STAG Technical Database Section 8

Safety

November 2015

Transport Scotland

Version History

Changes since STAG Refresh, May 2008

Change number	Section updated	Date
1	New sections 8.2.2, 8.2.3, 8.2.4 calculation of accident benefits	April 2009
2	Section 8.3.1 Assessment of security	April 2009
3	Section 8.5 Reporting	April 2009
4	NESA Update	November 2015

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8. Safety

The Safety Criterion includes two sub-criteria which the Part 2 Appraisal process should consider in detail:

- Accidents; and
- Security.

8.1 Introduction

The promotion of a safer transport system is a high-level objective included in *Scotland's Transport Future* (2004) and retained in the *National Transport Strategy for Scotland* (2006). The Safety Criterion covers two sub-criteria; to reduce accidents and to improve security.

Practitioners should note that the safety values derived via the methodology described below should be presented independently in the Safety Part 2 Appraisal Summary Tables, and not included with the TEE results. This is to avoid double counting and is consistent with the guidance for the Environment Criterion.

8.1.1 Accidents

The application and inclusion of monetary valuations on casualties and accidents of differing severity is now standard in UK cost-benefit analysis; however, within the STAG Appraisal, the monetary value should not be included in the TEE analysis, which is solely for economic impacts (See section 12.7 – Headline indicators in STAG). In transport appraisal, accidents can impose a wide range of impacts on people and organisations including medical and healthcare costs, losses in economic output, material damage, emergency services costs, insurance and legal costs and, more controversially, an allowance for the pain, grief and suffering incurred. In some cases there is concern with the direct safety performance of the system, it is therefore helpful to estimate accident numbers directly as well.

Practitioners are advised to consider whether the option under consideration will have any measurable impact on the number of transport related accidents and/or their severity.

If measurable changes to accident numbers and/or severity are identified as important impacts of an option, then practitioners are advised to adopt well established methodologies to aid the quantification of road traffic accidents and only in exceptional circumstances to depart from such methodologies.

For a rail-based public transport scheme practitioners should assume, in the first instance, that accidents associated with the option are negligible. For public transport options that involve shared running, practitioners should seek the advice from the Scottish Government and/or its agency Transport Scotland. For maritime and aviation options, practitioners should seek the advice of the respective safety agency.

8.1.2 Security

The Safety Criterion is also concerned with improving the personal security of travellers and their property, including pedestrians, cyclists and equestrians as well as public transport and car users. The security of public transport passengers increases with the provision of surveillance, design features which reduce the opportunities for attackers to surprise travellers and facilities for making emergency calls. The security of car users increases when the instances when they are required to stop or travel very slowly are

reduced, vehicles can be parked in safety and facilities for making emergency calls are increased.

Where appropriate, consideration should be given to any security impacts of an option. Options may impact on a range of users including pedestrians, cyclists (and stored/secured cycles) and equestrians as well as public transport and car users. The security sub-criterion should also consider the impacts of an option on particularly vulnerable sections of the community such as children, the elderly or women travelling alone.

The approach to considering security is largely qualitative, but practitioners are invited to adopt quantitative methods if they are robust and have been discussed with the Scottish Government and/or its agency Transport Scotland (or other appropriate funding agency) beforehand.

8.2 Accidents

The impact of an option on the number of transport related accidents and/or severity should be considered. If measurable changes to accident numbers and/or severity are identified as important impacts of an option then use should be made of established methodologies to aid the quantification of road traffic accidents. Only in exceptional circumstances should practitioners depart from such methodologies.

8.2.1 Assessment of Road Accidents

For options which could change road traffic accident numbers and/or the severity of road traffic accidents, the recommended approach to appraising the accident impacts should be followed during Part 2 Appraisal. The recommended approach to appraising the accident benefits or disbenefits in Part 2 (as discussed below) is consistent with the methodology set in the NESA manual (DMRB Vol. 15).

