

ESTIMATING USING RISK ANALYSIS

(ERA)

PRACTICE NOTE

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1.0 WHAT IS FINANCIAL RISK ?

- 1.1 Financial risk comes from the uncertainty about the cost consequences of incomplete information. It means both uncertainty about the feature in question (its scope) and the result of that uncertainty (its value).
- 1.2 Risks can arise from planning decisions, where the outcome cannot be adequately costed. The majority of risks however, arise from matters yet to be decided (eg. incomplete brief or no site investigation). Risk assessment of the cost of uncertain features will be present at all stages of a project. The number of risks will normally decrease as a project progresses through the stages of the Public Works Programme and as the design and planning develop, but new risks may appear after planning is complete and even during construction.
- 1.3 Risk can be referred to as a "contingency", or a "significant risk allowance" or a "risk feature" or similar. The terms mean the same thing i.e. the probable cost of uncertainty.

2.0 WHY ESTIMATING USING RISK ANALYSIS?

- 2.1 All too often risk is either ignored or dealt with in an arbitrary way by simply adding (about) 10% "contingency".
- 2.2 The traditional manner of preparing a project estimate allows little scope for provision against risks. Any allowance made for \$ value of risk is included on a once and for all basis with no formal method of updating it other than for inflation. Risks are not separately identified for methodical evaluation and the allowances are often set too high or double accounted in an item and again in a general contingency sum.
- 2.3 Risk analysis should be one of the most creative but also exacting tasks of project management. It should generate realism by encouraging problem solving.
- 2.4 Estimating needs to be structured, logical, accountable and easy to explain and trace. Estimating using Risk Analysis (ERA) does this.
- 2.5 ERA is a procedure to identify project (or contract) related risks in a formal manner and then to give a realistic estimated cost for each risk which makes the relevant importance of each risk immediately apparent.
- 2.6 As the project is developed towards the tender stage(s) the object is to resolve as much of the uncertainty as possible, concentrating on the major risks.

3.0 DEFINITIONS

3.1 There are two types of estimate viz :

- (a) **Base Estimate** The "risk free" part i.e. the certain features, the work that is unlikely to change, prepared by pricing the known features using current rates and prices and standard techniques appropriate to the stage of the project.
- (b) **Average Risk Estimate** The total of all Average Risk Allowances (see 3.3) plus the Base Estimate. It is the figure reported as the estimate in PWSC/FC papers and the like.

3.2 There are two types of Risk Assessment viz :

- (a) **Fixed Risk Assessment** A risk which will be incurred as a whole or not at all. Although an "all or nothing" allowance, the likelihood of it occurring can vary and this likelihood or probability also needs to be assessed.
eg. A secondary access road can be required in total or not at all. The need or probability may be assessed as "likely", therefore the probability might be decided as a 65% chance of being required (see Annex B).
- (b) **Variable Risk Assessment** A (usually certain) risk relating to an event or feature which can occur in varying degrees, with correspondingly varying probabilities.
eg. Piling, where the design and cost vary depending on the sub-strata. Both the probability of using a particular piling solution as well as the probable length of the piles have to be assessed to estimate the allowance.

3.3 There are two types of Risk Allowance viz :

- (a) **Maximum Risk Allowance** The estimated sum of money required if a risk were to occur to its full extent. It is only used as the basis of comparison with the Average Risk Allowance, and is not added into the estimate build-up.
- (b) **Average Risk Allowance**
 - (i) For a **Fixed Risk**, it is the product of the Maximum Risk Allowance and the assessed probability of the risk occurring - ie. paras 3.2(a) x 3.3(a).
 - (ii) For a **Variable Risk**, it is the estimated sum of money which is assessed as having a fifty/fifty chance (ie. 50% probability) of being exceeded. This may be anywhere on the probability chart (Annex B).

In each case the project team is using their experience and judgment to decide the probability.

4.0 ESTIMATING USING RISK ANALYSIS

- 4.1 ERA is not limited to projects (or contracts) of any particular type or value. It is essentially a brain-storming process of compiling realistic forecasts and answers to "what happens if?"
- 4.2 The main activities in ERA are :
- (a) identifying significant risks,
 - (b) assessing the probability and extent of those risks occurring, and
 - (c) establishing appropriate \$ values for the risks.
- 4.3 Any estimate is made up of two separate parts -
- (a) the work, and
 - (b) the pricing.
- ERA concentrates on (a), though if the accuracy of the prices is suspect, it might be treated as a significant risk.
- 4.4 ERA is most useful when the unknowns are greatest i.e. Cat C and B. At Cat A the work should be almost "risk free", but the estimate presentation should not change.
- 4.5 The benefit of ERA will only be realised where risks are considered by the project team (and when appropriate the client department) who should initiate enquiries, obtain information and evaluate the risks together. Identifying risks and assessing probabilities is a collective responsibility which avoids the risk of incomplete commitment and inconsistent decisions.
- 4.6 Each significant risk is estimated separately. Only those risks which are considered significant are included in the risk analysis. What constitutes a significant risk will vary between projects.
- 4.7 The extent or scope of the work included in any estimate shall be set down in a concise description of key features, referred to as the Estimate Description.
- 4.8 As the project is developed the uncertainties are resolved. This continuing process can identify cost reductions.
- 4.9 At each stage of re-estimating, each resolved risk becomes a known requirement and its cost allowance is then added to the Base Estimate. If the re-estimated cost of the resolved risk differs from its previous cost allowance, this difference is -

if greater added as part of the re-estimated cost to the Base Estimate (ie. the total re-estimated cost is included and the increase funded from the contingencies);

or if less held in the general contingencies to cover the cost of unresolved risks that on review exceed the previous anticipated cost, or used to compensate for any additional cost of other resolved risks transferred to the Base Estimate, or for entirely new risks.

