

Roads Service Policy & Procedure Guide: RSPPG_E058

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Classification

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Notes

Certification

This document complies with Roads Service Policy. For Implementation and Issue Dates, see above.

Signed RJM Cairns Director of Engineering

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1 Introduction

1.1 Purpose

This Roads Service Policy & Procedure Guide (RSPPG):-

- a) Is aimed at all Roads Service staff involved with compiling estimates for Major Works schemes at all stages of the scheme development.
- b) Defines the procedures involved in obtaining RSHQ approvals for scheme estimates.
- c) Provides guidance on how allowance should be made for risks/ uncertainty.
- d) Provide guidance on the preparation of estimates in a consistent format enabling project costs and performance to be reliably compared and benchmarked.

1.2 Definitions

1.2.1 SP is Strategic Programmes.

1.2.2 SRIHQ is the Strategic Road Improvements Team in HQ

1.2.3 TEPU is the Transportation and Engineering Policy Unit in HQ

1.2.4 Investment Decision Maker (IDM) is the Roads Service Board.

1.2.5 The Director of Strategic Programmes is responsible for monitoring and approving the changes in the scheme estimate on behalf of the Roads Service Board acting as IDM.

1.2.6 Project Owner¹ (PO) is normally the Divisional Roads Manager (DRM). The DRM has primary ownership of the relevant scheme estimate.

1.2.7 Project Sponsor (PS) will normally be a PPTO in the Divisional Strategic Road Improvement Team or Network Services.

1.2.8 Estimate is a calculated prediction of the amount of money required to undertake a specified scope of work for the base year in which it was prepared.

1.2.9 Risk is defined as uncertainty of outcome, whether opportunity or threat, of actions and events which could affect the objectives of an organisation, schedule or project.

¹ Also known as the Senior Responsible Owner (SRO)

1.2.10 Risk Register is a document that collates risks and outlines mitigation measures throughout the life of the project.

1.3 **Background**

1.3.1 As a scheme progresses through the early inception stages to the pre-tender estimate the elements of uncertainty and risk reduce as the scheme is developed and information is confirmed. The optimism bias relating to the estimate has to be carefully assessed and applied appropriately at the relevant level (Appendix 3).

1.3.2 It may also be appropriate to apply higher levels of optimism bias than that indicated in this guidance where there is a high level of uncertainty to a scheme.

1.3.3 Scheme Estimates must be reasonably accurate. It is important that the Investment Decision Maker and other approving bodies (such as DFP) are given robust information on the total cost of the scheme (including land and consultants fees). This will help ensure Roads Service retains its credibility as a competent custodian of financial resources and a professional programme manager. There is also an expectation from those controlling government finances that Roads Service will live within a finite funding envelope for SRI schemes which form the basis of the current programme.

1.3.4 In all cases the following must be avoided:

- instances where the scheme estimate increases significantly, either in one jump or over a series of moves;
- systematic estimate creep, where scheme estimates consistently increase over and above the rate of inflation;
- estimating low to get a scheme on the programme and once secure increasing the estimate to more realistic levels; and
- the practice of new consultants coming to a scheme and seeking a significant increase in the estimate, often to give themselves a higher tolerance level.

1.3.5 Scheme estimates may need to be increased from time to time, sometimes for good reason. For example:

- a change in the price base – until a scheme enters the Construction Programme (i.e. contract award) the price base is usually at current prices which need to be updated from time to time in line with construction price inflation.
- unforeseen cost increases outside Roads Service's control: e.g. significant increases/decreases in the estimated cost of land acquisition notified to us by the LPS;

- changes in the scope of the scheme: e.g. providing a high standard off-line dual carriageway with grade separation instead of the on-line option that was originally envisaged – where this occurs it is important to report the estimate for the original scheme and the additional cost for the improved standard, thus giving the Investment Decision Maker the opportunity to decide whether or not to endorse the improved standard at increased cost.

1.3.6 There are also other less acceptable reasons for increases in scheme estimates which lead to poor estimating such as failure to:

- include the appropriate compensating adjustment for optimism bias;
- include the cost of key elements of the scheme;
- allow for, or undertake timely investigations into, high-risk items such as ground conditions, archaeology or underground services;
- have regard for the scheme estimate during scheme development, resulting in over-ambitious schemes;
- check the scheme estimate against a high-level estimating model using the cost of previous recent schemes (e.g. cost of normal standard dualling per kilometre, cost per compact grade separated junction etc.)

1.4 **Costs and Benefits**

1.4.1 This RSPPG is the formalisation of existing practice, the costs and benefits are not relevant at this time

2 Roads Service Policy & Procedure

2.1 Major Works Estimating

2.1.1 Estimates are prepared and reviewed throughout the life of a major works scheme at the following milestones:

- (i) Feasibility Report;
- (ii) Preliminary Options Report;
- (iii) Preferred Options Appraisal Report;
- (iv) Economic Appraisal Report;
- (v) Pre-Tender Estimate;
- (vi) Tender Cost; and
- (vii) Any stage a major change, amendment or review occurs in the life of a project.

2.1.2 Responsibility for the scheme estimate passes to the Project Owner when appointed.

2.1.3 The guidance on Optimism Bias and Quantified Risk Assessment in Appendix 3 should be applied when compiling estimates.

