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JAPAN SOCIETY OF CIVIL ENGINEERS

FACILITATOR MANUAL FOR RISK WORKSHOPS IN ROAD PROJECTS

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1 INTRODUCTION

This Facilitators Manual for Risk Workshops in Road Projects has been produced by Capital Value & Risk Limited (CVRL) for a mission team from the Japan Society of Civil Engineers, headed by Prof. Kazuaki Miyamoto.

The Manual is in three key parts:

- Section 2, sets out the general approach to Risk Analysis and Management through the identification, assessment, quantification and management of risks on highway projects. It explains the purpose and timing of risk workshops in the scheme development process. The approach can be adopted for conventional as well as DBFO projects. The approach to design and construction risks and those additional risks associated with Design, Build, Finance and Operate (DBFO) procurement are outlined.

- Section 3, explains the role of the facilitator in risk workshops, the procedure and tools to be adopted when setting up, facilitating at a risk workshop and reporting on the outcome which normally includes a risk register. The section provides some worked examples from risk workshops based on a selection of road projects. The section includes practical guidance/tips for facilitators based on good practices and lessons learnt from the author's experience.

- The Appendices provide further tips to prospective facilitators undertaking workshops in general and specifically risk workshops for projects based on CVRL's direct experience of delivering hundreds of workshops over a number of years. The Appendices also include a generic risk checklist to aid identification along with source information used in compilation of the Manual and further reading.

The Manual is not intended as a detailed explanation of risk analysis theory but explains the principles involved in order to introduce the essential tools for facilitating risk workshops. The references given in the Appendices will provide the basis for readers who wish to explore the subject further.

The road scheme development process described in the manual and associated risk procedures draws on those utilised by the Highways Agency (HA). A source reference for the Manual is the HA's Value for Money Manual section on Risk Analysis and Management. Where necessary specific terms used by this organisation have been removed or explained.

1 INTRODUCTION

Risks to design and construction of new works and DBFO are explained to highlight how the types and management of risk differ, whilst the basic risk analysis and management process remains essentially the same. The authors acknowledge that there are other roads procurement mechanisms available and guidance contained in the Manual can, with adaptation, also be used for these.

CVRL would like to thank the HA for providing useful information to assist in the production of the Manual and the Japan Society of Civil Engineers headed by Prof. Kazuaki Miyamoto for the Facilitator Manual commission.

It is hoped that users will find the manual instructive, useful and that it will provide an insight in to the often seen but sometimes little understood work of the facilitator.

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2.1 INTRODUCTION

Construction projects in general contain a number of uncertainties that result in time and cost consequences which affect project deliverability. To manage these uncertainties, they need to be quantified. Risk is an uncertainty that can be quantified either from historical information e.g. statistical records or from an educated estimate e.g. using expert judgement.

Risk analysis and management is a process designed to allow for, remove or reduce the uncertainties or risks, which could threaten the achievement of project objectives. Risk analysis and management should be regarded as an integral part of project management and not just as a set of tools or techniques.

All construction projects have many inherent risks and road projects are no exception. These risks, which might include varying ground conditions, resource availability and requirements of other government departments, each have an impact on the ability to deliver a particular scheme to cost, time and in some cases quality.

Risks that remain unresolved at construction can result in cost increases. Any resulting delay and consequential effects on a contract can be attributed to individual changes resulting from uncertainties built into the contract.

Given that the changes are the result of the uncertainties (risks), the cost impacts can be directly related to residual risks transferred into the construction phase.

Scheme development undertaken by organisations such as the Highways Agency in England use risk analysis and management procedures to minimise the number of unplanned risk events during scheme development.

The management of risks commences at the initial feasibility stage and is a continuous dynamic process, requiring reaction to new information and investigations during the development of a scheme.

The assessment of risks aims to determine the likely financial impact that each Risk will have on the scheme should it occur. It should also be noted that there are opportunities (savings) as well as additional costs associated with risks.

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The financial effect of time related risks should be included to identify the overall financial impact.

At the early stages of development, the analysis of risks provides an assessment of the ability to deliver a scheme. Where schemes have high risk to achieve specific objectives, the risks and their potential costs can be highlighted and decisions made on the viability of that project.

To ensure that each scheme provides the best overall Value for Money, all of the important risks need to be identified and assessed at the earliest possible stage of a project. Risk Analysis & Management also provides critical information relating to the choice of a preferred scheme. From the inception of a scheme through to construction and to operation, risk analysis and management will aid the establishment of the anticipated final cost.

Risks at the early stages of a project tend to be less well defined and typically the significant issues are easily identified e.g. major constraints affecting route choice. During project development the risks can be better understood and their analysis and management detailed accordingly.

In principle the responsibility for managing each identified Risk should be allocated to the party best placed to exercise the most effective control over it. During the design phase, individual specialists may be identified to manage risks on behalf of the Employer. Where there are several risk responses or mitigation measures available, the object is to identify those which reduce the total cost of risk and give the best Value for Money solution. The nature of the residual risks addressed by the Employers design team and the cost of dealing with these will provide information to help to make an informed choice of the form of contract to be used for procurement.

When a contractor is appointed to deliver the scheme some risks may be transferred to the contractor who will both manage and own the consequences of the risks if they materialise.

2.2 OUTLINE RISK METHODOLOGY

The Risk Analysis and Management process can be subdivided into the following three distinct phases:

1. Identification: Determine what could go wrong. This is best achieved by brainstorming in a Workshop forum.

2. Assessment: Understand how the Risks occur and quantify their possible effects on the scheme.

3. Management: The process of evaluating options for reducing the Risks on the scheme and implementing management actions for their resolution.

The above process will identify risks which may occur during design and through construction to completion. For DBFO projects then the additional components of Finance and Operation risks also need to be considered.

2.2.1 Risk Workshops

Major road projects are organisationally complex to manage. They tend to have large project teams e.g. Employer representatives, design team, specialists e.g. environmental, archaeology, the construction team from the contractor and also stakeholders who may or may not have an influence on how the project progresses e.g. local government. DBFO projects comprise similar personnel to those above and in addition have representatives to take into account the ongoing maintenance/operation of the road and financial and legal representatives further add personnel to the overall team.

Risk workshops, therefore, provide a very useful forum in which to undertake risk reviews involving the wider project team. The risk workshops can be used for some or all of the following as aspects of the risk process, namely:

1. Identifying all risks, which could have an impact on cost, time or performance of the project

2. Assessing risks and,

3. Setting in train management actions for mitigation and quantification.

Risk workshops are often facilitated by an independent facilitator who will control the workshop and lead the workshop participants through the risk process.

A typical Risk Workshop will last one day and can comprise some or all of the following:

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- Introduction
- Overview of Risk Analysis & Management
- Risk Identification
- Risk Assessment
- Risk Management Actions

In a Risk Workshop a Risk Register will be produced, listing all of the Risks that could have an effect on the scheme and depending on the scope of the workshop it may also include risk assessment ranking and describe the mitigation actions required.

Quantification of risks can be carried out as part of the workshop process and developed further thereafter along with modelling of risks.

A more detailed explanation of the role of the facilitator, skills required and risk study procedure which includes the risk workshop process is given in Section 3.

The project team will take the outputs from the workshop to continue their ongoing risk management activity as part of scheme development/implementation.

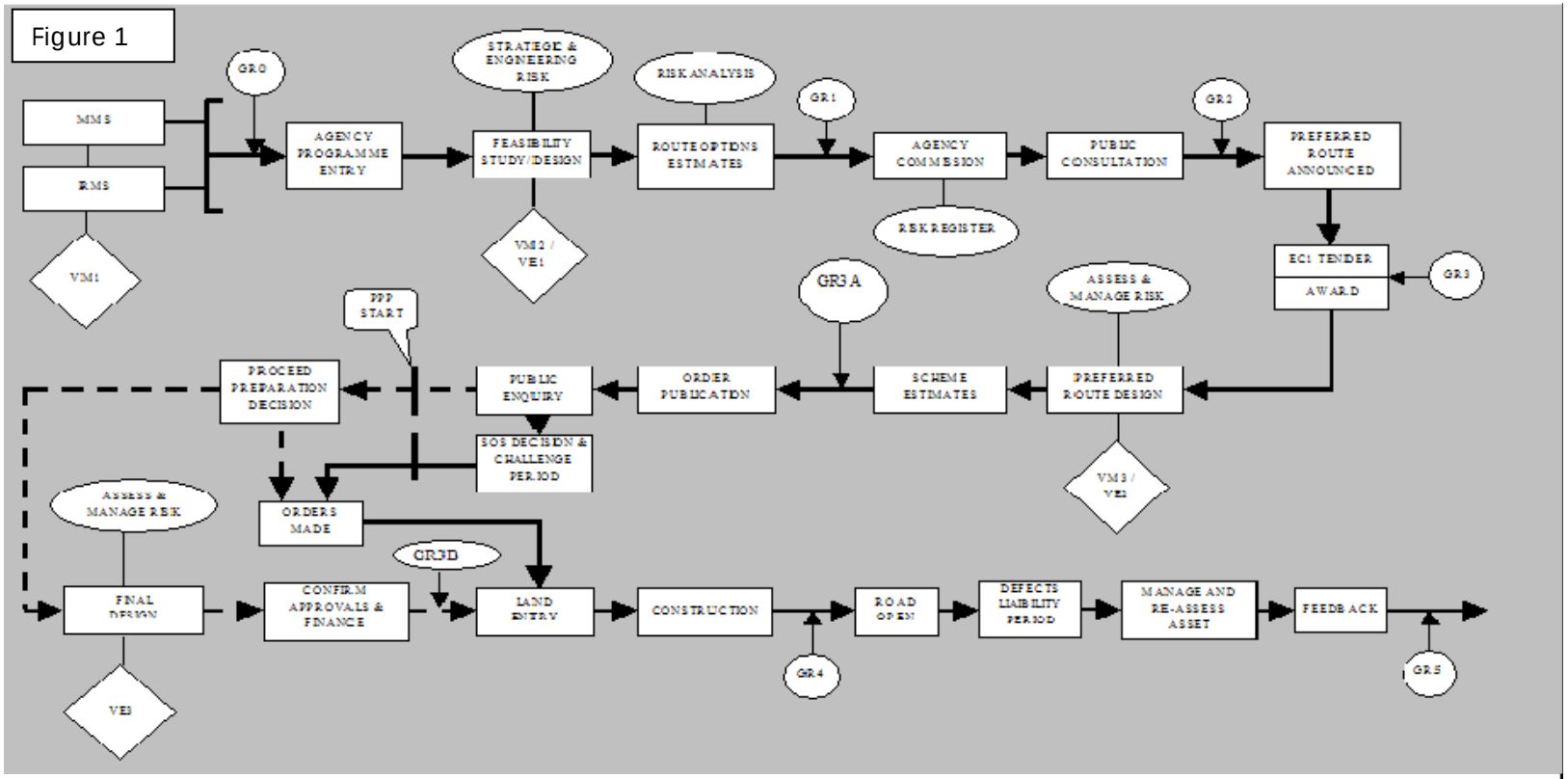
2.2.2 Risk Reviews during Project Development

Risk reviews often form part of Value Management (VM)/Value Engineering (VE) milestone workshops in the early stages but quickly become separate risk workshops.