Standard methodologies exist for calculating the projected number of accidents, the types of accidents and associated casualties in the do-minimum and do-something. The methods relate road traffic (measured by vehicle kilometres) to the number of accidents via the application of an accident rate. Accident rates (and casualty rates) for different road types are set out in the NESA manual and these should be used by practitioners. The accident and casualty rates given in the NESA manual are equivalent to those used in the DfT's economic appraisal program COBALT (up to November 2014). It should be noted that DfT's COBALT software includes recent revisions to accident rate parameters as defined in WebTAG (November 2014). These accident rates have a 2010 Base Year. Due to a limited dataset, the link category parameter values do not have the same level of disaggregation as before, and are difficult to apply to road schemes in Scotland. Consequently, the accident rate values in new versions of NESA will retain, for now, the 2000 Base Year accident rates. Transport Scotland will be working with DfT colleagues to revisit these values and establish a much more comprehensive dataset.

It should also be noted that accident rates and accident severity rates (casualties per accident) are predicted to change over time irrespective of whether or not a specific intervention is being considered. A full discussion of the accident rates etc. and the forecast changes over time is contained in the NESA manual (Part 6).

Standard cost values are attributed to fatal, serious and slight casualties allowing the monetisation of accidents in the before and after scenarios, and hence the calculation of the benefits or otherwise of an option. The standard costs per accident are given in the NESA manual. These include the casualty costs plus the costs per accident for insurance administration, damage to property and police costs for different types of accidents on different types of roads. Although average accident costs in Scotland are generally higher than for Great Britain as a whole, it is not possible to provide Scottish accident costs at the degree of disaggregation required for NESA. The accident costs in the NESA manual are therefore equivalent to those used in the DfT's economic appraisal program COBALT.

The calculation of monetised accident costs and benefits of a road related option should follow well established methodology (as detailed in the NESA manual). For road related options it is generally considered best practice (and easiest) to carry out the accident analysis by undertaking a NESA or COBALT assessment as NESA and COBALT will apply all the predicted changes over time etc. automatically. (NESA or COBALT 'accident only' assessments can be undertaken where alternative traffic assignment models have been adopted).

However, in exceptional cases, it may be felt by the practitioner that the established methodology does not allow the full benefits of a unique and particular option to be

identified or that it may overstate the likely scale of the benefits. For example, accident reductions due to work to address a particular black-spot may not be sufficiently captured by the NESA rate-based methodology, or the rate-based approach may not capture the benefits of improving crossing facilities near a school. In such cases, practitioners may, with extreme caution, undertake an additional quantitative or qualitative assessment. Any such departure from the established methodology should however be agreed with the relevant Overseeing Organisation. Care must always be taken to ensure that such an approach is based on sufficient historical data and should avoid falling into the trap of calculating benefits of improvements which are, in fact, simply due to the random nature of accidents. Further advice and guidance is contained in the NESA manual (Part 6).

STAG allows a qualitative assessment of accident benefits to be included. A qualitative assessment can be used to highlight matters including, but not limited to:

- The user groups affected by safety improvements, for example car occupants, pedestrians and cyclists;
- A change in the balance of accidents, for example fewer fatalities or serious injury accidents, but an increase in slight injury accidents; and
- Any uncertainties in the assessment, such as a view that the rate based calculation either under or over estimates accident savings.

The rate-based methodology requires projections of vehicle-kilometres in the do-minimum (or reference case) and do-something scenarios. Such projections could be sourced from transport models, or may be derived from other data as appropriate for the scale and type of intervention being considered (e.g. traffic counts combined with growth rates).

For public transport options, changes in accidents involving traffic due to a transfer of trips away from cars to public transport are captured by the NESA rate-based approach reviewed above. To use the NESA rate-based approach it is necessary to develop a projection of the reduction in car vehicle-kilometre due to the option. These could be sourced from a transport model, or could be derived from other available data combined with reasonable assumptions.