2.2 Level of Cost-Estimation Required through Scheme Development

A Programme Scheme Estimate should be produced at each stage of development, contained initially within an Options Range and then within an Estimate Range, when the Preferred Option has been identified.

		Feasibility Report	Preliminary Options	Preferred Options	Economic Appraisal & Stage 3	Pre-tender Estimate	Tender Cost
Estimate Management	Programme Scheme Estimate	Produced	Updated	Updated	Refined	Refined	Refined
	Options Range	Produced	Refined				
	Estimate Range			Produced	Refined ²	Refined	Refined

2.3 Programme Scheme Estimate

2.3.1 The Programme Scheme Estimate is a single point estimate identifying the “most likely” cost of the scheme. Accordingly the Programme Scheme Estimate uses a “most likely” assessment of optimism bias and risk. The Programme Scheme Estimate is commonly referred to as the Scheme Estimate.

2.3.2 This estimate will be used for programming and profiling purposes by SRIHQ.

2.3.3 At feasibility and preliminary options stage, before a preferred option has been identified, the Programme Scheme Estimate will be agreed between SRIHQ and the Project Team.

2.4 Options Range

2.4.1 In the conception stages there will be various options identified to meet the scheme objectives and to ameliorate the problems. The range in cost between the various options is known as the Options Range.

² The Upper Bound limit of the Estimate Range is to be used as the estimate for the DFP Economic Appraisal. Refer to section 2.4.

- 2.4.2 Not every scheme will undertake a feasibility study prior to the preliminary options stage. However for those schemes that do, depending on the specific purpose of the feasibility study, an attempt should be made to estimate the cost of each feasible option being brought forward. The Options Range will be developed from the most expensive and the least expensive options. It is recognised that this level of detail may not always be available.
- 2.4.3 At preliminary options stage there may be 1 preferred option, (generally identified as a preferred corridor), or there may still be 2 or 3 leading options. The construction costs for all recommended options are to be developed with an appropriate level of detail. If there is only a single preferred option, the Options Range will be developed from the uncertainties within the option.
- 2.4.4 An assessment of potential Blight (particularly in urban areas) will also need to be undertaken at preliminary options stage. This risk allowance will be included in the estimate.
- 2.4.5 If it is necessary to state scheme costs publically in the early stages of development the Options Range should be used. This should be accompanied by a caveat stressing that this is an indicative assessment to give perspective to the likely scale of the works involved, until sufficient detail is developed to identify a preferred solution. Project Owners should nonetheless endeavour to ensure the Options Range is as realistic as possible.

2.5 Estimate Range

- 2.5.1 Once the Preferred Option has been identified an Estimate Range should be established. This will be contained by an Upper Bound and a Lower Bound Estimate and identifies the range within which it is expected the scheme cost will fall. The Estimate Range demonstrates that there is uncertainty over the estimated scheme cost before detailed design has taken place. It is however expected that the Programme Scheme Estimate will remain within the Estimate Range and that this range will narrow as the scheme progresses.
- 2.5.2 The Upper Bound Estimate should be based on maximum plausible levels of optimism bias with the Lower Bound Estimate based on minimum plausible levels of optimism bias. The “most likely” assessment of risk allowance (consistent with the Programme Scheme Estimate) will be included in the Upper and Lower Bound Estimates. The suggested range will be submitted by the Project Owner and agreed by SRIHQ.
- 2.5.3 At the preferred options stage there will still be some uncertainty over the detail of various construction elements, for example the earthworks strategy. Whilst every effort should be made to find the optimal solution these uncertainties should be dealt with in the Quantified Risk Assessment.
- 2.5.4 The Estimate Range rather than a single point estimate will be quoted publically in all press releases, publications, web site etc.

2.6 **Economic Appraisal**

2.6.1 The Economic Appraisal submitted to DFP will seek approval for the Upper Bound limit of the Estimate Range (as explained in section 2.5) that is identified at this stage of scheme development.

2.6.2 This Upper Bound Estimate identifies the plausible worst case scenario. It is this estimate that is used when identifying the Benefit to Cost Ratio (BCR) for the DFP economic appraisal. In the event that the full contingencies are required, then the scheme should remain within the DFP approved figure, thus ensuring acceptable value for money despite the contingencies being expended.

2.7 **Inflation**

2.7.1 With the exception of the tender estimates, all estimates will be expressed in terms of a baseline date. No allowance is to be added for inflation beyond the base date selected on the major works estimate pro-forma. The allowances for inflation are reported separately by SRIHQ.

2.8 **Property Compensation**

2.8.1 Blight costs if applicable normally occur after the announcement of the preferred route but may also occur prior to this. The cost of acquisitions through Blight form part of the scheme cost to Roads Service and therefore should be included as part of the scheme estimate.

2.8.2 As the costs of these acquisitions are realised during the scheme development phase they must be clearly identified as soon as the issue arises to enable SRIHQ to manage budgets accordingly.