Value Management is a structured approach to defining what value means to a client in meeting a perceived need by establishing a clear consensus about the project objectives and how they can be achieved. Value Engineering is incorporated into value management as a systematic approach to delivering the required functions at lowest cost without detriment to quality, performance and reliability

A process for adopting VM/VE and Risk (RM) application during scheme development for large road projects is included in the flowchart given in Figure 1 – *Source Highways Agency*.

Figure 1



Flow chart to illustrate VfM and scheme preparation processes for typical DPT Schemes and larger schemes with Orders.

EC1 - Early Contractor Involvement and Partnering - Conversion of EC1 project to PPP may be appropriate after SOS Decision & Challenge.
PPP - LEP/Operator will normally start after the SOS Decision.
Risk Register to be reviewed throughout process

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For large road schemes the formal process of identification and assessment of risk is typically carried out during the various stages of scheme development as detailed below in Table 1. The risk approach for a project that is moving through scheme development towards a DBFO form of procurement is outlined in Table 2.

It is important to remember that the risk process is an ongoing part of the overall project management discipline with the risk register being updated on a regular basis. The project manager (person responsible for the project) will take responsibility for this activity and delegate where necessary the various actions required to address the risks.

The risk workshops are useful opportunities for the wider team to meet and review risks in line with the other key milestones that the project must move through as it develops.

For other smaller schemes, appropriate workshops and reviews should be used but tailored to suit the size and complexity of the project.

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Table 1

Stage	Workshop	Risk Analysis & Management Methodology
1. Project Identification	Part of VM1 Setting objectives, and considering options	1. Simple identification of key constraint issues & problem areas
2. Feasibility	Part of VM2 exercise for assessing different project options	1. High level identification of risks for different project options 2. Assessment of risks for criticality rating - Low, Medium, High 3. Identify practical risk management actions required 4. Ranking project options for potential risk exposure 5. Initial cost quantification of risks if required
3. Design Stages	Risk Workshop(s) on Preferred project development from outline to detailed design	1. Detailed risk identification and assessment of scheme design & construction risks 2. Cost quantification of risks: probabilities, minimum, most likely, maximum estimates of exposure 3. Computer support as required e.g. using Monte-Carlo risk simulation risk allowance calculation 4. Detailed risk management action review and re-analysis of risk quantification (if required) 5. Develop procurement strategy and risk allocation
4. During Construction	Risk Workshops	Similar to 3. above

Table 2

Stage	Workshop	Risk Analysis & Management Methodology
DBFO Project	Details from earlier scheme development VM or risk reviews form the basis for the DBFO risk workshops. The Employer will undertake risk workshops to cover all aspects of the DBFO contract and include the risk registers produced as part of the tender information to Contractors. The DBFO contractors will undertake their own risk reviews as part of their tender production.	1. Design & Construction Risks a. Detailed risk identification and assessment b. Cost quantification of risks: probabilities, minimum, most likely, maximum estimates of exposure c. Computer support as required e.g. using Monte-Carlo risk simulation risk allowance calculation d. Detailed risk management action review and re-analysis of risk quantification (if required) 2. Operation & Maintenance Risks a. Detailed risk identification and assessment of operations & maintenance risks b. Cost quantification of risks: probabilities, minimum, most likely, maximum estimates of exposure c. Computer support as required e.g. using Monte-Carlo risk simulation risk allowance calculation d. Detailed risk management review and re-analysis of risk 3. Finance & Legal Risks a. Detailed risk identification and assessment b. Cost quantification of risks: probabilities, minimum, most likely, maximum estimates of exposure c. Computer simulation support as required d. Detailed risk management review and re-analysis of risk

2.3 DEFINITIONS AND TERMINOLOGY

For the purposes of this Manual, the following definitions and terms are a useful guide:

- **Risk** - an uncertainty that can be quantified from either historical information or current knowledge
- **Risk Allowance** - the allowance to provide for the most likely estimate of the cost of risks
- **Risk Analysis** - the process of identifying risks, estimating the likelihood of their occurrence and evaluating potential consequences
- **Risk Management** - the process of risk control, to reduce or eliminate their impact, to ensure that the project objectives are achieved
- **Risk Model** - the computer system for predicting cost outcomes under various conditions using computer aided techniques (e.g. Monte - Carlo)
- **Risk Assessment Matrix** - a matrix which uses probability and consequence of risk in combination to ascertain the relative importance of individual risks
- **Probability** - the degree of certainty of an event happening, measured on a scale where zero equals impossibility and one equals certainty
- **Monte Carlo Simulation** - an established mathematical modelling technique used to determine the overall probability of several risks occurring
- **Risk Study** – the briefing/set-up activities , preparation work, facilitation and recording of a risk workshop, producing reports and risk registers from the workshop

- **Risk Workshop** - a highly structured group discussion coordinated by a facilitator and attended by key stakeholders, who take an active part in the decision making process
- **Facilitator** - an experienced independent coordinator who guides and controls a workshop
- **Employer** – the organisation with overall responsibility for the project
- **Contractor** – the organisation procured by the Employer to deliver the scheme. For example this may be design and build or design, build, finance and operate.
- **Stakeholder** - the representative of a body having an input or impact on scheme development
- **Residual Risk** - the amount of risk, which still remains after risk control activities are undertaken

2.4 RISK ANALYSIS

The following section describes the approach to be adopted for the key steps in the risk process. Each sub-section is dealt with in two parts: Part 1 – Design and Construction risks and Part 2: Additional factors to be considered for DBFO project risks.

2.4.1 Design and Construction

Risk Identification

The aim of Risk identification is to generate a comprehensive list of all the relevant risks that might have an impact on the project i.e. from design to road opening.

The identification process will produce a schedule of potential risks that could affect the scheme objectives or the ability to deliver the scheme to cost and/or time. There are a number of methods for identifying potential risks. Some generally accepted methods are as follows:

- Review meetings with key staff
- Risk audit interviews with key staff
- Risk Workshop

The Risk Workshop is a very effective way of identifying Risks and is generally the preferred method particularly on large projects.

The procedures described relate to a detailed risk workshop, however, these can be amended to fall within the scope of a wider Value Management or Value Engineering based study. The principles are similar. Given below is a detailed risk identification agenda, which can be used for structured brainstorming sessions at design and construction risk workshops.

Risk Identification Categories	Cat
Highway Design (excl structures)	**A**
Traffic	**A1**
Junctions	**A2**
Alignment	**A3**
X-sections, standards & safety	**A4**
Design for Maintenance	**A5**
Highway Construction risks	**A6**
Geotechnics	**B**
Design - Earthworks and ground conditions	**B1**
Drainage design	**B2**
Pavement design	**B3**
Construction geotechnics risks	**B4**
Structures	**C**
Tunnels	**C1**
Major Overbridges / underbridges & Skew bridges	**C2**
Viaducts	**C3**
Other	**C4**
Structures construction risks	**C5**
Technology	**D**
E&M	**D1**
High Tech	**D2**
IT Systems	**D3**
Lighting & comms	**D4**
Technology risks during construction	**D5**
Environment	**E**
Environmental mitigation including archeology	**E1**
Statutory bodies	**E2**
Environmental NGO's	**E3**
Environmental construction risks	**E4**

Risk Identification Categories	Cat
3rd Parties	**F**
Statutory Undertakers	**F1**
Planning bodies & regulatory issues s	**F2**
Accommodation Works/NGO's other	**F3**
Protestors	**F4**
3rd party construction risks	**F5**
Land & Compensation	**G**
Service Station's	**G1**
Land Acquisition	**G2**
Part 1 claims	**G3**
Land & compensation risks during construction	**G4**
Resources/Market	**H**
Pre-Construction Programme/Procurement	**I**
Public Inquiry & Objections	**I1**
Procurement Strategy change	**I2**
Other Pre-construction delay risks not already identified	**I3**
Buildability & Construction Programme	**J**
Buildability	**J1**
Traffic Management	**J2**
Phasing	**J3**
Interfaces with network and others	**J4**
Other Construction Delay Risks	**J5**
Finance	**K**
Error in Price basis risk - quantities, methods, materials, equipment	**K1**
Inflation	**K2**
Tax	**K3**
Other-General	**L**
Legislation	**L1**
Political	**L2**
Other Strategic	**L3**

Facilitator Tip: *As the risks are identified during the brainstorming session they are categorised so that like items can be collated together on the risk register. Use of a risk checklist can be useful reminder during and after the initial identification session to ensure all aspects have been considered by participants.*

Risk Assessment

During the Workshop, each risk identified should be qualitatively assessed for likelihood of occurrence and impact. The resultant product of these two criteria will enable the risk to be ranked in order of severity. There are several risk assessment matrices available to undertake the assessment and four examples in ascending levels of detail are given below:

1.

