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National Roads Authority

Project Appraisal Guidelines

Unit 13.0 Walking and Cycling Facilities

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Unit 13.0
Walking and Cycling Facilities

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1.0	March 2011	New Guidance

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1 Background

1.1. There is increasing interest in walking and cycling as modes of transport and possible alternatives to motorised transport for some trips. 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 attractive and well designed facilities for people to walk and cycle.

1.2. However, it is important to analyse any proposed infrastructure provided for walking and cycling 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.

1.3. This PAG Unit outlines a simple method for assessing the benefits of proposals to improve facilities for cycling and/or walking. It can be used for the appraisal of both standalone schemes and road schemes which incorporate cycling and walking facilities. In the latter case calculated benefits (and costs) are additive to those calculated in standard appraisals and the Project Appraisal Deliverables can be extended to incorporate the requirements outlined in this PAG Unit.

1.4. While this PAG Unit does include advice and suggestions for carrying out the appraisal of walking and cycling facilities, it should not be regarded as definitive. There are still a large number of unknowns and uncertainties about the appraisal of walking and cycling 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 walking and cycling facilities and how much value users place on them the guidance in this document is likely to be revised.

1.5. This PAG Unit explains the main impacts to be considered if a change is being made which will significantly affect walkers and cyclists, it also outlines how the impacts may be taken into account in the Project Appraisal Balance Sheet (PABS). Additionally it includes advice on post project review and includes a case study of the application of the guidance.

1.6. Section 2 describes how the necessary data needed for the appraisal process might be collected or forecast. Section 3 identifies the main impacts of a walking and/or cycling proposal and describes how these might be assessed and, in many cases, valued. Section 4 explains how the impacts can be incorporated into a Project Appraisal Balance Sheet (PABS). Section 5 has recommendations for post project review. 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 walking and/or cycling facility or the walking and/or cycling element to a larger scheme) has already been identified in sufficient detail for appraisal to proceed (the first box in the flowchart)

1.7. 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.

1.8. 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.

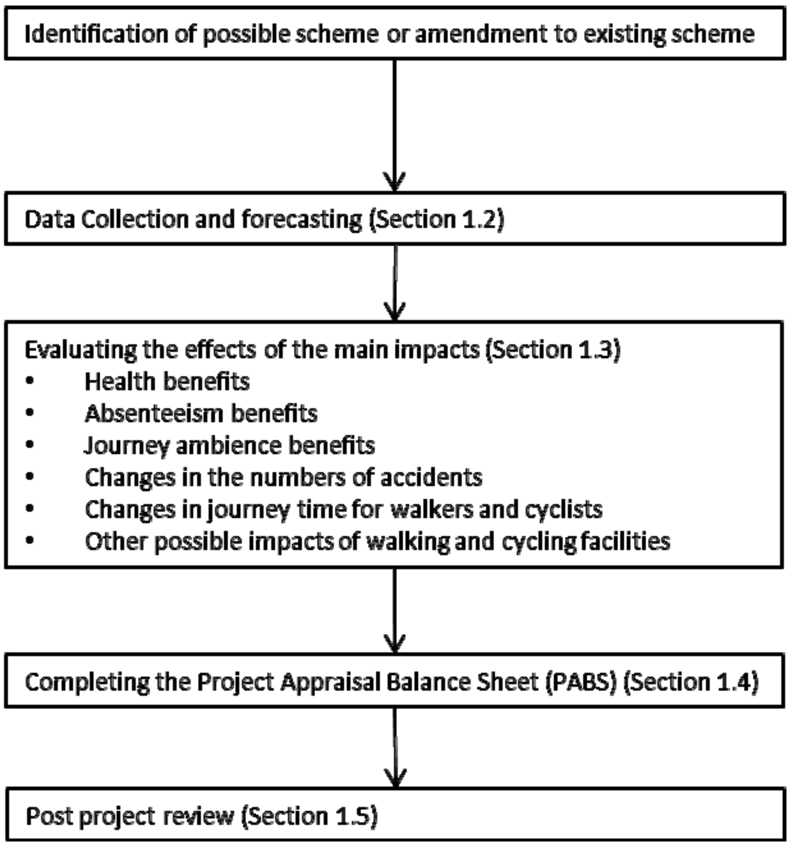

Figure 13.1: Appraisal Process for a Walking or Cycling Scheme

2. Data Collection and Forecasting

Discussion

2.1. 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 walkers and cyclists who will use the facility and will therefore benefit from the provision of facilities.