2.8.3 The treatment of these costs in economic appraisal is set out in Annex A of WebTAG Unit 3.5.9.

2.8.4 Scheme estimates must also make allowances for The Land Acquisition and Compensation (NI) Order 1973 Part II compensation claims for depreciation caused by public works. These claims are normally served during a 2 year period starting 1 year after the date of opening to public traffic. Allowance should also be made for providing insulation/compensation under the Noise Insulation Regulations (NI) 1995.

2.9 **Procedures for obtaining Director of Strategic Programmes approval**

2.9.1 All major works estimates are required to be approved by the Director of Strategic Programmes.

- 2.9.2 All (Programme) Scheme Estimates from Gateway 0 to Gateway 2 should be itemised on the proforma in **Appendix 1** and signed off by the Project Sponsor and DRM prior to submission to SRIHQ. The upper and lower Range Estimates should also be entered on the proforma.
- 2.9.3 All estimates from Gateway 3 (Pre-Tender) to Gateway 4 (Tender) should be itemised on the proforma in **Appendix 2** and be signed off by the DRM prior to submission to SRIHQ.
- 2.9.4 SRIHQ will consider the (Programme) Scheme Estimate and associated Estimate Range and will seek clarification, if required, before seeking approval from the Director.
- 2.9.5 Gateway approvals can not be advanced until the respective proforma is received and agreed by SRIHQ.

2.10 **Major Works Database / Roads Service Website**

- 2.10.1 SRIHQ retains a database on all major projects in Roads Service. Part of this database records the approved estimates for each scheme, as well as the history of previous estimates.
- 2.10.2 Where necessary the estimates contained therein, and on the Roads Service website, will be adjusted once the estimate proforma has been approved by the Director of Strategic Programmes. The purpose is to provide a system of control which:
- ensures estimates are realistic and up to date; and
 - avoids ad hoc changes without proper authorisation.

3 Equality Impact Assessment (EQIA)

3.1 Equality Impact Assessment Section 75 of the Northern Ireland Act 1998

- 3.1.1 The amendments to this RSPPG are being made to an existing internal document covering internal Roads Service procedures. As the amendments will not have any impact on any Section 75 group it is deemed that an EQIA Screening Analysis / full EQIA is not necessary.

4 References

4.1 General References

4.1.1 None used.

4.2 Endnote References

4.2.1 None used.

5 Appendices

5.1 Appendix 1: Proforma for Major Works Estimate

ROADS Service		Scheme Estimate Approval	
Project:	<input style="width: 90%;" type="text"/>	Division:	<input style="width: 90%;" type="text"/>
Approval Required:	<input style="width: 90%;" type="text"/>	Form:	<input style="width: 90%;" type="text"/>
Construction Costs (i) Preliminary Works <input style="width: 100%;" type="text"/> #DIV/0! (ii) Road Works <input style="width: 100%;" type="text"/> #DIV/0! (iii) Structures <input style="width: 100%;" type="text"/> #DIV/0! (iv) Utilities <input style="width: 100%;" type="text"/> #DIV/0! (v) Other Costs <input style="width: 100%;" type="text"/> #DIV/0! Total Works Costs <input style="width: 100%;" type="text"/> (a) #DIV/0!		Previous Estimate Estimate: <input style="width: 100%;" type="text"/> Approved Date: <input style="width: 100%;" type="text"/> Price Base for this Estimate Quarter: <input style="width: 100%;" type="text"/> Base Year: <input style="width: 100%;" type="text"/>	
Land Costs (No LPS Estimate) (vi) Land Estimate <input style="width: 100%;" type="text"/> (b) #DIV/0!			
Land Costs (Current LPS Estimate) (vii) Land Purchase Cost <input style="width: 100%;" type="text"/> #DIV/0! (viii) Disturbance / Severance / Injurious Affection / Part 2 <input style="width: 100%;" type="text"/> #DIV/0! Total Land Costs <input style="width: 100%;" type="text"/> (c) #DIV/0! Date of Land Estimate: <input style="width: 100%;" type="text"/>			
Sub-total Construction and Land Costs (a+b+c)		<input style="width: 100%;" type="text"/>	(d) #DIV/0!
Consultant Costs (ix) Preparation Costs <input style="width: 100%;" type="text"/> (e) #DIV/0! <input style="width: 50%;" type="text"/> % of d <input style="width: 100%;" type="text"/> #DIV/0! (x) Supervision Costs <input style="width: 100%;" type="text"/> (f) #DIV/0! <input style="width: 50%;" type="text"/> % of d <input style="width: 100%;" type="text"/> #DIV/0! Total Consultant Costs (e+f) <input style="width: 100%;" type="text"/> (g) #DIV/0!			
Total Construction, Land & Consultant Costs (d+g)		<input style="width: 100%;" type="text"/>	(h) #DIV/0!
Risk (xi) Risk Allowance (HARM) <input style="width: 100%;" type="text"/> (i) #DIV/0! Date of Risk Assessment: <input style="width: 100%;" type="text"/> (xii) Optimism Bias <input style="width: 50%;" type="text"/> % <input style="width: 100%;" type="text"/> (j) #DIV/0! <input type="checkbox"/> Tick if OB should NOT be applied to the current LPS Land Estimate (xiii) Land Optimism Bias (if different) <input style="width: 50%;" type="text"/> % <input style="width: 100%;" type="text"/> (k) #DIV/0! <input type="checkbox"/> Tick if OB should be applied to Risk Allowance Total Risk Element (l+j+k) <input style="width: 100%;" type="text"/> (l) #DIV/0!			
Total Estimate (h+l)		<input style="width: 100%;" type="text"/>	Scheme Estimate £ 0m
Estimate Range		<input style="width: 100%;" type="text"/> m	to <input style="width: 100%;" type="text"/> m
DIVISIONAL APPROVAL:			
Estimate prepared by:	<input style="width: 100%;" type="text"/>	Signed: _____	Date: <input style="width: 100%;" type="text"/>
Approved by (DRM):	<input style="width: 100%;" type="text"/>	Signed: _____	Date: <input style="width: 100%;" type="text"/>
SRI HQ APPROVAL:			
Estimate checked by:	<input style="width: 100%;" type="text"/>	Signed: _____	Date: <input style="width: 100%;" type="text"/>
DIRECTOR / RS BOARD APPROVAL:			
Approved by:	<input style="width: 100%;" type="text"/>	Signed: _____	Date: <input style="width: 100%;" type="text"/>
<small>Director of Strategic Programmes / Roads Service Board</small>			
Comments:			
<input style="width: 100%; height: 100%;" type="text"/>			