IMPACT	HIGH	Green	Amber	Red
	MEDIUM	Green	Amber	Amber
	LOW	Green	Green	Green
		LOW	MEDIUM	HIGH
		LIKELIHOOD		

2.

Probability				
High 3	**3**	**6**	**9**	**12**
Medium 2	**2**	**4**	**6**	**8**
Low 1	**1**	**2**	**3**	**4**
Impact Score	Low 1	Medium 2	High 3	Very High 4

3.

High Serious Impact	Important Risks Potential major affect on achievement of objectives	Important Risks Potential major affect on achievement of objectives	Critical Priority Serious threat to achievement of objectives
Moderate Limited Impact	Moderate risks Could impact achievement of objectives	Moderate risks Could impact achievement of objectives	Important Risks Potential major affect on achievement of objectives
Low No significant impact	Low Risks No current action required	Moderate risks Ensure they are being adequately managed	Moderate risks Ensure they are being adequately managed
	Low Unlikely to occur	*Moderate Likely to occur*	*High Could easily occur*

4.

Probability %	Rating					
75+%	Very High 5	5	**10**	**15**	**20**	**25**
51 - 75%	High 4	4	8	**12**	**16**	**20**
25 - 50%	Medium 3	3	6	9	**12**	**15**
10 - 25%	Low 2	2	4	6	8	**10**
0 - 10%	Very Low 1	1	2	3	4	5
	Impact	Very Low 1	Low 2	Medium 3	High 4	Very High 5
= HIGH RISK	*Cost*	*<£1m*	*£1 -£5m*	*£5m - £15m*	*£15m - £25m*	*>£25m+*
= MEDIUM RISK	*Time*	*<1 mth*	*1mth – 3ths*	*3 mths – 6mths*	*6mths – 12mths*	*> 12mths*
= LOW RISK						

Facilitator Tip: *Assessment matrices which describe the parameters for probability and impact provide workshop teams a good basis from which to undertake their judgement of risks. The Cost and Time impacts given above are examples. Where cost and time parameters are stated then they need adjustment to suit scheme value and duration.*

Facilitator Tip: *The severity ratings of Low/Medium/High need to be reviewed with the Employer to ascertain their appetite for risk tolerance.*

Ranking risks in the order of severity provides a basis for selecting the priority for managing risks. Generally those risks which fall into the green/low risk ranking are considered to be minor and under the control of the normal project procedures/processes. Those in the amber/medium ranking require management attention and those in the red/high risk ranking need immediate attention.

Risk Quantification

Each of the risks identified is now entered on a Risk Quantification Sheet to record the cost impact and the likelihood of occurrence. A quantified risk analysis (QRA) develops the initial assessment further. The aim of this stage is to quantify the potential impact of the assessed risks so that they can be subject to further risk analysis.

The workshop will build on the previously assessed risks and the process involves:

a. Reviewing the base estimate and the particular cost element affected by the risk in question to ascertain what if any allowance has already been made.
b. Confirming the occurrence probability of the risk from 1 to 100%. In some instances allocated ranges can be used e.g. : very low: less than 10%, low, less than 20%, medium 50%, high 70% and very high 90%.
c. Estimating the cost impact range from minimum, most likely to maximum impact.

Facilitator Tip: *As each risk is considered it is important to identify whether the Risk is an item already included in the estimate or an additional item.*

Initial consideration as to the potential risk management/mitigation is to be considered and the quantification can be adjusted to reflect this provided that the mitigation is realistic and achievable.

Opportunity costs (savings) can also be included so that the cost impact range does not have to commence with a positive figure. For example an earthworks risk associated with acceptable versus unacceptable fill could have a range from -£0.1m to +£0.25m with a most likely figure of +£0.15m.

Facilitator Tip: *In certain circumstances the Workshop will identify work elements that should have been included in the base estimate. When this occurs, the additional work elements will need to be added to the base estimate to determine a new base estimate and removed or adjusted in the risk register.*

The cost of Project Preliminaries (fixed or time related costs e.g. management team, site compound, plant items) per week or month can be used to establish a cost conversion for time delay on construction.

For schemes at earlier stages the impact of time could affect scheme progress and increase scheme preparation/design costs. These impacts should be quantified to assess Risks attached to scheme preparation costs.

Risk Modelling

To ascertain what might be the possible outcome of the risks and to establish a Risk Allowance the probability of occurrence is modelled along with the Risk cost impact should the risk materialise for each risk. Simple summation of all risks will assume that all risks identified will occur. This approach will result in risk over provision.

In practice, not all risks identified will be realised and hence the total Risk Allowance must be modified to take account of the characteristics of individual risks.

To achieve a robust forecast of the Risk Allowance, the project would need to be carried out many times over to achieve a statistically significant prediction of identified Risks occurring. Since it is not practical to physically repeat the project many times over to determine Risk Allowances, mathematical modelling techniques can be used to assist.

The Highways Agency in England has its own risk simulation tool which they use to undertake the risk modelling aspects, but there are other software products widely available which will undertake the task.

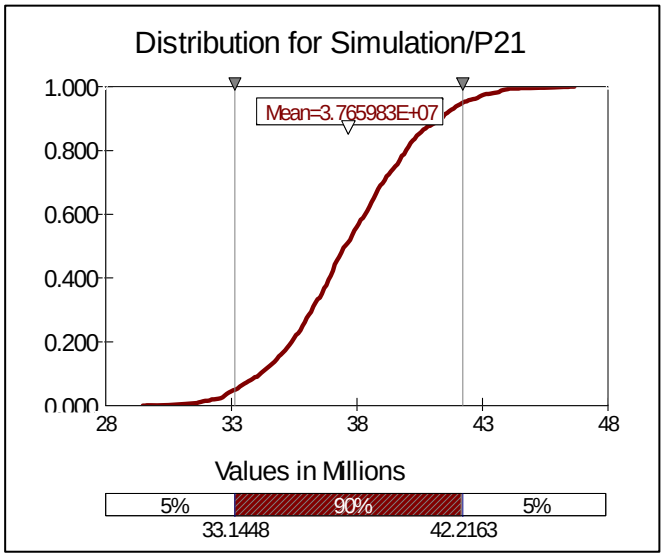
Once all risk data has been transferred to the model, the simulations can commence to produce a range of possible cost outcomes at given levels of confidence in attainment.

The outcome of a risk simulation can be represented as a cumulative histogram with confidence levels from 0 to 1 on the vertical axis and a cost range from minimum to maximum on the horizontal axis.

The Risk Allowance is a value chosen from the confidence range and the corresponding value chosen is normally 0.50 or higher.

An example of a graphical output from Monte Carlo simulation is given in Figure 2 below:

Figure 2



2.4.2 Design, Build, Finance and Operate (DBFO)

Risk Identification

The risk process associated with the design and build elements of the DBFO arrangement are the same as that already described above. As a DBFO contract involves the contractor operating the road for many years e.g. 30-40years then there are additional risk identification categories to be considered and an example of these is given below:

Risk Identification Categories
Operation and Maintenance
General O&M Risks
Pavement
Structures
Traffic Technology
Earthworks & Drainage
Street Furniture
Winter Maintenance
Environmental Issues
Routine and Cyclic
Third Parties and Liaison
Statutory Undertakers
Depot Management
Finance, including demand projections

Risk Identification Categories
Commercial
Legal
Contract – including payment mechanism and change procedures
Environmental
Policy/political
Network Security
Resourcing – including Employer, Contractor and Industry
Overall programme key milestones
Other

Risk Assessment

The design and construction risk assessment matrices examples given in Section 2.4.1 can be adopted for the new works aspect of a DBFO project. For those risks which may occur over the period from road opening until hand-back after the concession period has ended then the assessment matrix can similar to the previous but modified slightly.

An example is given below:

Probability				
High 3	**3**	**6**	**9**	**12**
Medium 2	**2**	**4**	**6**	**8**
Low 1	**1**	**2**	**3**	**4**
Impact Score	Low 1	Medium 2	High 3	Very High 4
Cost per event :	*Less than £50k*	*£50-200K*	*£200-£500K*	*£500K +*

Facilitator Tip: *As the concession period is of circa 30-40 years one way of assessing the probability of a risk occurring is as follows:*

Low 1 = Unlikely - Could occur twice or less over the period

Medium 2 = Possible, it may occur periodically e.g. every five years

High 3 = Very likely - frequent e.g. annually or more often

The cost impact will need to be adjusted to reflect the value of the scheme.

2.4.3 Strategic and Project Risks

As part of the risk assessment process different types of risk can be identified. These can be articulated as strategic or project risks. The Highways Agency guidance on the distinction between strategic versus project specific risks is as follows:

*A **Strategic Risk** is a change imposed on the scheme by Statute, Policy or a condition that falls outside the scope of the contract or the brief for the scheme or package of schemes.*

Strategic Risks are generally high value, low probability risks (in a design and construction context). They are excluded in the assessment and quantification of project risk as a separate allowance is made at a programme/business level for these types of risk.

Strategic risks include:

- Changes in government policy
- Changes in statute or regulations
- Outbreak of environmental or agricultural epidemics (e.g. Foot & Mouth)
- Addition or removal of a scheme from a contract package or changing the chosen route option (Changes resulting from fine-tuning or the public inquiry to features or provisions within the chosen scheme are not considered strategic changes).
- Contractor bankruptcy

***Facilitator Tip:** The Employer for the project in question will need to consider how he addresses the nature of these types of risk.*

For DBFO projects which run over many years there is a likelihood of these risks occurring at some stage during the contract. The specific provisions of the DBFO contract will specify which risks remain the ownership of the Employer and which become the responsibility of the DBFO contractor.