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

- Comparative studies can be carried out on similar facilities 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 demand for cycling and/or walking 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 cycling and/or walking 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.

2.3. General guidance on the data collection process is provided in *PAG Unit 5.1: Data Collection*. UK DfT (2010a) also discusses the issues in more detail.

Recommendations

2.4. 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 walkers 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.

2.5. It should also be noted that census journey to work data (POWCAR) will need to be supplemented as commuters form only a small proportion of total walking and cycling trips made.

2.6. 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 walkers 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 walkers 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.

Example

2.7. In a large study of a significant number of improvements to cycling and walking 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 cycling and walking 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 walking and cycling facilities similar to the type of facilities proposed. A questionnaire was used to carry out both household surveys and intercept surveys on the walking and cycling facilities themselves. The questionnaire asked about:

- Household cycling and walking 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.

2.8. 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.

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

2.10. 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 cycling and walking 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.

2.11. 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).

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

2.13. 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 2006 Census data.

2.14. This enabled the household model to be applied individually to each household. Numbers of walking and cycling trips were summed over all households within 250m of the scheme, to give estimates of what cycling and walking 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.

2.15. 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

Health Benefits

<u>*Discussion*</u>

3.1. These are the benefits to walkers 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. The method used is based on the World Health Organisation methodology (Cavill et al., 2008) which includes the use of the Health Economic Assessment Tool for cycling (HEAT). Note that this technique only assesses the mortality benefits of increased levels of physical activity. It therefore omits the benefits in terms of reduced morbidity or sickness – some of which are captured by absenteeism benefits (see below).

3.2. The methodology is based on the finding from a large scale study in Copenhagen that regular cyclists (people who cycled to work) had a relative risk of all-cause mortality of 72% compared to a similar group of non-cyclists (Andersen et al., 2000). The cyclists cycled for an average of 3 hours per week or 36 minutes per weekday, they covered an average of 1620 kilometres per year. Therefore, the assumption used is that each new cyclist who cycles an average of 36 minutes per weekday (or 1620 km per year) reduces their chance of all-cause mortality to 72% of the average. New cyclists who cycle less than 36 minutes per weekday will reduce their chance of all-cause mortality by less (a linear assumption is used), cyclists who cycle more may gain additional benefits but it is not clear what these should be. Normally an average amount of cycling is used to calculate the benefits. Note that there is an implicit assumption that all patterns of cycling, including irregular or unusual trip making provide the same benefits per kilometre cycled.

3.3. The methodology is derived from the figures for “all-cause mortality” for people who cycled to work compared to those who did not (Andersen et al., 2000). Thus it is net of any mortality impact of accidents as a result of the higher level of risk associated with cycling (the adverse consequences of which are much less than the beneficial health effects of regular cycling). It is important to take this into account in calculating the possible increase in accidents as a result of any increase in cycling. It may be concluded that the mortality impacts of increased accident risk to new cyclists are fully taken account of in the health benefits calculation if the accident risk in the study location after the intervention is felt to be similar to that in the original studies. These original studies were carried out in Copenhagen. This is considered further in the section on accidents below.

3.4. The methodology was developed from evidence of the benefit to cyclists; there is less evidence of the benefits to walkers. It is likely that there is a health benefit to regular walking in the same way as for cycling, though it is likely to be less for a similar amount of time spent. UK DfT (2010a) suggests (in a case study accompanying the guidance), that 36 minutes of walking per weekday results in a relative risk of 0.85 (compared to 0.72 for a similar time spent in regular cycling).

3.5. Assuming the benefits of physical activity take place as soon as someone takes up exercise (as is the case in the example above) might be an overestimate of the benefit as it may take some time before an individual enjoys the full health benefit of physical activity. UK DfT (2010a) suggests using an accrual period of 5 years – only after this period will the full benefits be enjoyed. This assumption could be used in the calculation of health benefits, though it is not included in the recommendations below.

3.6. 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. Note that the study which underpins the values used in the methodology (Andersen et al., 2000) simply compared a group of people who cycled to work with a group who did not, the groups were slightly different in their levels of leisure time physical activity, but adjustments were made to eliminate this effect.

