6 presents rates for Great Britain (source DfT, 2014).

Table 13.6: Killed and seriously injured cyclists per billion cycle kilometres in Great Britain 2014

Road Type	2008
Urban A	1664
Urban other	509
All Urban	737
Rural A	2833
Rural other	459
All Rural	691

Note: derived from figures in UK DfT (2014)

It is generally accepted that cycle collision/incident figures are under reported in the Great Britain and there may also be inaccuracies in the figures for cycle kilometres used to calculate the rates shown in Table 13.6. There is also significant variation in these rates year to year. It should of course be noted that the majority of these roads do not have cycle facilities.

3.12.1 Recommendations

Changes in the numbers of collisions/incidents should be considered for the different groups. That is for pedestrians and cyclists and for existing users (those whose behaviour is unchanged by the proposal) and new users (those who start walking and/or cycling in response to the facility).

For existing pedestrians – if there is evidence that the new facilities are likely to have a lower collision/incident rate than the existing situation, then the collision/incident reduction benefits should be evaluated using a simple estimate of the change in collision/incident rate and the number of pedestrians affected.

For existing cyclists – evidence on changes in collision/incident rates associated with new facilities is mixed. It is difficult to make a recommendation on any change in collision/incident rate. This change should be assumed to be zero unless there is significant evidence to the contrary.

For new pedestrians – for a well-designed facility, any increase in collision/incident as a result of more people walking is likely to be small. In addition, the health benefits calculations are likely to include an element of disbenefit due to the increased risk associated with walking. This change should be assumed to be zero unless there is significant evidence to the contrary.

For new cyclists – if the collision/incident rates associated with the new infrastructure are felt to be similar to those experienced in Copenhagen based on the design and expected usage then no calculation is necessary as the change in fatal collision/incident numbers has been taken encapsulated in the health benefits calculation (this is an approximation because it omits non-fatal collision/incident). If the collision/incident rate is felt to be significantly different than that for Copenhagen then a simple collision/incident rate model needs to be derived to account for the difference and used with the annual number of new kilometres cycled.

Comparable statistics for Copenhagen are only approximate; figures in City of Copenhagen (2009) suggest a killed and seriously injured rate of about 313 per billion cycle kilometres.

3.13 Example 6

In a study of proposed pedestrian and cyclist facilities on the National Secondary Roads network, an analysis was made of the possible changes in the numbers of collisions/incidents associated with the proposed infrastructure. After careful consideration of the possible collision/incident rates associated with the infrastructure proposed, it was decided to assume no change in collision/incident numbers beyond that already taken into account in the health benefits calculations.

3.14 Changes in Journey Time for Pedestrians and Cyclists

3.15 Discussion

Journey time savings can be calculated for pedestrians and cyclists in the same way as for other road users. This benefit occurs to existing pedestrians and cyclists if their new route is shorter or involves a less delay than before the intervention. Conversely, if the new route is longer or involves more delay, the change can represent a disbenefit for pedestrians and cyclists. A speed assumption is required (e.g. 4 kph for pedestrians and 20 kph for cyclists). Values of time can be taken from PAG Unit 6.11: National Parameter Values Sheet.

3.15.1 Recommendations

Journey time changes for pedestrians and cyclists should be calculated and valued using the values of time in PAG Unit 6.11: National Parameter Values Sheet. Any benefit to new users (pedestrians and cyclists) is obviously perceived by them, so is subject to the "rule of a half".

3.49. Note that normal appraisal accounting rules apply, so growth factors apply to the value of time and discount factors should also be used.

3.16 Other Possible Impacts of Pedestrian and Cyclist Facilities

3.17 Discussion

If there is a significant enough modal shift to walking and/or cycling then it is possible that there will be additional benefits resulting from a reduction in trips by motorised modes. However, these benefits are far more difficult to quantify given that they depend not just on growth in pedestrian or cyclist trips but also on an associated reduction in motorised trips.

If there is a significant reduction in motorised trips as a result of the proposal then the impact of this change can be entered into the relevant part of the PABS. If the effect can be quantified, then additional evidence can be added to the PABS, otherwise a qualitative adjustment can be made (See PAG Unit 7.0: Project Appraisal Balance Sheet).

The main impacts are likely to be in the PABS elements:

- Air quality improvement;
- Effects on Climate Change;
- Noise Reduction;
- Collision/Incident reduction (as a result of reduced levels of motorised traffic);
- Transport Efficiency and Effectiveness (decongestion benefits resulting in reduced journey times and vehicle operating costs); and
- Fuel tax foregone as a result of less fuel being purchased and consumed.

If the effect on motorised traffic is likely to be small or non-existent then these other possible benefits should be ignored.

