8 Risk and Uncertainty

8.1 Introduction

The aim of this section is to contribute, through assessment of risks, uncertainties and optimism bias, to determining the best possible estimates of the costs and benefits of each option.

One of the fundamental considerations of the assessment process is that of "Optimism Bias". Optimism Bias is the term used to reflect a tendency for the true capital costs and works duration of schemes in the public sector to be underestimated thereby overestimating the benefits of the scheme.

In evaluating the appropriate optimism bias factor for the Capital Expenditure (CAPEX) of each Package, the process as set out in Mott MacDonald's Report (Reference [1]) has been followed for Package 2 capital costs including assessment of the relevant applicable risks to the Package. The resulting optimism bias factor has then been assessed against the currently recommended factor of 25% which is generally accepted for road improvement schemes and which is now in common use in Traffic and Economic Assessments. Discussion with the Scottish Executive has confirmed their support for the adoption of 25% as an optimism bias factor for schemes such as these providing there is no special circumstance which might otherwise impact on the assessment.

It should also be noted that the costings, as is normal, allow a contingency to cover unidentified work which may arise. At this early stage a contingency of 20% has been allowed (before application of the 25% optimism bias factor).

The process as set out in the Mott MacDonald Report is intended to be applied to large procurement projects – it is based on 50 projects with costs exceeding £40m in 2001 prices. The process is therefore both inappropriate and cumbersome to apply in full to the Package 1 proposals which are costed at £530,000 including £300,000 allowance for procurement of No.43 New Street including the flat above. For Package 1 therefore we have carried out a sensitivity test to determine whether the level of optimism bias assumed is likely to change the outcome of the appraisal.

The Mott MacDonald Report also provides guidelines for assessing the impact of optimism bias on the Works Duration programme. However, on these schemes we consider that it is the gestation period from project initiation to tender stage that will be most susceptible variation, and this is dealt with separately below.

[1] "Review of Large Public Procurement in the UK" prepared by Mott MacDonald, July 2002

8.2 Optimism Bias – Capital Expenditure

8.2.1 Upper Bound Values - CAPEX

Both Package 1 and Package 2 can be classified as standard civil engineering packages of work (although Package 1 can be assessed as being minor works in comparison to the major projects which are the basis of the Mott MacDonald analysis).

Accordingly the Upper Bound optimism bias factor is 44% (from Table 4 in Reference 1). If project risks are not effectively managed this provides estimated Net Present Costs (NPCs) as follows assuming initial cost estimates of £530,000 and £18,000,000 respectively for Packages 1 and 2:

Package 1: £530,000 + (44% x £530,000) = £763,200 and

Package 2: £18,000,000 + (44% x £18,000,000) = £25,920,000

8.2.2 Optimism Bias Assessment - CAPEX

8.2.2.1 Package 1

As described in 8.1 above, a "sensitivity" approach has been adopted in assessing optimism bias. The section of this report dealing with Transport and Economic Efficiency has applied an optimism bias factor of 25% as described in 8.1 above. The resulting Benefit to Cost Ratio (BCR) is 9.22. In approximate terms, if the optimism bias was found to be 50%, instead of 25% as assumed, then the BCR would drop to between 6 and 8 which is still very healthy and there would be no change in the conclusions or recommendations should the 25% factor be found to be too low in practice.

The primary risk associated with Package 1 is the potential delay in achieving the required Approvals, Consents and Orders. As such this has the potential to impact on the programme, but will have little cost impact unless a Public Local Inquiry is called to address one or more of the issues. This is dealt with in more in section 8.4 of this Report.

Other risks are considered normal construction procurement risks and are not considered to be of an order to affect the 25% optimism bias factor for this Package.

8.2.2.2 Package 2

Following the approach outlined in Mott MacDonald Report, Table 8.2.2 below identifies the primary risk areas and suitable mitigation.