5.2 Appendix 2: Proforma for Pre-Tender & Post-Tender Costs

(Also available in RSPPG_P003)

Division	<input style="width: 100%;" type="text"/>					
Scheme	<input style="width: 100%;" type="text"/>					
Details of Works	<input style="width: 100%;" type="text"/>					
Comments	<input style="width: 100%;" type="text"/>					
Current Project Estimate	<input style="width: 100px;" type="text"/>	£k	Date Approved	<input style="width: 100px;" type="text"/>		
Contract Period	<input style="width: 100px;" type="text"/>	Weeks				
PROCUREMENT TIMETABLE (Forecast use Month and Year Only, Actual use Day, Month and Year)						
Advertise for restricted list	<input style="width: 100px;" type="text"/>	Issue of tender documents	<input style="width: 100px;" type="text"/>	Award Contract	<input style="width: 100px;" type="text"/>	
Selection of restricted list	<input style="width: 100px;" type="text"/>	Return of tenders	<input style="width: 100px;" type="text"/>	Start work	<input style="width: 100px;" type="text"/>	
Estimated Costs Pre-tender (£k)			Scheme Costs Post-tender (£k)			
a) Consultant Fees	Design <input style="width: 100px;" type="text"/>		Design <input style="width: 100px;" type="text"/>			
	Site Supervision <input style="width: 100px;" type="text"/>		Site Supervision <input style="width: 100px;" type="text"/>			
	Sub-total				<input style="width: 100px;" type="text"/>	
b) Land	<input style="width: 100px;" type="text"/>		b) Land		<input style="width: 100px;" type="text"/>	
c) Advance Works	<input style="width: 100px;" type="text"/>		c) Advance Works		<input style="width: 100px;" type="text"/>	
d) Risk / OB element (for a,b,c)	<input style="width: 100px;" type="text"/>		d) Risk / OB element (for a,b,c)		<input style="width: 100px;" type="text"/>	
Pre-tender Contract Costs			Post-tender Contract Costs			
e) Preliminary Works	<input style="width: 100px;" type="text"/>		e) Preliminary Works		<input style="width: 100px;" type="text"/>	
f) Main Contract Works	Design <input style="width: 100px;" type="text"/>		f) Main Contract Works			
	Build <input style="width: 100px;" type="text"/>		Design <input style="width: 100px;" type="text"/>			
	Sub-total		Build <input style="width: 100px;" type="text"/>			
			Sub-total		<input style="width: 100px;" type="text"/>	
g) Other costs or contributions	<input style="width: 100px;" type="text"/>		g) Other costs or contributions			
	<input style="width: 100px;" type="text"/>		<input style="width: 100px;" type="text"/>			
	Sub-total				<input style="width: 100px;" type="text"/>	
h) Contract Risk Contingency	<input style="width: 50px;" type="text"/>	%	h) Contract Risk Contingency		<input style="width: 50px;" type="text"/>	
	<input style="width: 100px;" type="text"/>				<input style="width: 100px;" type="text"/>	
	Pre-tender Contract Total		Post-tender Contract Total		<input style="width: 100px;" type="text"/>	
Pre-tender Project Estimate			Post-tender Project Cost			
ESTIMATE RANGE (£m)			ESTIMATE RANGE (£m)			
<input style="width: 100px;" type="text"/> to <input style="width: 100px;" type="text"/>			<input style="width: 100px;" type="text"/> to <input style="width: 100px;" type="text"/>			
Expenditure Profile (£k)						
	Paid to Date	2011/12	2012/13	2013/14	Future	Total
Pre-tender Project Estimate	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>
Post tender Project Cost	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input style="width: 100px;" type="text"/>
Signed:	<input style="width: 100px;" type="text"/>	DRM / on behalf of DRM* (*Delete as appropriate)				
Date:	<input style="width: 100px;" type="text"/>					
Signed:	<input style="width: 100px;" type="text"/>	DRM / on behalf of DRM* (*Delete as appropriate)				
Date:	<input style="width: 100px;" type="text"/>					

5.3 Appendix 3: Risk Assessment & Optimism Bias

5.3.1 Introduction

5.3.1.1 Organisations of all types and sizes face a range of risks affecting the achievement of their objectives and Roads Service is no different. While “risk” is commonly regarded as negative, risk management is as much about helping to realise potential opportunities as well as preventing potential problems. It is important to bear this in mind whenever managing risk. Risk management is an essential part of good management.