2.5 RISK MANAGEMENT

2.5.1 General Principles

Risk Management is a key process to achieving Value for Money. It comprises the following three steps:

- Risk Response Planning
- Risk Management Plan
- Review and Implementation

Risk Response Planning

The following three broad strategies are available for dealing with risks and their consequences:

- Risk avoidance - where possible, project design should be altered to avoid identified Risks
- Impact mitigation - where potential Risks cannot be removed, measures should be taken to minimise the consequences of their occurrence
- Risk transfer - where appropriate, the responsibility for a Risk is transferred (or allocated) from one party to another, who will be better able to manage it and who will ultimately bear the consequences should it occur. Sharing of risks may be a sub-option, where the management of risk is shared but ownership of the consequences resides with one party. The extent of Risk transfer is particularly important when considering procurement options.

Where risks cannot be avoided or prevented, they must be accepted and controlled if the project is to be properly managed.

For those risks where transfer may be an appropriate action, the following should be undertaken:

- List all the parties to whom the Risk may be transferred and determine the most appropriate
- Determine the most favourable manner in which the Risk might be transferred (e.g. through insurance or contract arrangements or some other method)
- Establish the potential impact of the Risk on the project
- Determine a fair price for transfer of the Risk
- Compare cost of retaining Risk and managing with cost of transfer

Selection of the best response to each risk involves a calculated assessment between the potential benefits of implementing a response and the actual costs of doing so. Experience will assist in the selection of alternative responses to each risk. The overall objective is to recognise the existence of risks, whose impact can be greatly reduced.

Risk Management Plan – The Risk Register

For each scheme, a Risk Management Plan should be prepared. The plan comprises a register of all the risks identified and assessed and describes the risk management measures to be implemented to reduce and control risks. It summarises the results of the risk management process to date and should be updated at scheme progress meetings to record risks avoided, realised and the revised strategy for management.

Review and Implementation

The Risk Management processes should be reviewed at regular meetings to ensure the following:

- That each Risk is removed or controlled
- That the Risk management process adopted for each Risk is effective
- That resources are made available to deal with Risks at appropriate times

3 THE FACILITATOR AT RISK WORKSHOPS

3.1 INTRODUCTION - WHAT IS A FACILITATOR?

The dictionary defines a facilitator as "*someone who makes progress easier"* Other definitions are:

"An instructor who assists, directs, and stimulates the learning during an online course" – Source www.worldwidelearn.com

"A facilitator is someone who skilfully helps a group reach a consensus without personally taking any side of the argument". Source - en.wikipedia.org

A facilitator is an individual whose job is to help to manage the process of information exchange normally during a meeting of individuals. An expert's" role is to offer advice on the content of the meeting while the facilitator's role is to help with how the meeting is proceeding.

In short, the facilitator's responsibility is to address the process rather than the outcome itself. The main roles of a facilitator for a project team are to:

- Maintain team focus;
- Suggest consensus alternatives;
- Provide direction and consultation;
- Encourage everyone's participation; and
- Supportively deal with problems.

The facilitator's role is therefore primarily concerned with the team dynamics. The facilitator should provide a cohesive influence and ensure that all team members are providing an effective input. In addition facilitators are usually experienced in the problem-solving techniques required by the team to bring about improvement although very often the facilitator will have little direct knowledge of the problem at hand.

Typically 'team-workers' are effective facilitators and, as with many of the aspects of quality development, good facilitation skills require training.

Source: The Fundamentals of Quality Management by Dennis F Kehoe

3 THE FACILITATOR AT RISK WORKSHOPS

The key skills required for a facilitator can be summarised below:

- Build and maintain rapport with and between group members
- Be aware and actively listen and observe group/individual behaviour
- Give useful feedback to the group in order to improve co-operative behaviour
- Good questioning techniques to draw out and explore issues in the group
- Ensure potential blockages to communication are identified and addressed
- Effectively manage information derived from the facilitation process, including note taking and producing workshop reports
- Use activities to illustrate key learning points and link to real life
- Balance the contribution and involvement of the participants
- Help the group to reach decisions so that people will be committed to their implementation
- Bring clarity to ambiguous situations by summarising and testing understanding outside of them
- Assist in the identification of any individuals not suited to the partnering arrangement
- Appreciate different learning styles to ensure that all needs are met
- Design a meeting process to reach the agreed event outcomes
- Flex the agenda, if required, in order to meet participants' needs
- Manage time effectively
- Monitor the energy within the group and manage the process to maintain interest and motivation

Source: Highways Agency Requirements for Facilitator's

3.2 ROLE OF FACILITATOR IN RISK WORKSHOPS

As mentioned earlier major projects have large teams and the role of the facilitator is to bring that team together in order to work effectively towards a common objective. In the case of a risk workshop then the objective will be to deliver some or all of the elements of the risk process described in Section 2.

Specifically for risk workshops the facilitator needs to be proficient and experienced enough to take on this key role, ideally the facilitator:

- Is expert in all relevant risk management techniques, to help command the confidence of all parties involved;
- Understand technical issues relevant to the project;
- Understands commercial issues relevant to the project;
- Has good management skills; and
- Has good communication skills

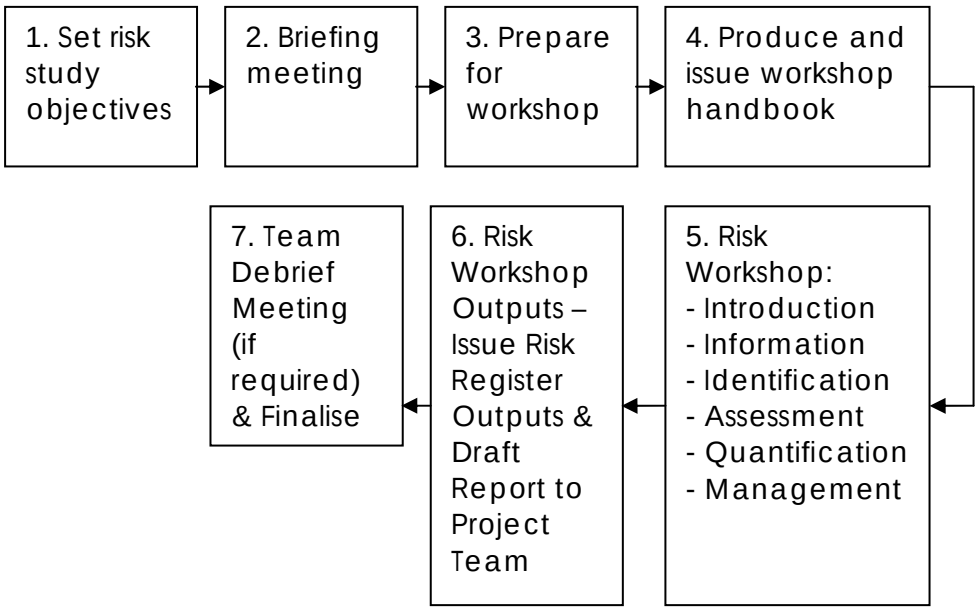
The facilitator leads the risk management process, chairs meetings and generally helps the project team get the full benefits of systematic risk management. Appointing a facilitator from outside of the project team usually gives the role and the person an air of impartiality and therefore greater credibility among team members who come from several organisations.

Source: Control of Risk – A Guide to the Systematic Management of Risk from Construction by CIRIA.

Additional support to the facilitator is provided by a trained workshop recorder person.

3.3 RISK STUDY PROCEDURE

The precise procedure involved will vary depending upon the nature and complexity of the individual scheme. The generic risk study process is given below:



3 THE FACILITATOR AT RISK WORKSHOPS

As indicated in Section 2 certain stages in the risk process may be integrated with the Value Management / Value Engineering process. Notwithstanding this the procedure outlined below (based on that contained in the Highways Agency's Value for Money Manual) is for a complete risk study including a workshop at its core. The approach can be adapted to suit the particular circumstances of the project and if some elements of the complete risk process are to be undertaken.

3.3.1 Risk Study Objectives

- To identify all project Risks
- To assess the major project Risks (in terms of cost & time)
- To quantitatively assess the potential impact of the Risks on the project outturn
- To develop, devise and implement cost effective Risk Management responses to all major Risks

At the core of the study a four stage risk study process is involved;

1. Briefing
2. Workshop
3. Risk Quantification
4. Debrief – meeting to finalise the outputs from the workshop and confirm follow-up actions.

3.3.2 Who Should Attend? (Briefing & Workshop)

Attendee	Briefing	Workshop
Employer		
Project Director	Advisable	Advisable
Project Manager/Engineer	Essential	Essential
Design Organisation		
Project Design Director	Essential	Essential
Lead design manager	As required	Essential
Cost Estimator	As required	Essential
Other Specialists from Employer & Design Organisation - (e.g. Environment, Structures, Traffic etc) as required	As required	Essential
Facilitator	Essential	Essential
Workshop Recorder		Essential

Other Organisations, which by their actions could have significant Risk impact on the project, can be represented at the workshop if desired, e.g. Local Authority representatives, rail operator. The inclusion or otherwise of these organisations is at the discretion of the Employer.

If the Contractor is involved on the project then members of their team should attend the workshop.

For DBFO workshops the attendees at the workshop will be expanded to include specialists/organisations/advisors relating to network Maintenance/Operations, Finance, Legal/Contracts.

Facilitator Tip: *The number of participants at the workshop can vary considerably. The expertise of the facilitator to ensure that the workshop runs smoothly and is effective will be tested as the group size increases. Attendance can range from 12 to 30+ with the use of syndicate group working an option.*

The output from the briefing meeting will be collated by the facilitator and that person will produce a workshop briefing paper/handbook. The project team may also produce complimentary information for the workshop which can be issued on the day. The pre workshop handbook will contain information on the project including:

- Drawing of whole scheme and if necessary sections of the scheme
- Cost estimate broken down into key elements
- Description of project scope
- Summary programme

For DBFO projects the information will also contain background information on maintenance/operation conditions and scope.

