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SOCIETY OF CONSTRUCTION LAW DELAY AND DISRUPTION PROTOCOL

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tel: 07730 474074
email: admin@scl.org.uk
www.scl.org.uk

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CONTENTS

INTRODUCTION	1
CORE PRINCIPLES	5
1. Programme and records	5
2. Purpose of EOT.....	5
3. Contractual procedural requirements.....	5
4. Do not ‘wait and see’ regarding impact of delay events (contemporaneous analysis).....	5
5. Procedure for granting EOT.....	6
6. Effect of delay.....	6
7. Incremental review of EOT	6
10. Concurrent delay – effect on entitlement to EOT	6
11. Analysis time-distant from the delay event	7
12. Link between EOT and compensation.....	7
13. Early completion as it relates to compensation.....	7
14. Concurrent delay – effect on entitlement to compensation for prolongation	7
15. Mitigation of delay and mitigation of loss.....	7
16. Acceleration	7
17. Global claims	8
18. Disruption claims	8
19. Valuation of variations.....	8
20. Basis of calculation of compensation for prolongation	8
21. Relevance of tender allowances.....	8
22. Period for evaluation of compensation	8
GUIDANCE PART A: DELAY, DISRUPTION & ACCELERATION CONCEPTS	9
GUIDANCE PART B: GUIDANCE ON CORE PRINCIPLES	12
1. Programme and records	12
Introduction to records.....	12
Format and storage of records.....	14
Categories of records	14
Programme.....	17
2. Purpose of EOT.....	22
3. Contractual procedural requirements.....	22

4.	Do not ‘wait and see’ regarding impact of delay events (contemporaneous analysis).....	23
	Contemporaneous analysis of delay.....	23
5.	Procedure for granting EOT.....	26
6.	Effect of delay.....	27
7.	Incremental review of EOT	27
8.	Float as it relates to time	27
9.	Identification of float	29
10.	Concurrent delay – effect on entitlement to EOT	29
	Meaning of concurrent delay	30
	Dealing with concurrent delay	31
11.	Analysis time-distant from the delay event	32
	Different methods of delay analysis	32
12.	Link between EOT and compensation	37
13.	Early completion as it relates to compensation.....	38
14.	Concurrent delay – effect on entitlement to compensation for prolongation	39
15.	Mitigation of delay and mitigation of loss.....	40
16.	Acceleration	41
17.	Global claims	42
18.	Disruption claims	43
	Disruption analysis.....	44
	Methods of disruption analysis	45
	Productivity-based methods.....	46
	Cost-based methods	49
	Further guidance	49
19.	Valuation of variations.....	50
20.	Basis of calculation of compensation for prolongation	51
21.	Relevance of tender allowances.....	52
22.	Period for evaluation of compensation	52
	GUIDANCE PART C: OTHER FINANCIAL HEADS OF CLAIM	54
1.	Claims for payment of interest.....	54
	Interest pursuant to contract.....	54
	Interest as damages/finance charges	54
	Time when interest starts to run.....	54

	Statutory interest on debts.....	55
2.	Head office overheads and profit.....	55
3.	Claim preparation costs.....	57
	APPENDIX A Definitions and glossary.....	60
	APPENDIX B Record types and examples	72

INTRODUCTION

- A. The object of the Protocol is to provide useful guidance on some of the common delay and disruption issues that arise on construction projects, where one party wishes to recover from the other an extension of time (EOT) and/or compensation for the additional time spent and the resources used to complete the project. The purpose of the Protocol is to provide a means by which the parties can resolve these matters and avoid unnecessary disputes. A focus of the Protocol therefore is the provision of practical and principled guidance on proportionate measures for dealing with delay and disruption issues that can be applied in relation to all projects, regardless of complexity or scale, to avoid disputes and, where disputes are unavoidable, to limit the costs of those disputes. On certain issues, the Protocol identifies various options, with the choice of the most appropriate being dependent on the nature, scale and level of complexity of a particular project and the circumstances in which the issue is being considered. On other issues, the Protocol makes a recommendation as to the most appropriate course of action, should that be available.
- B. It is not intended that the Protocol should be a contract document. Nor does it purport to take precedence over the express terms and governing law of a contract or be a statement of the law. It represents a scheme for dealing with delay and disruption issues that is balanced and viable (recognising that some of those issues do not have absolute answers). Therefore, the Protocol must be considered against (and give way to) the contract and governing law which regulate the relationships between project participants.
- C. The guidance in the Protocol is general in nature and has not been developed with reference to any specific standard form contracts. To do otherwise would not have been practical given the multitude and divergence of standard form contracts. Rather, the guidance is intended to be generally applicable to any contract that provides for the management of change.
- D. Delay and disruption issues that ought to be managed within the contract all too often become disputes that have to be decided by third parties (adjudicators, dispute review boards, arbitrators, judges). The number of such cases could be substantially reduced by the introduction of a transparent and unified approach to the understanding of programmed works, their expression in records, and the allocation of responsibility for the consequences of delay and disruption events.
- E. Overall, the Protocol aims to be consistent with good practice, but is not put forward as the benchmark of good practice throughout the construction industry. So as to make its recommendations more achievable by project participants, the Protocol does not strive to be consistent with best practice. That is not intended to detract from the benefits to project participants of applying best practice.
- F. Users of the Protocol should apply its recommendations with common sense. The Protocol is intended to be a balanced document, reflecting equally the interests of all parties to the construction process.
- G. The 2nd edition of the Protocol has been published in 2017 and supersedes the 1st edition and Rider 1.