5.3.1.2 This Appendix does not set out to establish a certifiable process or to produce a totally prescriptive framework rather this document is intended to provide guidance on best practice.

5.3.2 Adjusting for Risk and Optimism Bias

5.3.2.1 Roads Service requires that the base cost estimate should be adjusted to account for risk and optimism bias in order to obtain more accurate cost estimates. (A quantified risk assessment is not required until the preferred options report).

5.3.2.2 The risk adjustment should be calculated first and then the optimism bias applied to the full risk adjusted cost. Generally the land costs should be reported separately and an appropriate rate (if any) of optimism bias applied.

5.3.3 Risk Assessment

5.3.3.1 Risk assessment is required to determine the current level of and exposure to risk, and provide input to decisions on where responses to reduce or exploit risk are required.

5.3.3.2 A risk might have a number of consequences which could be negative or positive. Risk assessment can be undertaken with varying levels of detail depending upon the risk, the purpose of the assessment, and the information, data and resources available. Risk assessment can be qualitative or quantitative, or a combination of these.

5.3.3.3 A qualitative risk assessment is an initial evaluation of risk and determines the type, probability, impact and relative importance of the risk events using ‘expert’ opinion and engineering judgement.

5.3.3.4 A quantitative risk assessment defines the evaluation further by ascribing values to likelihood and impact and determines the range of uncertainty in cost and time, (which translates into cost) to the project out-turn.

5.3.3.5 The qualitative and quantitative assessments are used to develop an understanding of a project's risk in terms of its risk profile, and where and when the risk events might occur, in order to assist with evolving a risk management approach.

5.3.3.6 Each risk should be analysed to an appropriate extent, considering its consequences, and summarised in terms of the consequences arising and their likelihood. The process should be iterative being repeated as more data become available.

5.3.3.7 In most situations, it will be appropriate to carry out a qualitative assessment initially, followed by a quantitative assessment once the key risks from the qualitative assessment have been examined in detail.

5.3.4 **Risk Register**

5.3.4.1 A risk register should be produced at feasibility stage and updated as the scheme progresses.

5.3.5 **Qualitative Risk Assessment**

5.3.5.1 For qualitative risk assessment a 5x5 probability and impact scale aligned to a matrix should be used to ascertain priority.

5.3.5.2 *Probability*

Putting a number to the five categories often helps to give people a common understanding of risk exposure. The table below shows an approach to stating the probabilities of risks occurring.

Rating Level	Likelihood	Description	%
1	Very Low	Virtually impossible	0 to 5%
2	Low	Low but not impossible	6 to 20%
3	Medium	Fairly likely to occur	21 to 50%
4	High	More likely to occur than not	51 to 80%
5	Very High	Probably will occur	> 80%

A risk that has 'no' impact is unlikely to be assessed for probability; no matter how likely it is to occur. Similarly, a risk with zero probability will never happen and therefore presents no risk. Something which has happened or will definitely happen is not a risk, it is certain and should be included in the project cost estimate and programme.

5.3.5.3 *Impact*

Similarly for impact, putting a number to the five categories often helps to give people a common understanding of risk exposure.

For *individual* risks, consider impact separately in terms of the effects on:

- Costs;
- Time (programme and resources); and
- Quality (ability to meet objectives/reputation/information).

Individual risks will have a separate rating for each of the impact areas. Each needs to be defined in terms of appropriateness to the activity against the defined objective for the activity. The ranges should be selected to suit the activity, situation or size of project. The tables below provide examples of impact for individual risks on a project.

5.3.5.4 **Cost** (Budget) Impact

Rating Level	Degree of impact	Description	%	Example for a £50m project
1	Very Low	Minimal impact on project cost	< 0.5%	<£250k
2	Low	Minor impact on project cost	0.5 to 1%	£250k-£500k
3	Medium	Moderate impact on project cost	1 to 3%	£500k-£1.5m
4	High	Large impact on project cost	3 to 5%	£1.5m-£2.5m
5	Very High	Major impact on project cost	> 5%	>£2.5m

Note that whilst a percentage has been given for cost impact this should be converted to a value and then adjusted accordingly for appropriateness to size of scheme. For large projects e.g. over approx £200million then the degree of risk impact should be adjusted relative to the activities undertaken rather than a % based on overall project value. The above impact parameters can further be refined when a project moves into Construction stage.

5.3.5.5 **Time** (Project programme) Impact

Rating Level	Degree of impact	Description	%	Example 2yr programme
1	Very Low	Minimal impact on project programme	< 1%	< 1week

2	Low	Minor impact on project programme	1 to 5%	1 – 4 weeks
3	Medium	Moderate impact on project programme	5 to 10%	1 – 3 mths
4	High	Large impact on project programme	10 to 20%	3 – 5 mths
5	Very High	Major impact on project programme	> 20%	>5 mths

The above impact parameters can be refined when a project moves into Construction stage.