The resultant reduction in the optimum bias figure is therefore:

= 5 + 5 + 5 + 4 + 0 + 2.5 + 7.5 + 5 + 5 +3.75 + 3.75 + 3.75 + 0

= 50.25%

And the resultant capital expenditure optimism bias = (100 – 50.25) x 44% = 21.9%

This is only slightly lower than the normally accepted 25% level of Optimism Bias and we have therefore adopted the higher figure (25%) which is consistent with the currently accepted practice in carrying out Traffic and Economic Appraisals.

The Benefit to Cost ratio for Package 2 based on using an optimism bias factor of 25% is 4.84. If, however, the Upper Bound optimism bias factor as noted in 8.2.1 above was found to be closer to reality at 44%, then, with all else remaining equal, the Benefit to Cost Ratio would reduce to approximately 4 which is still very acceptable and would not change the conclusion of this Report.

8.2.3 Optimism Bias Conclusion

In conclusion therefore at this stage it is appropriate to apply an Optimism Bias factor of 25% on the capital cost estimate to both Package 1 and Package 2. The identified risks and uncertainties have been assessed and quantified with the result that the upper bound factor of 44% was able to be significantly reduced on Package 2. The final estimated costs used in the economic analyses are shown in the following table:

Table 8.2.1: Final Net Present Value Estimates

	Capital Cost estimate	Optimism Bias factor	Final Net Present Cost Estimate
Package 1	£530,000	1.25	£662,500
Package 2	£18,000,000	1.25	£22,500,00

Table 8.2.2 Project risks and Mitigation relating to Package 2

Project Risk Area Name	% Contribution to Optimism Bias (CAPEX)	Mitigation Factor	Cost of Risk Management	Mitigation
Poor Contractor Capabilities			Minimal additional cost – all good practice approaches.	
Inexperienced contractor	5	1.0		Pre-qualify D&B contractors experienced and successful in this type of work
Sub-standard work	5	1.0		Employ adequate design checking procedures and appropriate site attendance. D&B contractor will have 5-yr maintenance liability.
Insufficient Resources	5	1.0		Use D&B contract – contractor's risk.
Dispute and Claims o				
Claims for changes in scope	5	0.8		Carry out thorough consultation and option assessment during the pre-tender phase. Reasonable to assume small remaining risk.
Other Procurement				
Public Utilities	5	0.0		Significant risk area for contractor, current trend towards allowing this as a Client risk in D&B road schemes.
Rail Possession	5	0.5		Thorough consultation with Rail Operator carried out and possession agreed in advance of tender. Remaining risk of Rail Operator failing to comply with access agreement
Design Complexity				
Mine workings	15	0.5		Pre-tender Ground investigation to be designed after thorough desk study of available record information. Consolidation/Mineral protection work likely to be carried out on a re-measurement basis hence remaining risk carried by client if allowance inadequate.
Degree of Innovation				
Soil contamination	10	0.5		Pre-tender Ground investigation to be designed after thorough desk study of available record information. Remediation work is likely to be carried out on a re-measurement basis hence remaining risk carried by client if initial allowance inadequate
Project Management Team				
inadequate review by PM	5	1.0		Employ project management staff experienced in this type of work and familiar with expected
Poor Project Intelligence				
insufficient Ground Investigation	5	0.75		Investigation of old mine workings is typically difficult to right. Extend of investigation must be reasonable – leaving potential for features to be missed.
Environmental Risk	5	0.75		Ground water / surface water contamination. Impact on wildlife. Mitigated by thorough desk study & surveys and by ensuring appropriate design of temporary and permanent drainage provision. Remaining risk of unidentified wildlife or underground aquifer etc
Permits/Consents/Approval				
Difficulties in obtaining Orders	5	0.75		Early start to Draft Orders procedures – secure orders before tendering. Remaining risk of inadequate amount of land reserved for construction/geotechnical mitigation
Other	25	0.0		

8.3 Risk and uncertainty issues

8.3.1 Traffic Growth Assumptions

Having undertaken an analysis of historic traffic growth on the A737, all modelling has proceeded on the assumption that the application of Central NRTF growth is appropriate to future year assessments. Guidance issued by the Scottish Executive states that the application of Central NRTF growth is appropriate for economic assessments of trunk roads. Furthermore, the modelling has been undertaken on the basis that trips to and from all zones will be subject to Central NRTF growth, and that the growth will occur throughout all periods of the day. Sensitivity testing has been carried out to provide an indication of the impacts of Low and High growth occurring.