- H. The structure of the 2nd edition is set out in the above table of contents. It is divided into the following sections:
- (a) Core Principles: a summary of the 22 Core Principles;
 - (b) Guidance Part A: an overview of delay, disruption and acceleration concepts;
 - (c) Guidance Part B: guidance on each of the 22 Core Principles;
 - (d) Guidance Part C: guidance on other financial heads of claim that often arise in the context of delay and disruption;
 - (e) Appendix A: definitions and glossary for both defined terms in the Protocol and terms commonly used in relation to delay and disruption; and
 - (f) Appendix B: lists of the typical records within each of the six categories of records relevant to delay and disruption identified in the guidance to Core Principle 1.
- I. The 2nd edition represents the output of a partial review of the 1st edition against the background of: (a) developments in the law and construction industry practices since the Protocol was first published in 2002; (b) feedback on the uptake of the Protocol since that time; (c) developments in technology since 2002; (d) the scale of large projects having increased, leading to a wider divergence between small scale and large scale projects; and (e) anecdotal evidence that the Protocol is being used for international projects as well as UK projects. On this last point, while it may be the case that participants in the international construction legal market find the Protocol a useful reference document, the review committee decided that the Protocol should continue to focus upon the UK construction market and, in particular, the English law position.
- J. In producing the 2nd edition, a wholesale review of the 1st edition was not carried out. Rather, the review was limited to the eight following issues:
- (a) whether the expressed preference should remain for time impact analysis as a programming methodology where the effects of delay events are known;
 - (b) the menu and descriptions of delay methodologies;
 - (c) whether the Protocol should identify case law that has referenced the Protocol;
 - (d) records;
 - (e) global claims and concurrent delay – in light of recent case law;
 - (f) approach to consideration of claims (prolongation / disruption – time and money) during currency of project;
 - (g) model clauses; and
 - (h) the menu and descriptions of disruption methodologies.

- K. Some of the key changes introduced by the 2nd edition are as follows:-
- (a) There is more developed guidance on record keeping in relation to delay and disruption issues, with a focus on general principles that are applicable to all projects, regardless of their complexity or scale, and recognition of technological advancements which impact upon record keeping.
 - (b) The contemporaneous submission and assessment of EOT claims (rather than a 'wait and see' approach) is elevated to a core principle.
 - (c) There is no longer a preferred delay analysis methodology where that analysis is carried out time-distant from the delay event or its effect. The 2nd edition instead identifies the factors that ought to be taken into account in selecting the most appropriate methodology for the particular circumstances and provides an overview of a number of delay analysis methodologies in common use as at the date of publication.
 - (d) The approach to concurrent delay in the original Protocol has been amended in this 2nd edition to reflect recent case law.
 - (e) There is recognition of an apparent trend for the construction legal industry and the courts to take a more lenient approach towards global claims, albeit the risks in proceeding on this basis remain.
 - (f) There is more developed guidance on disruption and a broader list (with explanations) of different types of analyses that might be deployed to support a disruption claim. As in the 1st edition, the preference remains for a measured mile analysis, where the requisite records are available and it is properly carried out.
 - (g) The model contract clauses have been deleted, which is more consistent with the Protocol's approach that it should not be incorporated as a contract document.
 - (h) The graphics illustrating points in the Protocol have been deleted.
- L. The 2nd edition committee has carried out non-exhaustive research on the case law (both within the United Kingdom and internationally) that has referenced the Protocol. A summary of these cases is contained with the on-line version of the Protocol on the Society of Construction Law website. This summary does not constitute legal advice and it should not be relied upon (in particular, because it is updated infrequently).
- M. Both the 1st and 2nd editions of the Protocol were produced by drafting committees made up of members of the Society of Construction Law. The membership of the two drafting committees is set out prior to Appendix A. The views and opinions expressed and the aims identified in the Protocol are those adopted by the drafting committees. They are not necessarily the views and opinions or aims of any particular member of the drafting committees or member of the Society.
- N. The information, recommendations and/or advice contained in this Protocol (including its Guidance Sections and Appendices) are intended for use as a

general statement and guide only. Neither the Society of Construction Law nor any committee or member of the Society nor any member of the committees that drafted the Protocol accept any liability for any loss or damage which may be suffered as a result of the use in any way of the information, recommendations and/or advice contained herein and any person using such information or drafting contracts, specifications or other documents based thereon must in all cases take appropriate professional advice on the matters referred to in this publication and are themselves solely responsible for ensuring that any wording taken from this document is consistent with and appropriate to the remainder of their material.

The Society of Construction Law welcomes feedback on the Protocol. Please contact the Society at feedback@eotprotocol.com or write to SCL Administration, 234 Ashby Road, Hinkley, Leices LE10 1SW.