5.3.5.6 Quality Impact

Rating Level	Degree of impact	Generic Description
1	Very Low	Minimal - meets or exceeds mandatory requirements, minimal adverse impact on reputation, service delivery, and information to customers. E.G Some planting failures in new landscaping works not completed. Matrix sign temporarily unavailable during TM.
2	Low	Minor - a few minor shortfalls, some small changes required to rectify. Minor adverse impact on reputation, service delivery, information to customers. E.g. lighting failure
3	Medium	Moderate – some shortfalls requiring moderate changes to rectify but not impacting on delivery of an objective. Moderate adverse impact on reputation, service delivery, information to customers. E.g. temporary drainage failure/flooding during works affects road users.
4	High	Large - a large shortfall with an objective not being met, significant change required to rectify. Large adverse impact on reputation, service delivery, information to customers e.g. speed limit imposed due to poor pavement condition.
5	Very High	Major - a major shortfall with more than one objective not being met and requiring significant changes to rectify. Major adverse impact on reputation, service delivery, information to customers e.g. failure of asset following works.

Note – Appropriate values for quality impact should be defined on the basis of individual project's requirements. It is recognised that many of the quality impacts will be difficult to assess until later in the scheme development and that the contract specification will prevent many items from dropping below a minimum standard.

5.3.5.7 **Project Qualitative Risk Assessment Matrix**

5x5 level probability/impact risk assessment matrix to be used to rank risks:

	PROBABILITY	Very High 5	5	10	15	20	25
	>80%						
	51-80%	High 4	4	8	12	16	20
	21-50%	Medium 3	3	6	9	12	15
	6-20%	Low 2	2	4	6	8	10
	<5%	Very Low 1	1	2	3	4	5
		IMPACT	Very Low 1	Low 2	Medium 3	High 4	Very High 5
CRITICAL RISK							
HIGH RISK	Cost	< 0.5%	0.5 to 1%	1 to 3%	3 to 5%	> 5%	
MEDIUM RISK	Time	< 1%	1 to 5%	5 to 10%	10 to 20%	> 20%	
LOW RISK	Quality	Minimal	Minor	Moderate	Large	Major	

The above matrix is for use on assessing risks to projects. The parameters of Very Low to Very High impact ratings are indicative and need to be tailored to suit the circumstances on the project. The combination of probability and impact assessment gives a risk rating – number and colour. The following table explains the approach in terms of risk exposure and management response.

Risk Exposure	Management Response
Low	Acceptable – monitor risk Ensure adequate allowance included in cost estimates/risk allowances and programme plans
Medium	Manage/mitigate the risk as part of day-day project team activities and re-assess as risk register is updated. Ensure adequate allowance included in cost estimates/risk allowances and programme plans.
High	Focused project management attention is required to address the risk and seek to mitigate. Ensure adequate allowance included in cost estimates/risk allowances and programme plans. Report to Senior Project Management.
Critical	Risk with high likelihood and having significant detrimental impact on the achievement of project objectives which may/may not be effectively controlled by project team. Report to Senior Project Management. May require further upward reporting to Roads Service Board.

5.3.6 Quantitative Risk Assessment

- 5.3.6.1 Quantitative risk assessments (QRA's) are used later in the process when there is a more detailed understanding of the risks including consequences, probabilities and mitigation and management methods.
- 5.3.6.2 A QRA is a key process in developing a detailed quantified understanding of the overall cost and time effects of the portfolio of risk, whether at strategic, programme, or project level. A member from SRIHQ should be invited to Risk Management Workshops.
- 5.3.6.3 They are to be carried out using estimates of the actual costs, delays or other effects of a risk and the percentage probability of the risk occurring. This will usually be done taking into consideration any management of the risk to reduce the chance of it occurring and any mitigation of its effect if it does occur.
- 5.3.6.4 A considerable amount of work needs to be carried out in preparation for a quantitative risk assessment to ensure that the potential cost and time effects of a risk are fully understood. This underlines the importance of the qualitative risk assessment in focusing this activity on the key risks. Preparation work also needs to focus on understanding the likelihood of the risk occurring, potential mitigation measures and the cost and effectiveness of such measures. The quantification of risk provides a probability of occurrence in % terms. The product of probability times consequence provides the expected risk value.

5.3.6.5 There are a number of risk analysis software programs available on the market which use Monte Carlo simulation. Schemes with capital cost estimates of greater than £10M should use such a programme. In using these programmes, it is important to ensure that detailed preparatory work on the key issues is carried out to avoid 'garbage in, garbage out' and the number of iterations carried out is sufficient.

5.3.6.6 The overall cost and time effect is quoted at the percentage confidence levels (i.e. the likelihood that the overall estimate of time or cost for the project including risk allowances will not be exceeded). If used then it is recommended that the 50 percentile level is applied in the estimates. A check should be made on the 80 percentile level and reported to SRIHQ if there is a marked difference.