Workshop objectives, agenda, attendees, an explanation of the risk process to be adopted and venue details are also to be agreed at the briefing and included in the handbook. The handbook is to be issued to the attendees within one week of the event.

3.3.3 Timescales

Typically, a 1 or 2 day workshop which is followed by further detailed risk quantification and risk register development after the workshop by the project team.

3.3.4 Risk Workshop Process

The Workshop consists of a number of phases, which are summarised below. To help explain how the outputs from the risk identification, assessment, quantification and management phases are built up during the workshop example extracts from real workshops are provided.

Phase 1 - Introduction

The initial introduction should be by the Facilitator and cover the following points:

- Introductions by all participants
- Objectives of the Workshop and the parameters within which the Workshop is to be run
- A brief overview of the Risk Analysis and Management process
- Summarise the project stage and explain the need for the Risk Workshop
- Rules of Workshop and Roles of Facilitator and Participants at the workshop

Phase 2 - Information

The Employer will make a presentation following the introduction phase to confirm the objectives and need for risk workshop and also to explain the background to the project and outline scope. The design organisation will then follow with a detailed project scope and key areas of interest e.g. constraints, costs and programme. Further detailed information on the scheme can be made available at this stage which was not included in the initial handbook. The presentation phase normally lasts between 20mins to 1hour maximum including questions.

Phase 3 - Project Risk Identification

The workshop facilitator introduces the participants to the risk identification stage and then proceeds to explore the project in detail and motivate the participants to identify the Risks. The Risk categorisation format described in Section 2 can be utilised to structure the identification process coupled with a section by section review of the scheme layout plan.

As each Risk is identified, it is entered on the Risk Identification sheet and categorised.

3 THE FACILITATOR AT RISK WORKSHOPS

Facilitator Tip:
The facilitator will need to ensure that an adequate description of the risk is given to ensure understanding and where necessary to explore the causes of the risk as this often reveals other risks.

When identifying potential risks, it is important to distinguish between the origin of a risk and its effect. The facilitator will need to ensure that the workshop participants focus only on identification of risks during this stage. .The facilitator can record the risks on a flip-chart, however the use of additional support is provided to the facilitator by using a trained workshop executive support/recorder. The blank risk register template is normally an excel worksheet and the recorder (through the use of laptop computer and LCD projector) types the risks into the worksheet as the identification process continues.

An example extract from a design and construction risk register is given in Figure 1 below:

Figure 1

RISK IDENTIFICATION	
Risks	**Cat**
Current Junction Strategy - Additional connections required	A
Cross section verge width increased for signage and/or safety fencing	A
Climbing Lane might be required	A
Pavement condition better than estimated (VE Opportunity)	A
Risk that the traffic model is insufficiently robust	A
Earthworks side slope shallower than 1:3 required in some areas	B
Earthworks side slope shallower than 1:2 required in some areas	B
Construction sequence might not allow suitable material to be used with additional imported fill volume required and disposal/deposition of suitable material.	B
Acceptability of excavated material	B
Extensive upgrading required of existing drainage outfalls	B
Shortage of fill for environmental mounds	B
Asbestos - specialist removal/treatment	B

RISK IDENTIFICATION	
Risks	**Cat**
Increased size of existing drainage culverts	C
Changing telecommunication standards & technology	D
Standard changes post contractor award	L

Phase 4 - Risk Assessment - Qualitative
The objectives of this phase are to undertake the initial assessment for probability and impact using a probability/impact (PxI) matrix.

The exact form of PxI matrix should be agreed before the workshop with the team and the cost/time impact ranges agreed for each rating.

The facilitator uses the matrix as a means to deepen the participants understanding of the risks and to ascertain whether the risk is already accommodated in the scheme costs/plans and also within normal project management controls or whether the item is indeed a risk which may or may not occur along with an associated impact.

The following example in Figure 2 extract builds on the earlier design and construction risk identification listing and utilised a 5 by 5 PxI matrix.

Facilitator Tip: *The recorder will need to note any explanatory comments to the assessment process as it proceeds for useful reference at a later date.*

Figure 2

RISK IDENTIFICATION		RISK ASSESSMENT				
Risk	Cat	Prob	Cost Imp	Time Imp	Cost Rank (PxI)	Time Rank (PxI)
Current Junction Strategy - Additional connections required	A	3	3	1	9	3
Cross section verge width increased for signage and/or safety fencing	A	5	2	1	10	5
Climbing Lane might be required	A	1	3	1	3	1
Pavement condition better than estimated (VE Opportunity)	A	4	2	1	8	4
Risk that the traffic model is insufficiently robust	A	2	1	3	2	6
Earthworks side slope shallower than 1:3 required in some areas	B	4	2	1	8	4
Earthworks side slope shallower than 1:2 might be required in some areas	B	2	4	2	8	4
Construction sequence might not allow suitable material to be used with additional imported fill volume required and disposal/deposition of suitable material.	B	3	4	2	12	6
Acceptability of excavated material	B	2	2	2	4	4
Extensive upgrading required of existing drainage outfalls	B	2	2	2	4	4
Shortage of fill for environmental mounds	B	3	2	1	6	3
Asbestos - specialist removal/treatment	B	1	1	1	1	1
Increased size of existing drainage culverts	C	3	2	1	6	3
Changing telecommunication standards & technology	D	4	2	2	8	8
Standard changes post contractor award	L	5	3	1	15	5

Phase 5 - Risk Assessment - Quantitative
The aim of this phase is to build on the initial risk assessment phase and to quantify, for each Risk, the following:

- Occurrence probability
- The minimum, most likely and maximum cost impact

Facilitator Tip: *As each Risk is considered it is important to identify whether the Risk is an item already included in the estimate or an additional item. This emphasises the importance of having at least one participant who understands the breakdown of the estimate.*

The role of the Scheme Cost Estimator is particularly important during the quantification stage. The scheme cost is based on certain assumptions of quantities and if they change the estimate would vary. These variations also need to be taken account of in the Risk quantification assessment e.g. changes in earthworks quantities.

If an additional cost item (rather than risk) is identified then this can be noted during the quantification process and then added to the scheme cost estimate. This one example of how the evolving risk register interacts with the development of the scheme costs.

Facilitator Tip*: Care needs to be taken to ensure that:*

- *Double-counting of risks does not occur*
- *The cost of time delays is not double-counted in the costs for each risk*

Initial consideration as to the potential risk management/mitigation is to be considered and the quantification can be adjusted to reflect this provided that the mitigation is realistic and achievable.

As mentioned previously, opportunity costs (savings) can also be included so that the cost impact range does not have to commence with a positive figure.

The example extract in Figure 3, builds on the earlier design and construction risk identification and assessment sheet to demonstrate the quantification approach.

When considering each risk, the estimate of the time impact (in weeks) from the assessment phase can be identified as having a critical or non-critical impact and whether it is pre-construction or during construction.

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The total critical time impact for pre-construction and during construction can be assessed and the costs of the delays estimated and included in the risk quantification.

This approach is satisfactory at the early stages of a project where reasoned expert judgement can be made by the project team. As the programme is developed in detail, normally by the contractor, the programme and associated costs will be known and the costs associated with delays more accurately established.

An example of a time to cost risk quantification sheet (for an early stage quantification) is given in Figure 4.

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Figure 3

RISK IDENTIFICATION		RISK ASSESSMENT					QUANTIFICATION			
Risk	Cat	Prob	Cost Imp	Time Imp	Cost Rank (PxI)	Time Rank (PxI)	Prob	Min (£)	Most Likely (£)	Max (£)
Current Junction Strategy - Additional connections required	A	3	3	1	9	3	0.5	£5,000,000	£10,000,000	£15,000,000
Cross section verge width increased for signage and/or safety fencing	A	5	2	1	10	5	0.9	£1,000,000	£2,500,000	£5,000,000
Climbing Lane might be required	A	1	3	1	3	1	0.1	£5,000,000	£10,000,000	£15,000,000
Pavement condition better than estimated (VE Opportunity)	A	4	2	1	8	4	0.7	-£5,000,000	-£2,500,000	-£1,000,000
Risk that the traffic model is insufficiently robust	A	2	1	3	2	6	0.2	£100,000	£500,000	£1,000,000
Earthworks side slope shallower than 1:3 required in some areas	B	4	2	1	8	4	0.7	£1,000,000	£2,500,000	£5,000,000
Earthworks side slope shallower than 1:2 required in some areas	B	2	4	2	8	4	0.2	£15,000,000	£20,000,000	£25,000,000
Construction sequence might not allow suitable material to be used with additional imported fill volume required and disposal/deposition of suitable material.	B	3	4	2	12	6	0.5	£15,000,000	£20,000,000	£25,000,000

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RISK IDENTIFICATION		RISK ASSESSMENT					QUANTIFICATION			
Risk	Cat	Prob	Cost Imp	Time Imp	Cost Rank (PxI)	Time Rank (PxI)	Prob	Min (£)	Most Likely (£)	Max (£)
Acceptability of excavated material	B	2	2	2	4	4	0.2	£1,000,000	£2,500,000	£5,000,000
Extensive upgrading required of existing drainage outfalls	B	2	2	2	4	4	0.2	£1,000,000	£2,500,000	£5,000,000
Shortage of fill for environmental mounds	B	3	2	1	6	3	0.5	£1,000,000	£2,500,000	£5,000,000
Asbestos - specialist removal/treatment	B	1	1	1	1	1	0.1	£100,000	£500,000	£1,000,000
Increased size of existing drainage culverts	C	3	2	1	6	3	0.5	£1,000,000	£2,500,000	£5,000,000
Changing telecommunication standards & technology	D	4	2	2	8	8	0.7	£1,000,000	£2,500,000	£5,000,000
Standard changes post contractor award	L	5	3	1	15	5	0.9	£5,000,000	£10,000,000	£15,000,000