CORE PRINCIPLES

These are the Core Principles of the Protocol. Guidance on these Core Principles is contained in Part B.

1. Programme and records

Contracting parties should reach a clear agreement on the type of records to be kept and allocate the necessary resources to meet that agreement. Further, to assist in managing progress of the works and to reduce the number of disputes relating to delay and disruption, the Contractor should prepare and the Contract Administrator (CA) should accept a properly prepared programme showing the manner and sequence in which the Contractor plans to carry out the works. The programme should be updated to record actual progress, variations, changes of logic, methods and sequences, mitigation or acceleration measures and any EOTs granted. If this is done, then the programme can be more easily used as a tool for managing change and determining EOTs and periods of time for which compensation may be due.

2. Purpose of EOT

The benefit to the Contractor of an EOT is to relieve the Contractor of liability for damages for delay (usually liquidated damages or LDs) for any period prior to the extended contract completion date and allows for reprogramming of the works to completion. The benefit of an EOT for the Employer is that it establishes a new contract completion date, prevents time for completion of the works becoming 'at large' and allows for coordination / planning of its own activities.

3. Contractual procedural requirements

The parties and the CA should comply with the contractual procedural requirements relating to notices, particulars, substantiation and assessment in relation to delay events.

4. Do not 'wait and see' regarding impact of delay events (contemporaneous analysis)

The parties should attempt so far as possible to deal with the time impact of Employer Risk Events as the work proceeds (both in terms of EOT and compensation). Applications for an EOT should be made and dealt with as close in time as possible to the delay event that gives rise to the application. A 'wait and see' approach to assessing EOT is discouraged. Where the Contractor has complied with its contractual obligations regarding delay events and EOT applications, the Contractor should not be prejudiced in any dispute with the Employer as a result of the CA failing to assess EOT applications. EOT entitlement should be assessed by the CA within a reasonable time after submission of an EOT application by the Contractor. The Contractor potentially will be entitled to an EOT only for those events or causes of delay in respect of which the Employer has assumed risk and responsibility (called in the Protocol Employer Risk Events) that impact the critical path.

5. Procedure for granting EOT

Subject to the contract requirements, the EOT should be granted to the extent that the Employer Risk Event is reasonably predicted to prevent the works being completed by the then prevailing contract completion date. In general, this will be where the Employer Risk Event impacts the critical path of the works and thus extends the contract completion date. This assessment should be based upon an appropriate delay analysis, the conclusions derived from which must be sound from a common sense perspective. The goal of the EOT procedure is the ascertainment of the appropriate contractual entitlement to an EOT; the analysis should not start from a position of considering whether the Contractor needs an EOT in order not to be liable for liquidated damages.

6. Effect of delay

For an EOT to be granted, it is not necessary for the Employer Risk Event already to have begun to affect the Contractor's progress with the works, or for the effect of the Employer Risk Event to have ended.

7. Incremental review of EOT

Where the full effect of an Employer Risk Event cannot be predicted with certainty at the time of initial assessment by the CA, the CA should grant an EOT for the then predictable effect. The EOT should be considered by the CA at intervals as the actual impact of the Employer Risk Event unfolds and the EOT increased (but not decreased, unless there are express contract terms permitting this) if appropriate.

8. Float as it relates to time

Float values in a programme are an indication of the relative criticality of activities and, generally, when float is exhausted, the completion date will be impacted. Unless there is express provision to the contrary in the contract, where there is remaining total float in the programme at the time of an Employer Risk Event, an EOT should only be granted to the extent that the Employer Delay is predicted to reduce to below zero the total float on the critical path affected by the Employer Delay to Completion (i.e. if the Employer Delay is predicted to extend the critical path to completion).

9. Identification of float

The identification of float is greatly assisted where there is a properly prepared and regularly updated programme, the Accepted/Updated Programmes.

10. Concurrent delay – effect on entitlement to EOT

True concurrent delay is the occurrence of two or more delay events at the same time, one an Employer Risk Event, the other a Contractor Risk Event, and the effects of which are felt at the same time. For concurrent delay to exist, each of the Employer Risk Event and the Contractor Risk Event must be an effective cause of Delay to Completion (i.e. the delays must both affect the critical path). Where Contractor Delay to Completion occurs or has an effect concurrently with Employer Delay to Completion, the Contractor's concurrent delay should not reduce any EOT due.

11. Analysis time-distant from the delay event

Where an EOT application is assessed after completion of the works, or significantly after the effect of an Employer Risk Event, then the prospective analysis of delay referred to in the guidance to Core Principle 4 may no longer be appropriate.

12. Link between EOT and compensation

Entitlement to an EOT does not automatically lead to entitlement to compensation (and vice versa).

13. Early completion as it relates to compensation

If as a result of an Employer Delay, the Contractor is prevented from completing the works by the Contractor's planned completion date (being a date earlier than the contract completion date), the Contractor should in principle be entitled to be paid the costs directly caused by the Employer Delay, notwithstanding that there is no delay to the contract completion date (and therefore no entitlement to an EOT). However, this outcome will ensue only if at the time they enter into the contract, the Employer is aware of the Contractor's intention to complete the works prior to the contract completion date, and that intention is realistic and achievable.