5.3.7 **Minimum Level of Risk Assessment at Each Estimating Milestone**

A key part of risk management is reviewing implementation of the process to ensure that risks are being proactively and effectively managed on the project and that the exposure to risk is being kept within acceptable/ tolerance levels. Any risk assessment should be commensurate to the size and the stage of development of the project. In addition, the amount of time and resources that are devoted to quantifying risks should relate to how many risks have to be analysed, how difficult that is to do and the materiality of these risks. The table below indicates the minimum level of risk assessment required at each estimating milestone.

		Feasibility Report	Preliminary Options	Preferred Options	Economic Appraisal	Pre-tender Estimate	Tender Cost
Risk and Uncertainty Management	Risk Register	Produced	Updated	Updated	Updated	Updated	Updated
	Qualitative Risk Assessment		Produced	Reviewed			
	Quantitative Risk Assessment (including Monte Carlo Analysis)			Produced	Refined	Refined	Refined

The Risk Register and Quantitative Risk Assessment at the Economic Appraisal and Tender Cost milestones should be forwarded to SRIHQ. SRIHQ will have opportunity to consider the itemised levels of risk before tender documents are issued. The risks detailed at the Tender Cost milestone will be considered in the Post Project Evaluation. This will assess if the appropriate risks were detailed and if the cost allowances were appropriate.

5.3.8 **Optimism Bias**

5.3.8.1 As there is a tendency for all projects to be overly optimistic, project sponsors / managers should make adjustments (i.e. increasing estimates of the capital/operating costs, works duration and decreasing/delaying the receipt of benefits) to reduce this bias. The following paragraphs detail the generic adjustment factors to be included in estimates to make the optimism bias adjustments.

5.3.8.2 *Capital Cost Adjustments*

The spreadsheet in the web link below should be completed. This spreadsheet calculates the level of optimism bias to be used in the Programme Scheme Estimate, based on the project complexity (most road schemes will be *Standard Scheme / Non Controversial*); the stage of preparation and the selected response to each of the 24 statements contained therein.

<http://roadsnet/rshq/sri/OB.xls>

The spreadsheet has default upper bound and lower bound optimism levels for the purposes of the spreadsheet calculations. These figures may be used for the Preliminary Options and the Economic Appraisal cost estimate range. Alternatively if there are valid reasons for using a different scheme specific figure, this may be used. For the Preferred Option cost estimate range the upper bound level of optimism bias will generally be less, at around 35%. Divisions should consult SRIHQ where it is proposed to depart from default levels.

5.3.8.3 *Works Duration Adjustments*

An adjustment process can then be carried out in relation to estimated works duration. The steps below show how to calculate the optimism bias.

Step 1 Determine project type (see following table. Most road schemes will be *Standard Civil Engineering*.)

Project Type	Optimism Bias (%)	
	Works Duration	
	Upper	Lower
Standard Buildings	4	1
Non-standard buildings	39	2
Standard Civil Engineering	20	1
Non-standard Civil Engineering	25	3
Equipment / Development	54	10
Outsourcing	NA	NA

(source: Mott MacDonald)

Step 2 Using your own knowledge, or that given from the Mott Macdonald Study, take the Upper Bound limit for optimism bias (i.e. 20% for standard civil engineering).

Step 3 Adjust the works duration estimate by the optimism bias adjustment (thus, a project initially expected to take 20 months it will now take 24 months).

Step 4 Assess the risk factors, which cause works duration to overrun. HMT (through Mott MacDonald) has provided information on the factors which contribute to time overruns. Those for a standard civil engineering project are set out in the table below.

Contributory Factor to Upper Bound Optimism Bias	% Contribution to Works Duration Optimism Bias	Mitigation Factor (0.0 to 1.0)	Reduction in OB Adjustment %
Poor Contractor Capabilities	16		
Environmental Impact	46		
Inadequacy of the Business Case	8		
Funding Availability	6		
Poor Project Intelligence	14		
Site Characteristics	10		
TOTAL	100		

The next step, therefore, is to examine these factors and to determine if there are actions, which can be taken which would allow these risks to be mitigated. If so, that risk is allocated a risk mitigation factor of 1.0 and the optimism bias adjustment is thus reduced. Ideally, the adjustment will be reduced to the lower bound for the type of project being considered.

Step 5

Following this risk mitigation process, a final risk adjusted works duration estimate is determined. This will be the sum of the column entitled "Reduction in OB adjustment" subtracted from 100% and then multiplied by the Upper Bound works duration optimism bias factor. For example, if the sum of the column entitled "Reduction in OB adjustment" was 70% then the OB would be $(100-70)\% \times 20\% = 6\%$. Therefore if the project was initially expected to take 20 months it will now take $20 \times 1.06 = 21.2$ months.