Operational and economic assessments have been undertaken for both Package 1 and Package 2 based on the application of Central NRTF growth. On this basis the forecast lifespan of the Package 1 scheme is 2007 to 2015. In the event that High Growth occurs, the operational benefits afforded by the Package 1 scheme would diminish around 2013, whilst they would diminish by 2018 if Low growth were to occur. Thus, if the growth assumption proves too low, there is a risk that the operational effectiveness of the intervention will breakdown earlier.

However if Package 1A was implemented the operational benefits will be less than that for the full Package 1 thus leading to a greater sensitivity to possible higher traffic growth.

8.3.2 Enforcement of schemes

A major contributing factor to the existing traffic problems within the centre of Dalry is the lack of enforcement of the waiting/unloading restrictions, parking bay utilisation and the yellow box junction. In particular, the removal of illegally parked cars to the south of the existing signalised junction at the New Street/Townend Street junction would have a very positive impact on the ability of southbound vehicles to clear the junction. All modelling has been undertaken on the basis that the proposals to enhance the operation of the town centre are included as part of a package of measures, and, significantly, that they are adhered to by drivers, and enforced where necessary by the relevant authorities.

The failure of drivers to respect the Traffic Regulations Orders pertaining to car parking within Dalry town centre will have a negative impact upon the operation of the proposed schemes. Similarly, the failure of authorities to properly enforce existing or revised Orders will impact to a certain extent on the effectiveness of the schemes.

8.3.3 Environmental/Ecological Issues/Uncertainties

As a matter of course in progressing the detailed assessment of Package 2, should it be approved for implementation, detailed ecological surveys will be required for the bypass corridor, including for protected species (including otter, badger, water vole, birds and bats) together with detailed vegetation surveys. These surveys will establish the nature conservation value of the area and inform the detailed environmental impact assessment and development of appropriate mitigation measures. Certain surveys have seasonal restrictions in terms of obtaining most valid results, e.g. plant surveys, bat surveys, bird surveys.

In addition there are also uncertainties relating to potential changing environmental legislation that will need to be adhered to during the design, construction and operation of the bypass. For example, the requirements of the Water Framework Directive, implemented in Scotland through the Water Environment and Water Services (Scotland) Bill, including the Controlled Activity Regulations for all design / working methods with the potential to affect watercourses, including the River Garnock bridge and other culverts. This will require that all working methods be agreed with SEPA. All appropriate legislation relating to contamination will also require consideration.

8.3.4 Scheme Specific Risk

Both Package 1/1A and Package 2 contain elements that can be expected to attract objection and/or opposition which will have the potential to delay the implementation of the planned interventions. Most of the elements will require some form of specific approval or consent, and it is at that time that formal objection can be raised by parties directly affected by the proposed measures.

There are also a number of other risks relating to technical or other aspects which must be considered. The risk assessment table provided in **Appendix I** identifies the following as being the High Risk issues (each of which is expanded upon in the sections following the tables):

Table 8.3 – High Risk Issues relating to Package 1/1A

Risk Area	Issue
High Risk Issues (Programme)	Risk to project due to delay in making the Traffic Regulation Orders pertaining to the new junction arrangements arising from objection(s)
	Risk to project due to delay in Compulsory Purchase Order & Demolition Warrant relating to Procuring / Demolishing No.43 and flat above, arising from objection(s) (Package 1 only)
High Risk Issues (Cost)	None
High Risk Issues (Operational Effectiveness)	None