14. Concurrent delay – effect on entitlement to compensation for prolongation

Where Employer Delay to Completion and Contractor Delay to Completion are concurrent and, as a result of that delay the Contractor incurs additional costs, then the Contractor should only recover compensation if it is able to separate the additional costs caused by the Employer Delay from those caused by the Contractor Delay. If it would have incurred the additional costs in any event as a result of Contractor Delay, the Contractor will not be entitled to recover those additional costs.

15. Mitigation of delay and mitigation of loss

The Contractor has a general duty to mitigate the effect on its works of Employer Risk Events. Subject to express contract wording or agreement to the contrary, the duty to mitigate does not extend to requiring the Contractor to add extra resources or to work outside its planned working hours. The Contractor's duty to mitigate its loss has two aspects: first, the Contractor must take reasonable steps to minimise its loss; and secondly, the Contractor must not take unreasonable steps that increase its loss.

16. Acceleration

Where the contract provides for acceleration, payment for the acceleration should be based on the terms of the contract. Where the contract does not provide for acceleration but the Contractor and the Employer agree that accelerative measures should be undertaken, the basis of payment should be agreed before the acceleration is commenced. Contracting parties should seek to agree on the records to be kept when acceleration measures are employed. Where the Contractor is considering implementing acceleration measures to avoid the risk of liquidated damages as a result of not receiving an EOT that it considers is due, and then pursuing a constructive

acceleration claim, the Contractor should first take steps to have the dispute or difference about entitlement to an EOT resolved in accordance with the contract dispute resolution provisions.

17. Global claims

The not uncommon practice of contractors making composite or global claims without attempting to substantiate cause and effect is discouraged by the Protocol, despite an apparent trend for the courts to take a more lenient approach when considering global claims.

18. Disruption claims

Compensation may be recovered for disruption only to the extent that the contract permits or there is an available cause of action at law. The objective of a disruption analysis is to demonstrate the loss of productivity and hence additional loss and expense over and above that which would have been incurred were it not for the disruption events for which the Employer is responsible.

19. Valuation of variations

Where practicable, the total likely effect of variations should be pre-agreed between the Employer/CA and the Contractor to arrive at, if possible, a fixed price of a variation, to include not only the direct costs (labour, plant and materials) but also the time-related and disruption costs, an agreed EOT and the necessary revisions to the programme.

20. Basis of calculation of compensation for prolongation

Unless expressly provided for otherwise in the contract, compensation for prolongation should not be paid for anything other than work actually done, time actually taken up or loss and/or expense actually suffered. In other words, the compensation for prolongation caused other than by variations is based on the actual additional cost incurred by the Contractor. The objective is to put the Contractor in the same financial position it would have been if the Employer Risk Event had not occurred.

21. Relevance of tender allowances

The tender allowances have limited relevance to the evaluation of the cost of prolongation and disruption caused by breach of contract or any other cause that requires the evaluation of additional costs.

22. Period for evaluation of compensation

Once it is established that compensation for prolongation is due, the evaluation of the sum due is made by reference to the period when the effect of the Employer Risk Event was felt, not by reference to the extended period at the end of the contract.

GUIDANCE PART A: DELAY, DISRUPTION AND ACCELERATION CONCEPTS

This Part sets out an explanation of these fundamentally different but interrelated concepts by way of introduction to the remainder of the Protocol.

1. The construction industry often associates or conflates delay and disruption. While they are both effects of events, the impacts on the works are different, the events may be governed by separate provisions of the contract and governing law, they may require different types of substantiation and they will lead to different remedies. Having said that, the monetary consequences of delay and disruption may overlap and, further, delay can lead to disruption and, vice versa, disruption can lead to delay.
2. In referring to ‘delay’, the Protocol is concerned with time – work activities taking longer than planned. In large part, the focus is on delay to the completion of the works – in other words, critical delay. Hence, ‘delay’ is concerned with an analysis of time. This type of analysis is necessary to support an EOT claim by the Contractor.
3. Of course, time means money. Typical monetary claims by a Contractor that are dependent upon an analysis of time (i.e. a delay analysis) are as follows (subject to the terms of the contract and depending on the specific circumstances):
 - (a) relief from LDs (with the inverse claim by an Employer for LDs);
 - (b) compensation for time-related costs; and
 - (c) if the Contractor has taken acceleration steps in an attempt to mitigate the delay, compensation for those steps.
4. The guidance to Core Principles 4 and 11 in Part B of the Protocol explains delay analyses that, depending upon the contract and the circumstances, might be deployed to support the above types of delay claims.
5. In referring to ‘disruption’, the Protocol is concerned with disturbance, hindrance or interruption to a Contractor’s normal working methods, resulting in lower productivity or efficiency in the execution of particular work activities. If the Contractor is prevented from following what was its reasonable plan at the time of entering into the contract for carrying out the works or a part of them (i.e. it is disrupted), the likelihood is that its resources will accomplish a lower productivity rate than planned on the impacted work activities such that, overall, those work activities will cost more to complete and the Contractor’s profitability will be lower than anticipated. Work that is carried out with a lower than reasonably anticipated productivity rate (i.e. which is disrupted) will lead to: (a) activity delay; or (b) the need for acceleration, such as increasing resources, work faces or working hours, to avoid activity delay; or (c) a combination of both – and therefore, in each case, loss and expense. Hence, ‘disruption’ is concerned with an analysis of the productivity of work activities, irrespective of whether those activities are on the critical path to completion of the works.