In addition to the impacts of a shift from motorised modes, there might be other qualitative benefits from providing facilities for pedestrians and cyclists. These include:

- Security – there may be increased levels of security as a result of reduced perceptions of danger associated with improvements to pedestrian and cyclist facilities;
- Vulnerable users – those without access to motorised transport may especially benefit from the provision of pedestrian and cyclist facilities;
- Support for sustainable transport modes; and
- Support for other Government transport policies.

3.17.1 Recommendations

If there is evidence that there will be a significant mode shift away from motorised transport then this should be taken into account in completing the relevant elements of the PABS.

Impacts on security, vulnerable users and on elements in the Integration objective of the PABS should also be included.

The analyst is referred to the relevant PAG guidance contained elsewhere in this guide for the assessment of these impacts.

4. Completing the Project Appraisal Balance Sheet (PABS)

4.1 Discussion

For a road scheme which has pedestrian and cyclist facilities associated with it, modifications should be made to the PABS to represent the incremental effect of the pedestrian and cyclist facilities on the overall scheme. For a scheme which is solely a cycling and/or pedestrian scheme, the PABS should reflect the impacts of the scheme. For details of how to represent impacts in the PABS see PAG Unit 7.1: Project Appraisal Balance Sheet. The main impacts of both types of schemes are those discussed in detail above.

4.1.1 Recommendations

The way in which the impacts of the proposed scheme should be represented in the PABS is shown in Table 13.7

Table 13.7: Inclusion of the Main Pedestrian and Cyclist Impacts in the PABS

Criterion	Element	Qualitative Statement	Quantitative Statement
Environment	Climate	Possible impact if the scheme results in a significant shift away from motorised modes	Reduction in emissions of greenhouse gases and the value of these emissions reductions
	Air Quality		Changes in exposure to poor air quality (Indices of overall change in exposure)
	Noise/vibration		Potential impact rating of changes in noise/vibration
Safety	Collisions/ Incidents	There may be changes in collision/incident numbers for existing users if the new facility alters the collision/incident rate. There may be changes in collision/incident numbers as a result of new cyclists and pedestrians.	Changes in collision/incident numbers and the value of these changes
	Security	There is a potential Security benefit as a result of a reduced fear of collision/incident for pedestrians and cyclists. Note that there is an element of double counting here with journey ambience, which is taken into account under Efficiency / Effectiveness below	-
Economy	Effectiveness / Efficiency	Benefits for pedestrians and cyclists: • Journey ambience • Journey time savings	Benefits can be quantified and valued and compared with the costs. For a road scheme which includes pedestrian and cyclist facilities, the PVB and PVC of the scheme will need to be adjusted

Criterion	Element	Qualitative Statement	Quantitative Statement
			and PVB/PVC recalculated
Accessibility	Vulnerable groups	Possible benefit to non-car available people from the provision of pedestrian and cycle facilities which provide better access to employment and/or infrastructure.	-
Integration	Transport	Pedestrian and cyclist facilities provide support for sustainable transport modes	-
	Other	Support for other Government transport policies for instance if cycle facilities provide part of a route identified in the National Cycle Policy Framework (DoT, 2009b).	-
Physical Activity		Summary of nature of physical activity impacts including impacts on particular groups of road users. Benefits for pedestrians and cyclists: • Health • Absenteeism	NPV arising from these benefits

5. Post Project Review

5.1 Discussion

Guidance on post project reviews (PAG Unit 9.0: Post Project Review) indicates that post project reviews should be carried out for all projects costing in excess of €20 million and a sample of at least 5% of all projects less than €20m. If pedestrian and/or cyclist facilities have been assessed as part of a larger project then the assessment of these facilities should be included in the post project review for that project. Projects which consist only of pedestrian and cyclist facilities (which are unlikely to reach the €20 million threshold) should be reviewed if they are part of the 5% sample. The responsibility for carrying out the post project review rests with the sponsoring agency.

Of particular interest in the post project review will be the accuracy of projecting future demand for the pedestrian and/or cyclist facilities. It is recommended that the post project review should be commenced five years after project opening to allow for pedestrian and/or cyclist demand to respond fully to the intervention.

There is little published evidence on the effect of pedestrian and cyclist facilities on actual levels of cycling and walking and of any mode shift from motorised modes. It is important that the results of any post project reviews carried out on pedestrian and cyclist projects (either as part of a larger project or stand-alone facilities) are disseminated in order to improve the quality of demand forecasting in the future.

5.1.1 Recommendations

If the project is subject to post project review, monitoring should take place to determine outturn impacts and a comparison made with the ex-ante projections in relation to construction costs, demand and collisions/incidents. It will be difficult to devise monitoring programmes for health and absenteeism benefits, but considering should be given for doing so as this will enhance the evidence base.

Consideration should be given to when the post project monitoring should take place to try and ensure that pedestrian and cyclist demand has fully responded to the changes as a result of the project.

The results of the post project review should be disseminated widely to inform future studies.

6. Key References

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