Figure 4

RISK IDENTIFICATION		RISK ASSESSMENT					QUANTIFICATION			
Risk	**Cat**	**Stage: 1 or 2**	**On Critical Path?**	**Prob**	**Time Imp**	**Time Rank (PxI)**	**Prob**	**Min - months**	**Most Likely - months**	**Max - months**
Stage 1 - Pre-construction										
Current Junction Strategy - Additional connections required	A	1	Yes	3	1	3	0.5	**0.0**	**0.5**	**1.0**
Cross section verge width increased for signage and/or safety fencing	A	1	No	5	1	5	0.9	0.0	0.5	1.0
Climbing Lane might be required	A	1	Yes	1	1	1	0.1	**0.0**	**0.5**	**1.0**
Pavement condition better than estimated (VE Opportunity)	A	1	No	4	1	4	0.7	0.0	0.5	1.0
Risk that the traffic model is insufficiently robust	A	1	Yes	2	3	6	0.2	**3.0**	**4.5**	**6.0**
Increased size of existing drainage culverts	C	1	No	3	1	3	0.5	0.0	0.5	1.0
Changing telecommunication standards & technology	D	1	Yes	4	2	8	0.7	1.0	2.0	3.0
		Expert judgment of likelihood/impact from quantification & risk mitigation:					0.2	2.0	3.0	4.0
		Cost per month of related pre-construction activities is £50,000					**0.2**	**£100,000**	**£150,000**	**£200,000**

Stage 2 - Construction	Cat	Stage: 1 or 2	On Critical Path?	Prob	Time Imp	Time Rank (PxI)	Prob	Min - months	Most Likely - months	Max - months
Earthworks side slope shallower than 1:3 required in some areas	B	2	No	4	1	4	0.7	0.0	0.5	1.0
Earthworks side slope shallower than 1:2 might be required in some areas	B	2	No	2	2	4	0.2	1.0	2.0	3.0
Construction sequence might not allow suitable material to be used with additional imported fill volume required and disposal/deposition of suitable material.	B	2	Yes	3	2	6	0.5	**1.0**	**2.0**	**3.0**
Acceptability of excavated material	B	2	Yes	2	2	4	0.2	**1.0**	**2.0**	**3.0**
Extensive upgrading required of existing drainage outfalls	B	2	No	2	2	4	0.2	1.0	2.0	3.0
Shortage of fill for environmental mounds	B	2	No	3	1	3	0.5	0.0	0.5	1.0
Asbestos - specialist removal/treatment	B	2	Yes	1	1	1	0.1	**0.0**	**0.5**	**1.0**
Standard changes post contract	L	2	Yes	5	1	5	0.9	**0.0**	**0.5**	**1.0**
		Expert judgment of likelihood/impact from quantification & risk mitigation:					0.5	1.0	2.0	3.0
		Cost per month of preliminaries items for construction activities is £500,000					**0.5**	**£500,000**	**£1,000,000**	**£1,500,000**

Phase 6 - Modelling the Risks

As explained earlier there are several risk simulation modelling tools available to undertake risk simulation modelling, should this be required.

Normally the modelling element is undertaken after the workshop, and is an iterative process linked closely with the development of the scheme cost estimating process.

Notwithstanding the above an indicative result can be produced at the workshop if sufficient information is available for the participants to be provided with an initial indication of the resultant outcome range for the risk quantification exercise.

A simple probability x impact (minimum, most likely and maximum) calculation can be undertaken to produce an output range and average.

An example is given in Figure 5.

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Figure 5

RISK IDENTIFICATION		QUANTIFICATION				QUANTIFICATION OUTPUT		
Risk	Cat	Prob	Min (£)	Most Likely (£)	Max (£)	P x Min (£)	P x Most Likely (£)	P x Max (£)
Current Junction Strategy - Additional connections required	A	0.5	£5,000,000	£10,000,000	£15,000,000	£2,500,000	£5,000,000	£7,500,000
Cross section verge width increased for signage and/or safety fencing	A	0.9	£1,000,000	£2,500,000	£5,000,000	£900,000	£2,250,000	£4,500,000
Climbing Lane might be required	A	0.1	£5,000,000	£10,000,000	£15,000,000	£500,000	£1,000,000	£1,500,000
Pavement condition better than estimated (VE Opportunity)	A	0.7	-£5,000,000	-£2,500,000	-£1,000,000	-£3,500,000	-£1,750,000	-£700,000
Risk that the traffic model is insufficiently robust	A	0.2	£100,000	£500,000	£1,000,000	£20,000	£100,000	£200,000
Earthworks side slope shallower than 1:3 required in some areas	B	0.7	£1,000,000	£2,500,000	£5,000,000	£700,000	£1,750,000	£3,500,000
Earthworks side slope shallower than 1:2 might be required in some areas	B	0.2	£15,000,000	£20,000,000	£25,000,000	£3,000,000	£4,000,000	£5,000,000

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RISK IDENTIFICATION		QUANTIFICATION				QUANTIFICATION OUTPUT		
Risk	Cat	Prob	Min (£)	Most Likely (£)	Max (£)	P x Min (£)	P x Most Likely (£)	P x Max (£)
Construction sequence might not allow suitable material to be used with additional imported fill volume required and disposal/deposition of suitable material.	B	0.5	£15,000,000	£20,000,000	£25,000,000	£7,500,000	£10,000,000	£12,500,000
Acceptability of excavated material	B	0.2	£1,000,000	£2,500,000	£5,000,000	£200,000	£500,000	£1,000,000
Extensive upgrading required of existing drainage outfalls	B	0.2	£1,000,000	£2,500,000	£5,000,000	£200,000	£500,000	£1,000,000
Shortage of fill for environmental mounds	B	0.5	£1,000,000	£2,500,000	£5,000,000	£500,000	£1,250,000	£2,500,000
Asbestos - specialist removal/treatment	B	0.1	£100,000	£500,000	£1,000,000	£10,000	£50,000	£100,000
Increased size of existing drainage culverts	C	0.5	£1,000,000	£2,500,000	£5,000,000	£500,000	£1,250,000	£2,500,000
Changing telecommunication standards & technology	D	0.7	£1,000,000	£2,500,000	£5,000,000	£700,000	£1,750,000	£3,500,000

RISK IDENTIFICATION		QUANTIFICATION				QUANTIFICATION OUTPUT		
Risk	Cat	Prob	Min (£)	Most Likely (£)	Max (£)	P x Min (£)	P x Most Likely (£)	P x Max (£)
Standard changes post contract	L	0.9	£5,000,000	£10,000,000	£15,000,000	£4,500,000	£9,000,000	£13,500,000
Pre-construction - delays	I	0.2	£100,000	£150,000	£200,000	£20,000	£30,000	£40,000
Construction delays	J	0.5	£500,000	£1,000,000	£1,500,000	£250,000	£500,000	£750,000
					Output Range:	**£18,500,000**	**£37,180,000**	**£58,890,000**
						Average:	**£38,190,000**	

Facilitator Tip: *The above approach is a useful indication of the outputs prior to undertaking risk simulation modelling. It has weaknesses, for example it does not indicate the level of confidence of achieving the range of minimum to maximum output values, whereas simulation will, amongst other statistical information, calculate the probability for a range of possible outturn costs.*

Phase 7 – Risk Management
The facilitator addresses the high and medium rated risks to review with the participants how the risk will be managed. The management measures considered can be singular e.g. "design team will avoid this risk by re-designing around the problem" and/or multi faceted e.g. "design team will aim to mitigate this risk by re-designing but will then through the procurement process transfer the ownership of the risk to the contractor"

The risk register is completed for management responses and actions ascribed to organisations and individuals to undertake.

The risk items not reviewed at the workshop will be tasked to the project team to address following the workshop.

Facilitator Tip: *The facilitator should ensure that the ongoing development and reporting procedures for the risk register in the future are in place. Key questions to ask are:*

- *Who will act as risk register co-ordinator to ensure actions are completed?*
- *Who will act as lead manager for the risk quantification?*
- *How will the risk register be updated and reported to the management team?*

3.3.5 DBFO Risk Workshops

The same process to that described above can be applied to risk workshops on the other aspects associated with DBFO projects. The risks can be identified, assessed and quantified using similar procedures and adopting the guidance provided in Section 2.

With regards to this form of procurement the majority of risks are transferred to the DBFO Contractor to own and manage. The risk workshop provides a useful forum within which the Employer and team can discuss the appropriateness of the risk transfer, the advantages / disadvantages associated with the transfer and Value for Money issues.

Project risks should only be transferred to the private sector if, and to the extent that, the private sector is capable of managing such risk. DBFO contracts have transferred to the private sector a substantial degree of responsibility for constructing, operating and maintaining the project road and financing the relevant costs. Transfer of responsibility increases the scope for innovation by the private sector.

The risks associated with those obligations are transferred to the private sector, so that even if a risk materialises, the specified service has to be provided to the Agency at the price agreed at the outset. The private sector is thought to be better able to manage certain risks.

The Highways Agency(in England) carry out an analysis of the risks attaching to a project by drawing up a risk register setting out in detail the risks relevant to each stage of the project, the likelihood of those risks occurring and an estimate of the financial impact of occurrence. The analysis helps the Agency to establish what type, and the quantum, of risk that they should ask the private sector to take. The DBFO contract is drafted so that the DBFO Co bears all risks associated with an area of delivery, such as operation, unless the Agency is specified to take a risk, either through the payment mechanism, change mechanism, termination events or other contractual mechanisms. Therefore any unanticipated risk will be borne by the private sector.
Under a PFI contract, the private sector will generally be asked to take the following risks:

- construction and operational cost overruns;
- delay in delivery of the service;
- design of the underlying asset not delivering the agreed service; and
- changes of law, including tax law changes, which impose additional or increased costs on the operator (other than any change of law which discriminates against private sector operators).

DBFO contracts are structured to leave these risks with the DBFO Contractor.