3.7. 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.

3.8. 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.

3.9. It is assumed that the new walkers 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 accident 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 accident reduction benefits.

Recommendations

3.10. The health benefits should be calculated using the forecasts of the numbers of new walkers 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.

3.11. For new cyclists an average increase in physical activity of 1620 kilometres of cycling per year or 36 minutes per weekday should equate to a risk of all-cause mortality of 0.72 times the normal figure. 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 0.72 figure is a maximum benefit.

3.12. For new walkers, a similar calculation should be carried out, but with the risk of all-cause mortality should 0.85 times the normal figure (so a smaller benefit than for cycling). This should correspond to physical activity levels of 36 minutes walking per weekday. This approximately corresponds to 405 kilometres of walking per year.

3.13. 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.

3.14. 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 accident (*PAG Unit 6.11: National Parameter Values Sheet*)) to produce a monetised benefit.

3.15. 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.

3.16. 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.

Examples

Table 13.1: Health Benefits Example 1

The calculation of the health benefits of cycling (2009 prices and values)	
Calculate the amount of cycling per cyclist	
Mean distance travelled by new cyclists	5 km
Number of new trips per cyclist per year	200
Amount of new cycling per new cyclist (= 5 * 200)	1000 km
Calculate relative risk reduction	
Mean distance travelled in Copenhagen study	1620 km
Relative risk in Copenhagen study	0.72
Risk reduction in Copenhagen study (= 1 - 0.72)	0.28
Mean distance travelled in this example (see above)	1000 km
Risk reduction in this study (= 0.28 * 1000 / 1620)	0.17 (2 d.p.)
Calculate benefit of reduced mortality	
Mean proportion of population in Ireland aged 15-64 who die each year from all causes (derived from CSO, 2009)	0.00216
Number of extra cyclists encouraged by the scheme	150
Expected deaths in this population per year (= 0.00216 * 150)	0.324
Lives “saved” per year (= 0.324 * 0.17)	0.055
Value of life “saved” (2009 prices and values, *PAG Unit 6.11: National Parameter Values Sheet*)	€2.061 M
Total 2009 benefit (2009 prices) (= 0.055 * 2.061M)	€113,355

Table 13.2: Health Benefits Example 2

The calculation of the health benefits of walking (2009 prices and values)	
Calculate the amount of walking per walker	
Mean distance travelled by new walkers	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 36 mins/day (suggested)	0.85
Risk reduction for walkers (= 1 - 0.85)	0.15
Mean risk reduction in this example (= 0.15 * 36 / 36)	0.15
Calculate benefit of reduced mortality	
Mean proportion of population in Ireland aged 15-64 who die each year from all causes (derived from CSO, 2009)	0.00216
Number of extra walkers encouraged by the scheme	200
Expected deaths in this population per year (= 0.00216 * 200)	0.432
Lives “saved” per year (= 0.432 * 0.15)	0.0648
Value of life “saved” (2009 prices and values, *PAG Unit 6.11: National Parameter Values Sheet*)	€2.061 M
Total 2009 benefit (2009 prices) (= 0.0648 * 2.061M)	€133,553

Absenteeism Benefits

<u>Discussion</u>

3.17. 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. 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.

3.18. The Small Firms Association Absenteeism Report 2008 (SFA, 2008) suggests an average of 8 days absenteeism per year. This applies to the Irish private sector and does not give the proportion of short-term absence. The UK CBI suggests that 95% of their average figure (6.8 days) is short-term sick leave (UK DfT, 2010). A report on the Irish Civil Service (Government of Ireland, 2009) suggests that the average is 11.30 days, but that 49% of this was for periods of over 20 days (so not short-term sick leave). SFA (2008) suggests that public sector employment is about 17% of total employment in Ireland. Taking these results together suggests that private sector short-term sick leave is about 7.6 days per year (95% of 8 days). For the public sector the figure is about 5.8 days per year (51% of 11.30). Factoring this by the proportions of private versus public sector employment gives an overall figure of 7.3 days per year.

3.19. 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 0.4 days per employee per year (= 7.3 * 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 walkers and cyclists are taken as the number of newly active employed people.

3.20. 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”.

Recommendations

3.21. The absenteeism benefits should be calculated for new commuting walkers 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.