6 Control Sheet - Roads Service Policy & Procedure Guide: E058

Title: Major Works Estimates

6.1 Document History

Version	Date	Author	Authorised by Document Control Panel Members Name : Signature
1		J. Saulters / S. Wells	P. Hamilton R. Spiers C. Hutchinson

6.2 Overall Reasons for this Version

Version	Reasons
1	First Issue of RSPPG

6.3 Revision Details

Version	Amendments

OPTIMISM BIAS SECTION

Please select appropriate Level of Complexity Standard Scheme / Non-Controversial

Please select appropriate Stage of Preparation Economic Appraisal

Please detail the level of QRA analysis completed and taken into account in the Works Cost Estimate

Basic Optimism Bias Addition Factors :

Scheme Type	Stage of Preparation	Basic Optimism Factor (%)	
		Lower bound	Upper bound
Standard Scheme / Non-Controversial	Preliminary & Preferred Options	15	45
	Economic Appraisal	5	25
Non-Standard / Controversial / Tunnels / Complicated Structures	Preliminary & Preferred Options	32	65
	Economic Appraisal	15	40

Optimism Bias Mitigation Factors

Control	Cause	Evidence Required	Select	%
Value Management	Poor planning Delivery fails to meet objectives Lack of innovation Stakeholder involvement Critical item programme Scope change / late changes in design	Workshop undertaken with facilitator independent of project	<input checked="" type="checkbox"/>	13.33
		Stated objectives expressed to team/stakeholders	<input checked="" type="checkbox"/>	13.33
		Optioneering undertaken differentiating using performance criteria	<input checked="" type="checkbox"/>	13.33
Site Surveys / investigations	Buildability issues unknown until construction Unforeseen service diversions Unforeseen archaeological find	Desktop study identifies likely risks (comply with HD22 process)	<input checked="" type="checkbox"/>	5.00
		Environmental stage two surveys completed and reported	<input checked="" type="checkbox"/>	5.00
Risk Management	Fail to sufficiently scope project Contractual disputes Delivery fails to meet objectives Optimistic benefits	Workshop carried out with facilitator independent of project	<input checked="" type="checkbox"/>	5.00
		Uncertainties in scope and risk contingency defined	<input checked="" type="checkbox"/>	5.00
		Evidence risk register is continually updated / risks managed	<input checked="" type="checkbox"/>	5.00
Identify internal and external approvals and prepare timeline	Third party approvals not granted Fail to secure permits, consents approvals	Communication plan in place	<input checked="" type="checkbox"/>	3.75
		Potential changes in ministerial/local strategy identified in risks	<input checked="" type="checkbox"/>	3.75
		Approvals built into project programme	<input checked="" type="checkbox"/>	3.75
		Written communications with key third party stakeholders	<input checked="" type="checkbox"/>	3.75
Effective governance	HA corporate governance/political/standards influences Lack of adequate change control Funding availability Duration to construction start Construction duration	Scope of works, objectives and scheme outputs documented	<input checked="" type="checkbox"/>	1.67
		Deliverables at key gateways defined	<input checked="" type="checkbox"/>	1.67
		Change control system implemented/experienced Project Leader	<input checked="" type="checkbox"/>	1.67
		Adequate funds allocated within specific spend years	<input checked="" type="checkbox"/>	1.67
		Detailed programme for development reflecting most likely option	<input checked="" type="checkbox"/>	1.67
		Detailed programme available from ECI contractor	<input checked="" type="checkbox"/>	1.67
Clear roles and responsibilities	Contractual disputes Poor communication Duplication	Organogram exists	<input checked="" type="checkbox"/>	1.67
		Procurement route selected	<input checked="" type="checkbox"/>	1.67
		Role of client/consultant expressed in terms of reference	<input checked="" type="checkbox"/>	1.67
Estimates cost/benefits independently verified	Estimates unsound	Cost build-up independently checked & signed	<input checked="" type="checkbox"/>	1.67
		Comparison made on cost build-up and use of benchmarked prices	<input checked="" type="checkbox"/>	1.67
		Independent check of this checklist	<input checked="" type="checkbox"/>	1.67
			TOTAL	100.0%

Gross, Mitigated Optimism Bias calculation :

Upper Bound = Lower Bound = Difference = x = Gross OB =

Total Optimism Bias which will be applied to this Cost Estimate =

- LAND -

OPTIMISM BIAS SECTION

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Site Surveys / investigations	Buildability issues unknown until construction Unforeseen service diversions Unforeseen archaeological find	Desktop study identifies likely risks (comply with HD22 process)	<input checked="" type="checkbox"/>	5.00
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		Comparison made on cost build-up and use of benchmarked prices	<input type="checkbox"/>	-
		Independent check of this checklist	<input type="checkbox"/>	-
			TOTAL	95.0%

Gross, Mitigated Optimism Bias calculation :

Upper Bound = Lower Bound = Difference = x = Gross OB =

Total Optimism Bias which will be applied to this Cost Estimate =

OPTIMISM BIAS SECTION

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		Comparison made on cost build-up and use of benchmarked prices	<input type="checkbox"/>	-
		Independent check of this checklist	<input type="checkbox"/>	-
			TOTAL	77.9%

Gross, Mitigated Optimism Bias calculation :

Upper Bound = Lower Bound = Difference = x = Gross OB =

Total Optimism Bias which will be applied to this Cost Estimate =

- LAND -

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			TOTAL	77.9%

Gross, Mitigated Optimism Bias calculation :

Upper Bound = Lower Bound = Difference = x = Gross OB = Lower Bound

Total Optimism Bias which will be applied to this Cost Estimate =