6. A disruption claim ought to be supported by some form of disruption analysis, which is explained in the guidance to Core Principle 18 in Part B.
7. Delay and disruption are inherently interrelated. A loss of productivity (i.e. disruption) can lead to delay and, if the impacted activities are on the critical path, that can be critical delay. Hence, the Contractor may rely upon a disruption analysis to support a critical delay claim in addition to its delay analysis. It is possible for work to be disrupted and yet for the works still to be completed by the contract completion date. In this situation, the Contractor will not have a claim for an EOT, but it may have a claim for the cost of the lost productivity.
8. Equally, delay can lead to disruption. If the Contractor has less time in which to carry out work activities (absent an EOT for the critical path activities), it is possible that acceleration measures implemented will lead to those tasks being carried out with a lower productivity than planned and hence at greater cost.
9. The monetary consequences of delay and disruption can also overlap. For example, again, if acceleration measures are taken to overcome critical delay but which lead to a loss of productivity, the costs of those steps cannot be recovered under both the delay and disruption heads of claim. Typically, both claims will be advanced, but it must be recognised in the second claim that a credit has to be given for any recovery in the first claim. It is important for the Contractor to be diligent in avoiding duplication in claimed entitlement for delay and disruption.
10. The question of who should bear the cost of delay and disruption is often contentious. The Protocol is not primarily concerned with the question of the valuation of the direct cost (labour, plant and materials) of change to or variation of the works. Instead it sets out guidance on the Contractor's cost of prolongation and disruption.
11. A Contractor may claim its costs arising out of acceleration measures to overcome either delay or disruption. Core Principle 16 concerns acceleration. Before implementing acceleration measures, it is worth bearing in mind that, of themselves, these measures can lead to disruption. However, if reasonable acceleration measures are adopted, that disruption ought to be offset by the overall delay recovery achieved in the absence of other intervening events.
12. The Protocol makes reference to both mitigation and acceleration. Mitigation simply means to make less severe or lessen delay, disruption and/or the resultant costs and/or loss. Acceleration is a subset of mitigation, and typically refers to the situation where additional costs are incurred to seek to overcome all or part of delay or disruption (for example, to ensure that that the contract completion date is achieved). Where the Employer is responsible for that delay or disruption, the Contractor may claim its acceleration costs from the Employer. This situation is distinct from a Contractor's general duty to mitigate its loss when it suffers delay and disruption or incurs additional cost due to an Employer Risk Event. That general duty to mitigate does not require the Contractor to incur additional costs.
13. For all delay, disruption and acceleration claims, the claim document must explain the legal basis for entitlement, whether that is under the contract (in

which case, identify and apply the relevant provisions) or at law (in which case, identify and apply the relevant legal basis). This is because delay, disruption and acceleration are not causes of action in their own right. In addition, the claim document must explain the cause of the delay, disruption and/or acceleration and the remedies claimed.

14. As can be seen, there is a close association between the concepts of delay and disruption. However, their differing impacts and the remedies sought as a result ought not to be confused. All project participants need to understand these issues so that the likelihood and scope of disputes over delay and disruption can be reduced.
15. Usually it is the Contractor that advances delay and/or disruption claims against the Employer. (The exception is an LDs claim by the Employer against the Contractor, but that claim does not typically require any detailed analysis, only the identification of whether the contract completion date has passed without the Contractor having achieved completion.) As a simplification for ease of explanation, the Protocol proceeds on the basis it is the Contractor that is advancing an EOT application or claim for compensation for delay and/or disruption. However, it should be borne in mind that it is possible for an Employer to have delay and disruption claims against the Contractor, for example where there are multiple contractors on site and the Contractor is responsible for disruption events that have hindered the progress of those other contractors. Further, a sub-contractor may have a delay and/or disruption claim against the Contractor (or vice versa).

GUIDANCE PART B: GUIDANCE ON CORE PRINCIPLES

This Part sets out guidance on each of the 22 Core Principles of the Protocol (with the Core Principles themselves designated by bold text).

1. Programme and records

Contracting parties should reach a clear agreement on the type of records to be kept and allocate the necessary resources to meet that agreement. Further, to assist in managing progress of the works and to reduce the number of disputes relating to delay and disruption, the Contractor should prepare and the CA should accept a properly prepared programme showing the manner and sequence in which the Contractor plans to carry out the works. The programme should be updated to record actual progress, variations, changes of logic, methods and sequences, mitigations or accelerations measures and any EOTs granted. If this is done, then the programme can be more easily used as a tool for managing change and determining EOTs and periods of time for which compensation may be due.