3.22. The total number of hours saved is the product of the number of employees affected, the expected reduction in absenteeism (0.4 days per year) and an estimate of the length of the working day (7.5 hours).

3.23. 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.

3.24. 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).

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

3.26. This method could optionally be enhanced to use local data on the wage rates of walkers 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 walkers and cyclists.

<u>*Example*</u>

Table 13.3: Absenteeism Benefits Example

Example calculation of the absenteeism benefits of walking and cycling (2009 prices and values)	
Calculate the number of employees affected	
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 (= 0.4 * 8)	3.2
Total number of hours saved (= 3.2 * 7.5)	24
Value of work time per hour (2009 prices and values, *PAG Unit 6.11: National Parameter Values Sheet*)	€27.81
Total 2009 benefit (2009 prices) (= 24 * 27.81)	€667.44

Journey Ambience Benefits

<u>*Discussion*</u>

3.27. The journey ambience benefits are the users' perception of reduced danger (a reduced fear of potential accidents) 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 (eg 20 kph for cycling or 5kph for walking) can be used to convert distance on the facility to time on the facility.

3.28. 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).

3.29. 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. 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 (2009 market prices and values)

Scheme Type	UK values in Euros (Note 1)	From survey on national secondary road network (Note 2)	Trip duration (Note 3)	Value per trip
Cycle trail (off-road segregated cycle track)	17.23 cents/min	-	14 minutes	241.22 cents
Cycleway (on-road segregated cycle lane)	7.30 cents/min	-	14 minutes	102.20 cents
Cycleway (on-road segregated cycle track shared with pedestrians)	-	2.22 cents/min	17.6 minutes	39.07 cents
Pedestrian footway (shared with cyclists)	-	2.05 cents/min	29.8 minutes	61.09 cents

Note 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 gives the values shown.

Note 2:Carried out in connection with the National Secondary Roads Needs Study (Laird et al., 2010).

Note 3: Average UK bicycle trip length in 2009 was 2.9 miles (UK DfT, 2010b), trip times assume 20kph.

Recommendations

3.30. 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).

3.31. 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".

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

Example

Table 13.5: Journey Ambience Example

Example calculation of the journey ambience of walking and cycling (2009 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
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 * 2.22 / 100)	€727.27
Calculate the number of existing walk trips and the total walk time on facility	
Existing walk trips per year	5,000
Average length of walk trips	2.1 km
Average proportion of walk 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 walkers) (= 20.16 * 5,000)	100,800 minutes
Total existing walker benefit (assuming Pedestrian footway survey journey ambience valuation) (= 100,800 * 2.05 / 100)	€2066.40
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 * 2.22 / 100)	€121.21
Calculate the number of existing walk trips and the total walk time on facility	
New walk trips per year	2,000
Average length of walk trips	2.1 km
Average proportion of walk 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 walkers) (= 20.16 * 2,000)	40,320 minutes
Total new walker benefit (assuming Pedestrian footway survey journey ambience valuation), reduced by rule of a half (= 0.5 * 40,320 * 2.05 / 100)	€413.28
Total 2009 benefit (2009 prices) (sum of the above)	**€3328.16**

Changes in the Numbers of Accidents

Discussion

3.33. If a new facility for cyclists and pedestrians is well designed then it would be expected to have a lower cyclist and pedestrian accident risk associated with it than in the previous situation. For existing cyclists and pedestrians there is therefore likely to be an accident 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 accidents, because these people have shifted from other modes with a lower accident risk, or are making new trips. The overall outcome will be the net of the two effects.

3.34. It is difficult to give definitive advice about the accident 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.

3.35. Possible methods for estimating accident rates (and therefore the number of accidents) 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 cycling and walking schemes can inform the accident rate which might be associated with future schemes.

3.36. There is clear evidence that suggest that overall increases in walking and cycling result in a decrease in accident risk for cyclists (Jacobsen, 2003). Jacobsen suggested that the increase in accidents 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 accidents (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.

3.37. As mentioned above, the evaluation of the health benefits for new cyclists is net of the mortality impacts of an increase in the number of cycle accidents, but only for the location where the study on which the evaluation of the health benefits took place (Copenhagen, see Andersen et al., 2000). The scale of any possible increase in accidents as a result of increased cycling depends on how the fatal accident risk associated with any facility compares to the accident risk in Copenhagen.