Table 8.4 – High Risk Issues relating to Package 2

Risk Area	Issue
High Risk Issues (Programme)	Risk of delay to Main Line Orders arising from objections
	Risk of delay to Side Road Orders arising from objections
	Risk of delay Compulsory Purchase Orders arising from objections
High Risk Issues (Cost)	Risk of delay due to Extensive mine workings
High Risk Issues (Operational Effectiveness)	None

8.3.5 Traffic Regulation Orders for the new junction arrangements

For the affected parties who are not in support of the proposal, objecting to these Draft Orders when published could be seen as an effective means of fighting the intervention.

If the objections cannot be negotiated away, then it is possible that a Public Local Inquiry would need to be called. This would typically add some 6 months to the programme. This is explored further in Section 8.4 of this Report.

Continuing public consultation to inform the public of the progress and programme can be expected to assist in mitigating this risk together with early drafting and publication of the Draft Orders.

8.3.6 Procurement and demolition of No.43 New Street and flat above

For Package 1, the critical factors relate to the procurement and demolition of the Category B listed building at No.43 New Street, and No.2 Aitken Street, in respect of Option 2. Any demolition will require consent from Historic Scotland and therefore discussions will need to take place as soon as possible to determine whether or not consent is likely to be given. Appropriate forms will need to be completed giving reasons for the demolition. The implications may be that consent is not given or that delays occur due to the time required to obtain consent. At this stage it is not possible to get firm advice as to whether or not consent to demolish can be expected i.e. there will be a remaining risk that consent to demolish may be withheld.

There are two key milestones that will need to be achieved if it is determined to proceed with the proposed changes:

1. Procure the two properties, either by negotiation or by Compulsory Purchase.
2. Obtain Consent to demolish these Category B Listed Buildings.

If these issues are not progressed promptly the primary risk is to the programme; any significant delay will allow traffic delay/congestion to deteriorate. As confirmed earlier in the report, assuming traffic flows rise at a rate consistent with Central NRTF growth levels, with no intervention the existing road network is likely to become further congested, resulting in increased queuing and delay, leading to the eventual breakdown of the network and the need to introduce a scheme which provides relief to the existing network beyond 2007.

Strong opposition to the proposal can be expected with a Public Local Inquiry potentially being required which will impact on the programme.

To be able to meet the 2007/2008 deadline, it will be important therefore that the procurement process is commenced early in the process should it be determined to proceed with this scheme. The impact on the programme and the need for early commitment is discussed in section 8.4.1 below.

If Package 1A was taken forward this risk would be eliminated.

8.3.7 Risk of delay to Main Line Orders for By-pass

The consultation process has identified a general desire to have a by-pass but nonetheless there can be expected to opposition from directly affected parties. This is not unusual for a scheme such as this and can be considered as a normal risk, but it still needs to be allowed for. If such objections cannot be negotiated away, then it is possible that a Public Local Inquiry would need to be called. This could typically add some 12 months to the programme and is discussed in more in section 8.4 below.

8.3.8 Risk of delay to Side Road Orders for By-pass

As above.

8.3.9 Risk of delay to Compulsory Purchase Orders

For those landowners who are affected by the works, and who are not in support of the Package 2, resistance to the Orders might well give rise to a delay in the implementation process.

8.3.10 Technical risk to by-pass arising from Extensive Mine workings

The extent of the mine workings is largely unknown at present with only approximate mine entry locations being provided. No description of the type of working has been forthcoming. Information provided by North Ayrshire Council indicates that there are a number of mine entries within the proposed bypass corridor together with other collieries, quarries and spoil heaps noted in close proximity. The nature and extent of these sites is currently unknown and there is a potential for contamination/unsuitable ground conditions to be present. Although it is anticipated that some of these sites could be avoided at the design stage, an element of uncertainty remains in relation to the risks associated with these sites. Further consultation will be required with North Ayrshire Council and detailed reports on each site obtained so that such risks and potential delays can be identified and managed. This will have cost implications as will the treatment/removal of any contamination or hazards related to previous mining activity.