- 1.1 The following guidance is supplemented by Appendix B which describes the typical records needed for effectively managing progress of the works and substantiating EOT and compensation claims for delay and/or disruption.
- 1.2 It is not intended that this guidance should be incorporated into a contract, but contracting parties may wish to consider this guidance when drafting their contracts. Those who assess delay and disruption claims often find that there is uncertainty and a lack of records regarding what was delayed and/or disrupted and what and how parts of the works were affected by delay or disruption events. Good record keeping and good use of the programmes removes a significant amount of this uncertainty, will improve the ability to manage progress and allows for the early assessment of claims, thereby reducing the likelihood of disputes. This is because adequate and complete records should allow robust progress management and, where necessary, delay and/or disruption assessments. This also often reduces the cost of carrying out such assessments. As a result, the importance of good quality records on all projects cannot be underestimated.
- 1.3 The Protocol recommends that the parties reach a clear and documented agreement prior to the time they enter into the contract (or at least at the outset of the works) regarding record keeping and programme use. In doing so, the parties need to take an approach that is proportionate and appropriate to the specific circumstances of the works. This will vary from project to project.

Introduction to records

- 1.4 There is often a lack of good record keeping and a lack of uniformity of approach to record keeping as relevant to management of progress of the works and delay and disruption claims.
- 1.5 In seeking to reach a clear and documented agreement on record keeping, the parties should consider:

- (a) the types of records to be produced and the information to be contained therein;
 - (b) who is responsible for both producing and checking those records;
 - (c) the frequency with which those records are to be updated or produced;
 - (d) the distribution list for those records;
 - (e) the format of those records (for example, to ensure compatibility with any project-wide database); and
 - (f) the ownership (including any relevant intellectual property rights) and storage of, and access to, those records.
- 1.6 Good record keeping requires an investment of time and cost, and the commitment of staff resources by all project participants. It is therefore recommended that, prior to preparing the tender documents, the Employer considers its requirements of the Contractor in relation to record keeping and includes these within the tender documents. This will allow tenderers to accurately price their obligations regarding record keeping. The imposition by the Employer or the CA of additional record keeping requirements after the contract has been entered could constitute a variation under the contract (with compensation consequences) or, in rare cases, be prohibited in the absence of the Contractor's agreement.
- 1.7 Records relevant to progress and delay and disruption events must be generated contemporaneously as the works progress, and not afterwards. The project records must document all work under way (on and off-site) and in the case of work at the site, the circumstances in which that work is being carried out. That data should be recorded in a manner that allows it to be matched to the activities in the Accepted Programme/Updated Programme. Project records therefore cover design, approvals, procurement or manufacturing, installation, construction, coordination, commissioning and taking over (as applicable).
- 1.8 Once the parties have agreed and documented the record keeping regime, adequate resources must be allocated by all relevant parties to ensure the records are produced, checked and stored in line with that agreement. As part of the checking process, where reasonably practicable and proportionate in the circumstances, inconsistencies between different records should be identified and notations made as to the reasons for the differences.
- 1.9 The Employer should consider whether it is proportionate and appropriate to produce and maintain its own independent set of relevant records regarding the works. Such records will assist the Employer both in the event the Contractor fails to produce and maintain adequate records and in supporting any claims the Employer may have against the Contractor.
- 1.10 If the circumstances of the works change during the project, the parties and the CA should revisit the agreed record keeping regime and identify if changes (such as supplementary records) are required.

- 1.11 As explained above, Appendix B describes the typical records needed for managing progress of the works and substantiating EOT and compensation claims for delay and/or disruption. These are divided into the following six categories: (a) programme; (b) progress; (c) resource; (d) costs; (e) correspondence and administration; and (f) contract and tender documents. The precise nature and level of detail of the records in each category depends upon the specifics of the works. Certain types of records fall within multiple categories.
- 1.12 Records falling within categories (b)-(d) should set out facts only and offer no opinions. Where reasonably practicable, they should be signed by authorised representatives of both the CA and the Contractor.
- 1.13 Records should be maintained for an adequate period of time after completion of the works, expiration of the defects liability period, and resolution of any outstanding disputes. Records should be kept and stored for at least as long as the contract requires or for any relevant statutory limitation period.

Format and storage of records

- 1.14 Records should be produced electronically in a manner that allows them to be easily accessed, distributed, searched, stored and retrieved. At a minimum (with the exception of emails), records should be kept in PDF searchable format and stored in an electronic document management system database. Emails, programmes and spreadsheets containing formulae should be kept in their native electronic format (which, in the case of programmes, is explained further below).
- 1.15 To the extent reasonably practicable, with the possible exception of certain costs records (given competition law and business confidentiality considerations), the document management system database should be collaborative so that all records are accessible by the Contractor and the CA.
- 1.16 Recognising that technology is quickly changing, the Protocol recommends that only standard document management systems, capable of being easily searched and exported and exchanged, be used.
- 1.17 The Protocol recognises the growing use of building information modelling (or 'BIM') in design development, project management, claims assessment, dispute resolution and operations and maintenance. The effective use of BIM requires specific agreement between the parties regarding its content, use and ownership.