8.2.2 Assessment of Rail Accidents

Current Government advice is that accidents on segregated rail-based systems are negligible and so need not be considered. For systems that involve shared running by rail and other road vehicles, promoters should seek the advice of the Scottish Government and/or its agency Transport Scotland on how to consider accidents in the appraisal of such options.

8.2.3 Assessment of Walking and Cycling Accidents

In common with the assessment of accidents for road vehicle schemes, it is expected that the primary starting point for the assessment of accidents for walking and cycling schemes will be identifying the change in the number of users and the route type; however, Transport Scotland recognize that this is an area which is not well researched and provides significant challenges, given the variety of different facilities which could form part of a scheme and the amount of time needed to establish changes in the number of accidents which result from a scheme. Guidance in this area is the same as that provided by the Department for Transport.

Possible methods for estimating accident rates could include comparative studies of the performance of existing similar schemes combined with expert judgement. In all cases, the detail of the design might be crucial, as there are clear differences in scale and sensitivity compared to schemes for motorised users. Clearly, the monitoring and

evaluation of cycling and walking schemes is important in order to provide more robust input to the analysis of further schemes.

The introduction of an intervention may also demonstrate a large enough mode shift in the modelling to produce significant reductions in accidents associated with other modes. This will have the effect of increasing the value of a scheme where fewer traffic accidents occur. Where this is the case, such considerations must be included in the appraisal. Monitoring techniques such as stated preference surveys are useful in determining potential mode shift where walk and cycle users state that an alternative mode of transport was available to them.

There is good evidence to suggest that increasing levels of cycling does not result in an equivalent increase in the numbers of accidents involving cyclists (all other things being equal). Jacobsen (2003) used American and European data to create a power function model of the type:

$I = aE^b$

Where:

I = injury measure
E = measure of walking and cycling
a = a constant
b = a constant and was found to be approximately 0.4

This implies that a doubling of cycling would only lead to a 32% increase in the number of cycling accidents (20.4 = 1.32) and that therefore the cyclist accident rate decreases. It seems intuitive that this model is applicable for cases above a certain critical mass of walkers and cyclists. For very small values, one should be careful in the application of this model as a close-to-linear increase in accidents per additional unit may well be more appropriate. The evidence base for this requires expanding through further research and monitoring.

Ideally one should incorporate the background changes to walking and cycling accident rates, which may indeed be decreasing over time. This may be due to increased bicycle safety, awareness and public information campaigns.

Where facilities are being introduced which are expected to have a significant impact on the accident rate for cyclists and pedestrians, such mitigation is likely to have a more significant local impact than any increase in these modes.

Once the accident forecasts have been completed, one can then assign economic values to those accidents in order to derive the benefits or costs brought about by the intervention. The NESA Manual contains monetary values for accidents of different severity: fatal, serious and slight (DfT, 2004d). These accident costs should be uplifted over time in line with increases in real GDP per capita, somewhat offsetting the discounting process.

8.2.4 Assessment of Maritime and Aviation Accidents

For options in the marine or aviation sectors that are expected to have a measurable impact on accident rates or the risk of accidents, specific advice should be sought from the Maritime and Coastguard Agency and the Civil Aviation Authority, as appropriate.

8.3 Security

The Safety Criterion is also concerned with improving the personal security of travellers and their property, including pedestrians, cyclists and equestrians as well as public transport and car users. The aim of this sub-criterion is to assess and reflect changes in security arising from a particular transport option and the likely number of users affected.

8.3.1 Assessment of Security Sub-Criterion

In the Part 1 Appraisal, practitioners have considered whether the option under consideration has any material impact on security for the users. Where impacts have been identified, to complete the security sub-criterion in the Part 2 AST, it is recommended that the methodology and approach applied is consistent with that set out below. A key set of security indicators for public transport passengers, roads, and walking and cycling are illustrated in Tables 8.1, 8.2, and 8.3 respectively. This set is not exhaustive, but it is anticipated that it will be sufficient for most schemes; however, practitioners may wish to consider including other indicators they feel are relevant for the options they are appraising.