i.e As a general rule surplus money from identified savings is held in the general contingencies, not "lost" by reducing the Average Risk Estimate. This is very important when the total value of unresolved risk is relatively high (e.g. when the works will have to be remeasured). Where there is a relatively low total unresolved risk value (e.g lump sum contracts) it may be possible for the Cat A estimate to be reduced by the value of savings made on resolved risks, particularly if the resolved risk savings are from Fixed Risks. Judgment needs to be used.

4.10 The terms "general contingencies" and "contract contingencies" are used in the example (at Annex C) to separate these contingencies from the term "project contingencies". Whilst they are in effect the same thing, project contingencies have a special meaning in ACP cost control procedures.

5.0 IDENTIFYING SIGNIFICANT RISKS

5.1 ERA requires the identification of those features of a project (or contract) that are at risk of changing. The project team (and client department when appropriate) should meet to analyze the risks at the feasibility stage and thereafter when necessary to achieve the degree of information necessary to identify all significant risks and reduce or eliminate them.

5.2 The risks included in any previous analysis shall be reviewed and identified new risks included.

5.3 The approach to risk analysis is not based upon any established risk classification. Risks identified as relevant and significant should be arranged in the most appropriate groupings and order at each estimating stage. The inclusion of a risk under a particular heading does not exclude it from another (i.e. separating the Fixed Risk and the Variable Risk elements).

5.4 The project team should keep sufficient notes on file to ensure that the reason(s) for the inclusion or exclusion of a risk is sufficiently documented to enable the origin to be easily identified at each review.

5.5 As each risk is identified its significance, whether it is a 'fixed' or a 'variable' risk and its probability must be agreed.

5.6 Having identified and placed a value on each risk, the object is to concentrate on resolving those with the highest cost.

- 5.7 Preparing the Base Estimate and calculating Average Risk Allowances to arrive at the Average Risk Estimate should be carried out by the officer (in consultation, see para 4.5) responsible for compiling the overall project estimate at each estimating stage.
- 5.8 A list of circumstances giving rise to risk in construction projects is at Annex A. The list is not exhaustive.

6.0 ASSESSING PROBABILITY AND RISK ALLOWANCES

- 6.1 The process of assessing probability is the most unfamiliar aspect of ERA. A scale of probability from 0% (chances are nil) to 100% (certain) is used. In the former case the circumstance is not a risk and would not be considered in the estimate. In the latter case the circumstance is also not a risk but would be considered in the calculation of the Base Estimate. Anything between the two extremes would be considered in the Risk Analysis calculation if the risk was considered significant.
- 6.2 Assessment of probability is not an exact science, therefore it is appropriate to use familiar language, which can be translated into a probability percentage, as set out in Annex B. Examples from this are -

Statement	Meaning	Probability Suggested for ERA
Highly unlikely	Very little chance	10-20%
"Little chance"	Not more than slight probability - of occurrence (fixed risks) - of exceeding (variable risks)	31-40%
"Unlikely"	-	41-50%
"Better than even"	Average likelihood - of occurrence (fixed risks) - of exceeding (variable risks)	51-60%
"Likely"	-	61-70%
"Highly likely"	-	81-90%

6.3 The technique for assessing probability differs for Fixed Risks and Variable Risks.

For Fixed Risks the probability is assessed against the Maximum Risk Allowance and the Average Risk Allowance is calculated from it (see para 3.3). The cost consequences are assessed as in para 6.2 ie. "little chance" through to "highly likely" to be exceeded.

For Variable Risks the probability of "Average" is pre-determined (see para 3.3(b)). The "Average" allowance has no constant relationship to the Maximum Risk Allowance ie. the probability of a fifty/fifty chance that the estimated cost will be exceeded does not automatically equate to 50% of the Maximum Risk Allowance. However, the cost consequences must be assessed as for a Fixed Risk i.e. using Annex B.

6.4 Risk can also be interdependent (eg. design solutions can affect the tenderer's pricing, the contractor's operations and the client's cash flow). Interdependent risks that are not individually significant should be listed and treated as a single group. If the group is considered to be significant, the combined risk allowance for it will equal the sum of the separate figures for each feature in the group. But, any risk considered to be significant must be assessed and allowed for separately.

7.0 RECORDING RISK DATA

7.1 The record that should be kept at each estimating stage is indicated in the Worked Example at Annex C. ERA calculations should be to a standard format varied to meet special needs. The proforma is at Annex E.

8.0 QUESTIONS AND ANSWERS SHEET

8.1 A number of questions have been asked during ERA workshops. They are set out, with answers at Annex D.