Source: Highways Agency – Value In Roads

An example extract output from a DBFO risk workshop is given in Figure 6.

As indicated above each contract is different and the example given is only to demonstrate the approach and not as guidance on which risks ought or ought not to be transferred to the DBFO contractor nor is it a complete list of risks. For example there is a current emphasis on level of service (safety and lane availability) with linkage to the payment mechanism.

Figure 6

Risk Category	Risk Description	Risk Ownership Allocation		
		Employer	DBFO Contractor	Share
Finance	Aggregate Levy/Tax Changes		X	
Finance	Change in Currency in UK (Euro)			X
Finance	Change in Government Funding of Employer	X		
Finance	Continued Availability of County Council Funding	X		
Finance	Inflation		X	
Finance	Insolvency / Bankruptcy / Liquidation of Provider / Supply Chain Member		X	
Finance	Insurance - Public Liability and Others		X	
Finance	Interest / Exchange Rate Changes		X	
Finance	Taxation Changes		X	
Finance	VAT Changes (Other than Irrevocable VAT)		X	
Legal	Change in Local, Regional or National Policy	X		
Legal	Legislative Changes - Discriminatory and Specific Changes in Law	X		
Legal	Legislative Changes - Construction Phase		X	
Legal	Legislative Changes - Non-Construction Phase			X
Legal	Maladministration		X	
Legal	Step-In by Financiers		X	
Design	Change in Design Standards & Codes of Practice		X	
Design	Change Requested by Employer	X		
Design	Change Requested by Service Provider		X	
Design	Compensation Events - Delays and Costs			X

Risk Category / Stage	Risk Description	Risk Ownership Allocation		
		Employer	DBFO Contractor	Share
Design	Compliance with Quality Standards		X	
Design	Departures from Standards		X	
Design	Failure to Develop Design in Required Timetable		X	
Design	Failure to Turn Specification into Suitable Design			X
Design	Fitness For Purpose		X	
Design	Stage 1 and 2 Safety Audits		X	
Design	Stakeholder Liaison, Consultation and Interface		X	
Construction	Accuracy of Inventory and all Surveys		X	
Construction	Archaeological and Historical Finds / Fossils and Antiquities			X
Construction	Breakdown in Communications / Partnering Ethos			X
Construction	Change Requested by Employer	X		
Construction	Change Requested by Service Provider		X	
Construction	Communication Systems		X	
Construction	Compensation Events - Delays and Costs			X
Construction	Contamination / Hazardous Materials		X	
Construction	Cost / Delay of Advance Works		X	
Construction	Damage to Property / Neighbouring Buildings		X	
Construction	Delays Caused by / Increased Costs of Statutory Undertakers / Service Diversions		X	
Construction	Design and Certification Procedures		X	
Construction	Design Assumptions Incorrect		X	

3 THE FACILITATOR & RISK WORKSHOPS

Risk Category / Stage	Risk Description	Risk Ownership Allocation		
		Employer	DBFO Contractor	Share
Construction	Ground Settlement During / After Construction		X	
Construction	Health & Safety Issues / Site Safety		X	
Construction	Inclement Weather and Flooding		X	
Operations	Breakdown in Communications / Partnering Ethos			X
Operations	Compliance with Quality Standards		X	
Operations	Customer / Public Relations (Image, Reputation of Employer			X
Operations	Damage to Property / Neighbouring Buildings		X	
Operations	Industrial Action / Disputes		X	
Operations	Labour Costs, Availability and Performance		X	
Operations	Liaison with Emergency Services		X	
Operations	Maintenance Requirements More Onerous Than Anticipated		X	
Operations	Management & Supervision of Contract, including Sub-Contractors		X	
Operations	Management and Upkeep of Inventories, Asset Databases		X	
Operations	Material Costs, Availability, Supply, Installation		X	
Operations	Material Failures, Latent Defects, Poor Workmanship		X	
Operations	Monitoring and Operating Costs		X	
Operations	Oil Prices		X	
Operations	Terrorism, War, Insurrection or Invasion			X
Operations	Waste Management		X	
Operations	Risks associated with Winter Maintenance Operations		X	

3.3.6 Roles and Rules of Workshops

For the Workshop to be successful in group decision making and to achieve the Workshop objectives, participants must agree to the following ground rules:

- A mutual commitment for the Workshop to succeed
- Everybody to contribute and be of equal status
- No professional intimidation
- Not to stay silent and to speak their thoughts,
- Avoiding minutiae and unnecessary digression
- Avoiding time wasting, speak in turn and be precise
- Asking questions if unclear

A successful Workshop requires the full and uninterrupted time of its participants; it is often intense and demanding. For success, participants must comply with the following rules:

- Attendance from start to finish
- Keeping the period of the Workshop clear for the Workshop only
- Attending to normal business outside Workshop hours (before the start, during lunch or after the day's session)
- Switching off all mobile telephones and alarms

3.3.7 Example Risk Workshop Agendas

The following provides example workshop agendas for three different types of risk workshop.

Facilitator Tip: *the facilitator will need to carefully design the agenda to suit the objectives of the session, the complexity and size of the project and the number of participants attending the workshop.*

Figure 7

DESIGN & CONSTRUCTION – NEW WORKS AGENDA	
9.30	**Introduction – Facilitator**
	Participant introductions, Workshop objectives, rules & role Risk process
9.40	**Information**
	∆ Background to Scheme: Employer (5-10 mins) ∆ Proposed illustrative scope, costs, programme & initial risks: Consultant (20 mins)
	Questions & Answers Reviewing of base estimate, cost derivation, assumptions
10.30	Coffee
10.45	**Risk Identification**
	∆ Identification of potential risks to new works using structured agenda, checklists and group experience
11.45	**Risk Assessment**
	∆ Initial matrix assessment of risks against probability of occurrence & impact (cost & time) to give H/M/L – Rating
1.00	Lunch
2.00	**Quantified Risk Assessment** ∆ Undertaking a QRA for all key risks by establishing: ∆ Probability of occurrence (%) ∆ Cost impact range: £ min/£ most likely/£ max ∆ Time impacts converted to cost
3.00	**Coffee/Tea**
3.15	**Quantified Risk Assessment cont'd** ∆ Undertaking a QRA for all key risks by establishing: ∆ Probability of occurrence (%) ∆ Cost impact range: £ minimum/£ most likely/£ maximum ∆ Time impacts converted to cost
4.45	**Workshop Review & Conclusions** ∆ Way Forward & Action Planning
5.00	**Workshop Close**

3 THE FACILITATOR & RISK WORKSHOPS

Figure 8

OPERATIONS & MAINTENANCE DBFO AGENDA	
9.30	**Introduction – Facilitator**
	Participant introductions, Workshop objectives, rules & role risk process
9.40	**Information**
	∆ Background to Scheme: Employer (5-10 mins) ∆ Proposed operations & maintenance works regime & costs: Consultant (20 mins)
	Questions & Answers
10.30	Coffee
10.45	**O&M Works Planned Regime & Risks** ∆ Review of regime & proposed approach for each element of O&M works ∆ Review of pricing, testing assumptions & variability ∆ Review timing of works annual or periodic ∆ Identification of risks against each element
1.00	Lunch
2.00	**Risk Assessment**
	∆ Initial matrix assessment of O&M risks against probability of occurrence & impact (cost & time) – Rating high/medium/low
3.00	**Quantified Risk Assessment** ∆ Undertaking a QRA for all key risks by establishing: ∆ Probability of occurrence – frequency of risk ∆ Cost impact range: £ minimum/£ most likely/£ maximum
3.00	**Coffee/Tea**
3.15	**Quantified Risk Assessment cont'd**
4.45	**Workshop Review & Conclusions** ∆ Way Forward & Action Planning
5.00	**Workshop Close**

Figure 9

DBFO "NON-ENGINEERING" RISKS AGENDA	
9.30	**Introduction -Facilitator** Introductions, workshop Day 2 objectives, agenda, roles
9.40	**Other Non Engineering Risks** Joint identification and review of other areas of risk to include: 1. Finance 2. Legal - including tax, legislation, regulations 3. Contract – including payment mechanism and change procedures 4. Environmental - environmental impact statement and environmental risks during concession period 5. Policy/political – including Road User Charging, Integrated Demand Management measures 6. Network Security 7. Resourcing – including Employer/Contactor and Industry 8. Overall programme key milestones, including public inquiry, tender period, award and timing of widening phases 9. Other Discussion on key risk areas: Δ Which risks are to be transferred? Δ What further work (if any) is required in order that the transfer can be achieved?
11.00	**Coffee**
11.15	**Identification and Transfer Review cont'd**
12.15	**Summary of Risk Management Actions arising** Agree Way Forward
12.30	**Workshop Close**

The above can be extended to a one day format.

APPENDIX A FURTHER FACILITATOR TIPS

The following provides some further tips for facilitators when conducting risk workshops.

GENERAL TIPS

- Understand the risk process, know how and when to apply certain tools and in principle keep it simple
- Prepare well, understand the project, brief the recorder and set-up pro-forma blank risk registers for populating at the workshop
- Focus on the objectives of the workshop and do not get side-tracked
- When dealing with participants address the situation, issue, or behaviour and not the person
- Maintain and support constructive behaviour and build self-confidence in quieter members
- Be flexible – change the approach to improve the workshop process if the group is not working well or is getting unduly side-tracked on to unimportant matters
- Lead by example – take responsibility for delivery of the workshop and provide leadership in achieving the outcome required
- Be capable of facilitating the detail as well as the overall process
- If you are working with a person who is acting as the workshop recorder make sure you inform that person of your requirements and give clear instructions as you proceed

WORKSHOP ENVIRONMENT/LOGISTICS

- Ensure the workshop handbook/briefing pack reached participants several days ahead of the workshop.
- Ensure laptop computer and LCD projector are available and pro-forma template risk registers set up ready for use.
- Enforce the rules and roles
- Use humour as appropriate
- Control distractions e.g. turn off mobile phones
- Ensure the room environment is conducive to team working e.g. table layout, air-conditioned, free of extraneous noise, easy to view facilitator and front-screen
- Keep to time and take breaks when needed

APPENDIX A FURTHER FACILITATOR TIPS

MANAGING PARTICIPATION

- Where possible ensure attendance is full-time
- Show interest by maintaining eye contact and actively listen
- Watch for nonverbal cues
- Control participation from individuals to ensure others get an opportunity to contribute
- Ask open-ended questions and rephrase questions
- Defer to the group if you want a view on a subject/issue
- Use participant first names
- Give both verbal & nonverbal reinforcement
- Use syndicate discussion groups to help speed up the process and also to encourage effective participation in larger workshop forums
- Give clear, concise instructions
- Encourage participants to speak in simple terms and avoid use acronyms or jargon
- Use visual aids
- Check for common understanding across the participants
- Ask participants to summarize
- Prevent individuals from taking too much control of the workshop time by using close-ended questions and summarising in order to move on.