Categories of records

Programme records

- 1.18 Programme records include the Contractor's proposed baseline programme (which upon acceptance becomes the Accepted Programme), Updated Programmes, revised programmes to take account of re-sequencing or other acceleration measures or mitigation measures, and detailed versions of these programmes (such as four week look-ahead programmes), as well as those records which assist in understanding these programmes, including programme narratives. These records allow the parties to effectively manage progress and

allow the CA, adjudicator, judge or arbitrator to understand the Contractor's plan for carrying out the works in assessing any delay or disruption claims. Specific considerations in relation to the programmes themselves are set out in paragraphs 1.39-1.64 below.

- 1.19 Updated Programmes are a repository of data regarding progress achieved prior to their data date. This progress data includes the dates for the start and finish of activities (new, modified and original) and progress achieved at updating intervals. Hence, Updated Programmes are also a helpful progress record.

Progress records

- 1.20 Progress records contain as-built data, both on and off-site. These records should cover all the activities that affect completion of the works whether or not they comprise distinct activities in the Accepted Programme/Updated Programme. Progress records are required to establish the progress of the works at the time of a delay or disruption event, the impact of that event, and its effect on the works.
- 1.21 Progress records should be reconciled with and complementary to the Accepted Programme/Updated Programme and costs records. Progress is ideally recorded and coded to the Accepted Programme/Updated Programme activities and also to the cost accounts for the project.

Resource records

- 1.22 Resource records capture the resources utilised to deliver the works, including management, labour, plant, equipment, materials, and sub-contractors, and their output and productivity rates.
- 1.23 Without records of planned and utilised resources it will be more difficult for the Contractor to prove entitlement to time and costs incurred arising from additions or changes to the works and other delay or disruption events.
- 1.24 Resource records should be detailed and comprehensive and where possible should be allocated to the Accepted/Updated Programme activities or at a minimum to an area or section of the works.

Costs records

- 1.25 Costs records should include a sufficient level of detail such that costs can be linked, even at a high level, to delay or disruption events.
- 1.26 Costs are classified into the following broad headings:
 - (a) direct costs (labour, task-specific equipment, materials, and sub-contracted work); and
 - (b) indirect costs (on-site overheads and head office overheads), whether time-related or otherwise.
- 1.27 Section 2 of Part C regarding head office overheads explains the difference between 'dedicated' and 'unabsorbed' overheads. 'Dedicated' overhead costs may be capable of being substantiated by specific records. These would include

staff time sheet bookings, together with any staff travel expenses, directly or indirectly relating to the Employer Risk Event. In the case of ‘unabsorbed’ costs, which are incurred regardless of the Contractor’s volume of work, the retained records should include those relating to rent, rates, heating, lighting, directors’ salaries, wages of support staff, pension fund contributions and auditors’ fees.

- 1.28 If the Contractor intends to rely on the application of a formula for the assessment of lost profits and unabsorbed head office overheads, it will first need to produce evidence that it was unable to undertake other work that was available to it because of the Employer Delay. These records may include the Contractor’s business plans prior to the Employer Delay, the Contractor’s tendering history and records of acceptance or rejection of tender opportunities depending upon resource availability. Also relevant will be minutes of any meetings to review future tendering opportunities and staff availability. The Contractor will also need to produce the records that support the inputs into the formula used, in particular the Contractor’s company accounts for the periods immediately preceding and succeeding the Employer Delay as well as for the period when the Employer Delay occurred.
- 1.29 There may be competition law and business confidentiality considerations to take into account before project participants share their costs information and parties seek to agree on the costs consequences of delay or disruption events. In some cases (such as a claim for loss of profit), a claiming party has to accept some loss of confidentiality as a necessary condition of establishing its claim. The parties might therefore consider agreeing relevant rates in the contract, rather than requiring proof of actual costs or loss for certain eventualities (an example would be an agreement regarding staff rates to be charged in the event of an Employer Delay to Completion). This is likely to be beneficial to both the claiming party and the paying party; the claiming party does not need to produce proof of actual cost or loss, and the paying party benefits from a pre-agreed rate.
- 1.30 Cost records are essential to establish the costs consequences of delay or disruption events.

Correspondence and administration records

- 1.31 This category covers all written communications between the Employer, the Contractor, the CA, and third parties relevant to the progress of the works, including any delay or disruption. This includes emails, letters, notices, instructions, submittals, requests for information and responses, meeting minutes and claims.
- 1.32 Written communications should be uniquely numbered, contain a descriptive subject line, be dated and be issued to the agreed distribution list. Any important oral communication ought to be confirmed in writing.
- 1.33 Emails are frequently used for communications between parties. In particular, email is a convenient way to transmit information in native format (particularly spreadsheets, programmes and drawings). The management of emails is challenging, and should be addressed by the parties from the outset of the works. A protocol should be developed and implemented for the use of email and its

archiving on each project. Emails regarding the works that are internal to a party should also be archived.

- 1.34 The Protocol recognises that even with the best system for managing and archiving emails, some emails may be lost, and the importance of others may be overlooked. To reduce the adverse effect of these issues, the Protocol recommends that material communications (of whatever nature) should be prepared in the form of a letter, uniquely numbered and carefully retained. Alternatively, key emails should be kept in a centralised folder and given a unique correspondence number.
- 1.35 Parties should be aware of any contractual procedural requirements for advancing and determining delay or disruption claims, and should comply with these to avoid prejudice. This relates to the timing of the submission of any notices or particulars of claim or the determination of a claim, the format of those documents, and to whom those documents ought to be transmitted (see Core Principle 3 in Part B).