Where appropriate, consideration should be given to the security impacts of an option. Options may impact on a range of users including but not limited to equestrians as well those shown here. The security sub-criterion should also consider the impacts of options on particularly vulnerable sections of the community such as children, the elderly or women travelling alone.

Table 8.1: Security Indicators for Public Transport Passengers

Security Indicator	Poor	Moderate	High
Site perimeters, entrances and exits	Unmarked or poorly marked site perimeters, exits etc. Use of solid walls or similar.	Attention to boundary and exit marking, but otherwise unfavourable use of materials.	Clearly marked site perimeters/exits. Use of open fencing rather than solid walls.
Formal surveillance	No CCTV system in place. Design discourages staff surveillance and isolates passengers.	CCTV system in place, but number, location of system not optimal. Poor design which discourages staff surveillance.	Effective CCTV system in place. Design to encourage staff surveillance and group passengers.
Informal surveillance	Poor use of materials (fencing etc) and design. Poor visibility from site surrounds. Very isolated from retailers or other human activity.	Unfavourable use of materials (fencing etc) but reasonable proximity of retailers or other activity.	Positive use of materials (fencing etc) and design to encourage open visibility from site surrounds. Encouragement or proximity of retailers or other activity.
Landscaping	Landscaping features (design, plants etc) inhibits visibility and encourages intruders.	Evidence of some positive use of landscaping features (design, plants etc), but more measures needed to contribute to visibility and deter intruders.	Positive use of landscaping features (design, plants etc) to contribute to visibility and deter intruders.
Lighting and visibility	Poor design including recesses, pillars, obstructions etc which hinder camera/monitor view. Poor or no lighting in passenger areas at night when facility open. No or poor lighting on any signing, information or help points.	Design includes some recesses but not problematical to camera/monitor view. Lighting in passenger areas at some, but not all times when facility open. Lighting not to daylight standard. Attention to lighting on signing, information and help points.	Good design to avoid recesses and facilitate camera/monitor view. Lighting to daylight standard in passenger areas when facility open. Attention to lighting on signing, information and help points.
Emergency call	No or very poor provision of emergency phones, help points and public telephones. Little provision or information on emergency help procedures.	Basic provision of emergency phones, help points and public telephones. Improvements to these and on emergency help procedures needed.	Good provision of emergency phones, help points, public telephones and information on emergency help procedure

Source: DETR Mobility Unit (1998b)

Table 8.2: Security Indicators for Roads

Security Indicator	Relevant Locations	Poor	Moderate	High
Formal surveillance	Service areas, car parks, some roads	No CCTV system. Presence of security staff not apparent.	CCTV system in place but number, location not optimal. Passive system monitoring by staff.	Effective CCTV system in place, used for active real-time monitoring.
Informal surveillance	Service areas, car parks	Poor design that hinders observation of public areas by staff.	Neutral characteristics	Design features facilitate staff monitoring.
Landscaping	Service areas, lay-bys	Landscaping features (slopes, trees etc.) inhibit visibility. For lay-bys, not visible from road.	Generally good, but with a small number of features that conceal areas	Clear sight lines exist to all areas. No concealed areas. For lay-bys, clearly visible from a distance.
Lighting and visibility	Service areas, car parks, lay-bys and possibly trunk & slip roads	Large areas obscured from view or unlit	Few areas where lighting is dim or absent	Well lit, no areas obscured from view
Emergency call facilities	Car parks, lay-bys	Difficult to locate, damaged or non-functional	Reasonable level of service	Well located, easy to identify & in full working order
Pedestrian and cyclist facilities	Bridges and under-passes	Obscured from view, poorly lit	Reasonable features	Well lit, designed for visibility