3.38. In the absence of killed and seriously injured cycle accident rates for Ireland, Table 13.6 presents rates for Great Britain (source DfT, 2009).

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

Road Type	2008
Urban A	1227
Urban other	375
All Urban	533
Rural A	1600
Rural other	402
All Rural	571

Note: derived from figures in UK DfT (2009)

3.39. It is generally accepted that cycle accident figures are under reported in Great Britain and there may also be inaccuracies in the figures for cycle kilometres used to calculate the rates shown in Table 1.2. There is also significant variation in these rates year to year (the average pedal cycle killed and seriously injured rate over 1999-08 is about 9% higher than the 2008 figures). It should of course be noted that the majority of these roads do not have cycle facilities.

3.40. 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.

<u>Recommendations</u>

3.41. Changes in the numbers of accidents 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).

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

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

3.44. For new pedestrians – for a well-designed facility, any increase in accidents 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.

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

Example

3.46. In a study of proposed cycling and walking facilities on the National Secondary Roads network, an analysis was made of the possible changes in the numbers of accidents associated with the proposed infrastructure. After careful consideration of the possible accident rates associated with the infrastructure proposed, it was decided to assume no change in accident numbers beyond that already taken into account in the health benefits calculations.

Changes in Journey Time for Walkers and Cyclists

Discussion

3.47. Journey time savings can be calculated for walkers and cyclists in the same way as for other road users. This benefit occurs to existing walkers 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 walkers and cyclists. A speed assumption is required (e.g. 4 kph for walkers and 20 kph for cyclists). Values of time can be taken from *PAG Unit 6.11: National Parameter Values Sheet*.

Recommendations

3.48. Journey time changes for cyclists and walkers should be calculated and valued using the values of time in *PAG Unit 6.11: National Parameter Values Sheet*. Any benefit to new users (cyclists or walkers) 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.

Other Possible Impacts of Walking and Cycling Facilities

Discussion

3.50. 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 walk or cycle trips but also on an associated reduction in motorised trips.

3.51. 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*).

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

- Air quality;
- Climate;
- Noise;
- Accident 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.

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

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

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

Recommendations

3.55. 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.

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

3.57. 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)

Discussion

4.1. For a road scheme which has cycling and walking facilities associated with it modifications should be made to the PABS to represent the incremental effect of the walking and cycling facilities on the overall scheme. For a scheme which is solely a cycling and/or walking scheme, the PABS should reflect the impacts of the scheme. For details of how to represent impacts in the PABS see *PAG Unit 7.0: Project Appraisal Balance Sheet*. The main impacts of both types of schemes are those discussed in detail above.

Recommendations

4.2. 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 Walking and Cycling 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	Accidents	There may be changes in accident numbers for existing users if the new facility alters the accident rate. There may be changes in accident numbers as a result of new cyclists and pedestrians.	Changes in accident numbers and the value of these changes
	Security	There is a potential Security benefit as a result of a reduced fear of accidents 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 cyclists and walkers: • Health • Absenteeism • Journey ambience • Journey time savings	Benefits can be quantified and valued and compared with the costs. For a road scheme which includes walking and/or cycling facilities, the PVB and PVC of the scheme will need to be adjusted 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	Cycling and walking 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).	-

5. Post Project Review

Discussion

5.1. Guidance on post project reviews (Goodbody Economic Consultants, 2009) indicates that post project reviews should be carried out for all projects costing in excess of €30 million and a sample of at least 5% of all projects generally. If cycling and/or walking facilities have been assessed as part of a larger project then these assessment of these facilities should be included in the post project review for that project. Projects which consist only of cycling and walking facilities (which are unlikely to reach the €30 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.

5.2. Of particular interest in the post project review will be the accuracy of the forecasting of demand for the cycling and/or walking facilities. It is recommended that the post project review should be commenced one year after project opening (Goodbody Economic Consultants, 2009), but consideration should be given to whether cycling and walking demand has responded fully to the intervention after this period. Real world evidence of how long it takes for cycling and walking levels to change in response to an intervention is sparse, but the figures used in the case studies in UK DfT (2010a) compare pre-project and post-project figures collected 2-3 years later.

5.3. There is little published evidence on the effect of cycling and walking 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 cycling or walking 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.

Recommendations

5.4. 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 forecasts in relation to construction costs, demand and accidents. 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.

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

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

6. Key References

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