A thorough Ground Investigation (GI) Desk Study followed by an extensive GI Contract will be essential to work towards reducing this risk, but there will need to be a balance between GI costs and the likely risk. The costing for the by-pass includes £500,000 for the cost of the investigation, and £1,000,000 for the cost of treating the affected areas.

8.3.11 Valuing the risks

In conclusion of the above it can be seen that the only high/medium cost risk is attached to the unknown in respect of the extent/nature of the old mine workings. As noted there is a cost allowance of £500,000 for the GI Survey, this is unlikely to increase significantly. The sum of £1,000,000 to treat the affected areas is however liable to increase or decrease significantly depending the actual findings of the GI Survey (and the findings of the contractor once the works commence).

At this stage, given the relatively limited risk to cost, it is considered that there is no need to make any additional allowance than is provided for by the 20% contingency and 25% optimism bias i.e. the cost estimates should remain as noted in section 8.2.3 above.

8.4 Programme Risk

As noted in Section 8.1 there are risks to the gestation period (from project initiation to tender ready stage) for each package. These risks are highlighted in section 8.3 above.

8.4.1 Package 1 Programme

Taking due account of the normal period for progressing a design and preparing / negotiating the necessary Orders, a period of 15 months from project initiation to commencement on site (which includes a 3 month negotiation period) would not be unreasonable in normal circumstances. Thus, if a decision to proceed could be made by 1 April 2006, then on the basis of a 3 month construction period the project might be expected to be completed by the end of September 2007 if there were no other constraints. But it would probably be advisable to carry out the contract after the holiday period i.e. construction period say September/October/November 2007.

Table 8.3 above shows Package 1 to be exposed to 2no high risk issues which may require a Public Local Inquiry (PLI) to resolve and which would have an impact on the programme. Previous experience suggests a PLI can take 12 months to complete the due process and reach a conclusion. This would not all be lost time with other activities carrying on in parallel but an overall delay of approximately 6 months could be expected if a PLI is required which would push completion out to May/June 2008.

Given the findings of the Operational Assessment of Package 1 (that the existing network is unable to accommodate Central NRTF growth beyond 2007) it is clear that an early decision is required on Package 1.

To mitigate the risks associated with the implementation of Package 1 in full and particularly the need to demolish No 43 New Street it thought prudent that a Package 1A (Package 1 excluding the introduction of two way traffic flow through New Street/Town End Street junction) be considered as a realistic deliverable alternative by 2007.

8.4.2 Package 2 Programme

On the assumption that Package 1 interventions are implemented there is not the same pressure for an early decision on the by-pass. The Operational Assessment of Package 2 concluded that the by-pass is required by 2015 at which time the relief offered by Package 1 is expected to have been eroded by continuing traffic growth.

Assuming therefore that the by-pass should be available no later than December 2015, then, making due allowance for the normal time periods required to progress a scheme of this nature, a design consultant would be required to be appointed by early 2010. This timescale assumes no major objections.

As noted in section 8.3, there is a relatively high likelihood of delays arising from objections to the various Traffic Regulation Orders, with a strong possibility that a PLI will be required. As confirmed in 8.4.1 above, a PLI can be expected to take 12 months to conclude. In view of the potential consequence of the findings on the design of the scheme, it would be advisable to allow the full 12 months as additional time.

Therefore, to complete by December 2015, and on the basis that a PLI is a strong possibility, then a design consultant should be appointed by early 2009.

However, if Package 1A is implemented it is expected to have an operational life expectancy considerably less than the year 2015 predicted for the full Package 1. Therefore, given that the estimated design and construction period for Package 2 will be a minimum of 6 years an early commitment to progress with Package 2 should be made.