APPENDIX B – RISK CHECKLIST

The following provides a list of potential risks.

Statutory External Factors

Changes in taxation (e.g. VAT)
Consent - Architect
Consent - EA
Consent - Emergency Services
Consent - Foreshores
Consent - Highways
Consent - Planning (including archaeological)
Conservation area consent
Delays - statutory authorities
EU directives
Electricity (supply, liaison)
Environmental
Existing rights of way
Gas (supply, liaison)
Government Legislation
Legal Agreements
Legal Changes
Listed building consent
Noise abatement
Other Consent Procedures
Planning clearance
Planning Requirements
Political Change
Public Enquiries
Rights of light
Scheduled monument consent
Sewage/waste treatment
SSSIs
Statutory Undertakings
Tax - Aggregate tax
Tax - Change in Landfill Tax
Tax - Change in VAT
Tax - Other
Telephone (supply, liaison)
Water (supply, liaison)

APPENDIX B – RISK CHECKLIST

Non Statutory External Factors

Aggregates tax
Community objections
Economic changes
Environmental impact assessment
Force Majeure Industrial action Inflation - not as expected Local protests Press/media Pressure groups Socio-economic/political changes Terrorism Union requirements

Project Definition

Decanting
Decision making
Early handover or phased completion
End user requirements
Occupancy levels
Occupation
Phasing
Postponement or acceleration
Review of the feasibility of the project
Special facilities
Special services
Specific changes in requirement
Statement of Requirement/Brief
Timescales

Design and Technology

Bad workmanship
Client changes
Collateral warranties
Construction delays and disruption
Contractor - main contractor does not perform
Contractor - main contractor insolvent
Contractor - sub contractor insolvent
Contractor - subcontractor does not perform
Procurement path

APPENDIX B – RISK CHECKLIST

Legal/Contractual

Cumulative effect of numerous changes
Design and Build Contracts
Design Development
Design errors - collateral warranties
Disputes and Claims
Effect on construction duration and changes
Errors
Extended - contract period
Extended - maintenance period
Fixed or fluctuating price basis
Interaction of Site on Construction
Interpretation of Brief
Interpretation of brief
Liquidation/Insolvency
Nominated sub contracts
Price
Professional indemnity insurance
Professional Negligence Services (i.e. infrastructure; building size etc.)
Stability/Adaptability Structural/foundation relationship
The effect on the design of any proposed changes
Timing of commencement of contractor involvement
Variations

Duration / Schedule & Urgency

Activity timing and duration
Archaeological dig delays
Availability of funds
Bad workmanship
Cash flow
Cashflow effects on timing
Change in labour/materials/plant costs
Changes in taxation
Client department regulations
Concurrency of project activities
Construction delays and disruptions
Co-ordination of sub contractors
Cumulative effect of numerous changes
Disputes and Claims
Economic changes
Effect on construction duration and changes
Existing liabilities
Financial changes

APPENDIX B – RISK CHECKLIST

Financial and Commercial

Inclement weather
Industrial action
Insurance claims - below excess cost
Latent defects
Liquidation/Insolvency
Market Conditions/Demand changes
Nominated sub contracts
Political changes
Programme
Resource allocation
Socio-economic/political changes
Special contract arrangements
Standards/codes of practice
Statutory requirements
Unconventional tender action
Variations

Organisation Implementation

Continuity of team members
Experience of the team
Labour relations
Leadership within the project

Human Factors

Accident/Injury
Accidents (traffic / pedestrians)
Bankruptcy Of Subcontractors
Bankruptcy Of Suppliers
Client agreement
Client doesn't pay
Consultants insolvent
Continuity of team members
Contractor insolvent
Contractor mis-management
Design details (slow response)
Design not approved
Health and Safety
Interface - other developers
Interface - other works/phases
Labour availability
Lack of communication

Lack of customer focus
Lack of experience
Lack of performance
Lack of resource
Lack of Staff
Lack of time
Loss of staff
Major Plant Breakdowns
Non adoption (abortive work)
Non Performance of Sub-contractors
Non Performance of Suppliers
Pioneering design
Poor communications
Poor industrial relations
Poor information flow
Poor Management
Public protest
Quality and adequacy of site control
Recruitment of Skilled Operatives
Shortage of Lorries
Shortage of Plant Excluding Lorries
Staff Cost Allowances
Statutory authority - non performance
Sub contractor goes bust
Sub-contractor non performance due to Contractor cash flow problems
Teams technological and managerial abilities
Unforeseen conditions stats / drainage
Vandalism / theft
Variations
Weather

Site Conditions

Access - denied or restricted access
Accident - road, public safety, speeding
Accident - site staff
Adjacent properties - fire, refurbishment
Adoption problems
Air quality
Archaeology
Archaeology - dig
Archaeology - finds
Boundaries
British Waterways

APPENDIX B – RISK CHECKLIST

Contamination - dealing with contamination
Contamination - land
Contamination - river pollution / storm drains
Contamination - water course
Debris
Earthworks - balance
Earthworks - ground condition
Earthworks - re-soiling
Earthworks - settlement
Earthworks - soft spots
Emergency evacuation
Environment
Environment - activists
Environment - animal conservation
Environment - protected species.
Environment - rare species
Environment Agency - restraints
Excavations
Excavations - flooded
Excavations - artesian pressure
Excavations - safety
Excavations - unstable
Existing services - gas, location and condition
Existing services - location and condition
Existing services - sewerage, location and condition
Existing services - uncharted
Existing services - water, location and condition
Flood – 3rd party impacts
Flood - disruption to works
Foundations – obstruction
Gas hazards, Ground conditions – contamination - Ground conditions – groundwater – upper aquifer
Ground conditions - hard/soft bands Ground conditions - obstructions Ground conditions - other
Ground conditions - varying strata levels/thickness Ground water Health & Safety - Aids Health & Safety - Hepatitis A&B
Health & Safety - Weil's disease
Inherited backfill
Inherited levels
Land purchase
Land requirements - change
Landfill tax - contaminated land

APPENDIX B – RISK CHECKLIST

Landowners - difficulties
Local housing group - Public Relations
Maintain existing flood defences
Manual handling
Materials - accuracy of quantities
Materials - availability
Materials - cost change
Materials - defective materials
Materials - disposal
Materials - failures due to poor quality
Materials - not to specification
Materials - procurement
Materials - quality (dimensions)
Materials - quantities
Materials - supply (including re-use)
Method statement
Mine workings
Mud
Noise
Overhead - cables
Overhead - power lines
Parking - staff
Partnering failure
Permanent works.
Plant overturning/safety
Programme - delivery
Programme - No clear understanding of time and programme and impacts
Programme - overrun
Protester - disruption
Protester action - additional security costs
Protester action - delays
Remoteness of compound
Resource - materials
Resource - plant
Resource - staff illness
Resource - staff turn over
Resource - plant positioning
Restrictions - method
Restrictions - working hours
Restructuring
Rights of way
Risk of flood
River levels
Safety aspects - public

APPENDIX B – RISK CHECKLIST

Security
Services
Setting out - major errors
Setting out - minor errors
Settlement during construction
Site boundaries - public access
Site fencing
Specification requirements
Standing time
Stockpiles - location
Storage of materials and plant
Structure - transport
Structure - erection
Structure - existing location and condition
Structure - fabrication
Structure - support/damage to adjacent properties
Theft/vandalism)
Traffic
Traffic management
Underground obstructions and service clashes
Unexploded - Bombs
Vegetation
Vibration
Waste licence restrictions
Water - drowning
Water - erosion
Water – pollution - diesel spillage
Weather - dry (dust)
Weather - rain
Weather - temperature
Weather - water levels
Weather - wind
Working from height

Source: Highways Agency

APPENDIX C – SOURCES & REFERENCES

Sources used for compilation of the Manual:

- Highways Agency - Value for Money Manual
- Highways Agency - Value in Roads – Study of DBFO Projects
- Highways Agency Requirements for Facilitator's
- The Fundamentals of Quality Management by Dennis F Kehoe published by Chapman & Hall
- Control of Risk – A Guide to the Systematic Management of Risk from Construction by CIRIA

Other useful references for further reading on project risk analysis & management:

- The Orange Book, Management of Risks – Principles and Concepts - HM Treasury, UK, published by HMSO
- Project Risk Analysis and Management (PRAM) Guide – The Association for Project Management, published by the APM Group
- Risk Analysis and Management for Projects (RAMP) – Institution of Civil Engineers and the Faculty and Institute of Actuaries, published by Thomas Telford
- Value for Money Assessment Guidance and Quantitative Assessment User Guide – HM Treasury, UK, published by HMSO
- PFI Meeting the Investment Challenge - HM Treasury, UK, published by HMSO
- Technical Note No 5 " How to construct a public sector comparator" - published by HM Treasury Taskforce: Private Finance
- Risk Analysis: A Quantitative Guide – David Vose, published by Wiley