Source: Department for Transport

Table 8.3 Security Indicators for Walking and Cycling

Security Indicator	Poor	Moderate	High
Route length and facilities.	Unmarked or poorly marked paths/cycleway, no signage, etc.	Attention to route marking and signs, but not separated from main vehicular flows.	Clearly marked and signed route, separated from vehicular flows. Rest/secure parking facilities.
Formal surveillance	No CCTV system. Presence of security staff not apparent.	CCTV system in place but number, location not optimal. Passive system monitoring by staff.	Effective CCTV system in place, used for active real-time monitoring.
Informal surveillance	Poor design that hinders observation of public areas by staff.	Neutral characteristics	Design features facilitate staff monitoring.
Landscaping	Landscaping features (design, plants etc) inhibits visibility.	Evidence of some positive use of landscaping features (design, plants etc), but some areas concealed and more measures needed to contribute to visibility.	Positive use of landscaping features (design, plants etc) to contribute to visibility. Clear lines of sight and no concealed areas.
Lighting and visibility	Large areas unlit or obscured from view. Poor or no lighting in night . No or poor lighting on any signing, information or help points.	Few areas where lighting dim or absent Attention to lighting on signing, information and help points.	All areas well lit. Attention to lighting on signing, information and help points.
Emergency call	No or very poor provision of emergency phones, help points and public telephones. Little provision or information on emergency help procedures.	Basic provision of emergency phones, help points and public telephones. Improvements to these and on emergency help procedures needed.	Good provision of emergency phones, help points, public telephones and information on emergency help procedure

Using these indicators practitioners should complete Table 8.4 to assess the impact of an option on security. Where the option involves more than one mode, separate versions should be completed. This assesses the level on each security indicator before and after the implementation of the option being appraised.

Table 8.4: Assessment of Security Sub-Criterion

Security Indicator	Relative importance (High/Medium/Low)	Vulnerable groups of society affected	Without strategy (Poor/Moderate/High)	With strategy (Poor/Moderate/High)
Site perimeters, entrances and exits				
Formal surveillance				
Informal surveillance				
Landscaping				
Lighting and visibility				
Emergency call				

Completion of the table should be accompanied by an assessment/details of:

- Approximate numbers of users affected;
- Overall assessment on security (marginal/moderate/major positive or negative, or neutral);
- Reference source(s); and
- Qualitative comments.

Where possible there should be a link between the assessment of security related problems and the appraisal of security in the AST. Public consultation can inform the appraisal of security improvements in a similar way as it can inform the identification of problems associated with security of a particular mode (see section 8.4).

At Part 2 Appraisal, it will be necessary to introduce quantitative measures to the appraisal to complement or even replace qualitative measures. Examples include:

- Outputs from surveys designed to capture users' perception of security in different scenarios or assess their preference for different security measures. An example of the latter could include surveys where participants are asked to prioritise security related improvements by allocating a fixed sum of money to different measures;
- Quality of service monitors which explicitly capture perception of security at different facilities; and
- 'Before' and 'After' surveys of levels of use of comparative facilities where security enhancing measures have been introduced.

If practitioners are considering deviating from the methodology outlined in the STAG technical database, they should consult with the Scottish Government and/or its agency Transport Scotland through the STAG mailbox or other relevant means or such other funding agency as is appropriate.

8.4 Participation and Consultation

Participation and consultation are of particular value to informing both the appraisal of security improvements and the identification of problems associated with security of a particular mode.

8.5 Reporting

This section of the STAG Report should describe which, if any, user groups are affected by the options. The calculation of monetised accident costs and benefits follows a well established methodology and no detailed further descriptions are required. However, where the methodology does not allow the full benefits of an option to be identified then this, and any additional analysis should be included in the report and summarised in the Part 2 AST.

The monetised present value of safety benefits should be reported under the safety criterion in the AST; it should not be reported as part of the TEE analysis, which is meant to show only economic impacts. Further guidance on calculating present values can be found in Section 9.5 – Appraisal Parameters.

Further guidance on how to report monetised values of safety benefits is set out in Section 12 – Headline indicators in STAG.