Contract and tender documents

- 1.36 Construction contracts typically consist of numerous documents and it is therefore important to ensure that there is no uncertainty about what documents form part of the contract and that a complete copy is maintained by both parties (including any amendments).
- 1.37 Tender documents include all correspondence between the parties regarding the contract negotiations. These also include:
- (a) on the part of the Employer: tender submissions by all tenderers, the tender evaluations, and the Employer's calculations of any liquidated damages rates; and
 - (b) on the part of the Contractor: records demonstrating the build-up to its tender price (and any amendments to the price) and the assumptions on which the tender price is based.
- 1.38 Tender documents may be relevant to demonstrating the reasonableness of claimed costs in periods affected by delay or disruption events or the enforceability of the liquidated damages provisions. However, unless incorporated into the contract, tender documents are not relevant to the interpretation of the contract.

Programme

- 1.39 The form and software for the programme should be specified in the tender documents and the contract. Commercially available software (rather than specialist in-house software) should be specified and, in most cases, the programme should be based on the Critical Path Method (or CPM).
- 1.40 As early as possible during the works, the Contractor should submit and the CA should accept a programme showing the manner and sequence in which the Contractor plans to carry out the works, which becomes the Accepted Programme. This should address the key stages of the works, namely design,

approvals, procurement or manufacturing, installation, construction, commissioning and taking over (as applicable).

- 1.41 Most standard forms of contract contain inadequate requirements for generating an Accepted Programme and/or Updated Programmes. The Protocol recommends that the parties reach a clear and documented agreement on the requirements of the Contractor's proposed programme in order for it to be accepted by the CA (and then form the Accepted Programme) and the manner in which it is to be updated (being the Updated Programmes). The agreement should cover the following matters and be documented in the contract.

Form of the Contractor's proposed programme

- 1.42 The Contractor's proposed programme should generally be prepared as a critical path network using commercially available CPM programming software. The complexity of the programme should be proportionate to the project. Both the Contractor and the CA should have a copy of the programming software.
- 1.43 For the Contractor's proposed programme to be suitable for use as a tool for monitoring progress and assessing delay and disruption claims, it ought to be properly prepared so that, when a delay or disruption event occurs, it can accurately predict the effects. The Contractor's proposed programme should be provided in its native electronic form to the CA (not just as a PDF). Using the software, the Contractor should identify on the proposed programme:
- (a) the critical path(s);
 - (b) all relevant activities and key interfaces; and
 - (c) the information the Contractor reasonably requires from the Employer or CA, when that information is required, and all Employer or CA activities and constraints (such as approvals/reviews and Employer-supplied services or materials). This should be done by logically linking to the activities of the Contractor (and not by means of fixed dates).
- 1.44 The programme submitted by the Contractor in securing the contract should form the basis of the Contractor's proposed programme. Detailed suggestions as to how the Contractor's proposed programme should be prepared are provided below.

Detail within the proposed programme

- 1.45 The Contractor's proposed programme (and any revisions) should be prepared with sufficient detail using logic links (i.e. each activity is linked to both a predecessor and successor activity or milestone) to provide proper forward visibility so that the effect of delay and disruption events can be predicted with as much accuracy as possible.
- 1.46 Depending on the complexity of the works, it may be appropriate to specify in the contract the maximum duration of an activity in the Contractor's proposed programme. As a guide, no activity or lag (other than a summary activity) should exceed 28 days in duration. Wherever possible, an activity should not encompass more than one trade or operation. However, when 'rolling wave'

programming is used (i.e. where the activities are detailed for the next 6 to 18 months of the project and the remainder of the activities are shown at a summarised level), an activity limitation of 28 days for the later summarised activities is not necessary. Instead, common sense should be applied and reasonable summary bar activities incorporated in the programme that are then detailed as the time to execute them draws nearer.

- 1.47 Activities should be linked together by the appropriate logic links such as finish-to-start, start-to-start and finish-to-finish. Those logic links may demonstrate: (a) a sequence constrained critical path based upon necessary construction sequencing (e.g., the roof cannot be erected until after the foundations and walls are constructed); (b) a resource constrained critical path taking account of resource constraints (e.g. in a piping project where there are many work faces that could be progressed in parallel); or (c) preferential sequencing where no constraint is influential. Lags may be introduced for non-work periods (such as curing of concrete) but better visibility and understanding is provided if such matters are shown as activities in themselves (See Appendix A for definitions of logic links and lags). Activities to be executed by the use of overtime and/or additional shifts should be identified and explained in the programme narrative. All necessary logic links should be inserted. Excessive leads and lags should be avoided. Where utilised, the Contractor should provide an explanation in the programme narrative as to why particular leads and lags have been applied. Manually applied constraints such as ‘must start’ or ‘must finish’ fixed dates, ‘zero float’ and other programming techniques that can have the effect of inhibiting a programme from reacting dynamically to change should be avoided (or, if unavoidable, properly explained in the programme narrative).
- 1.48 Key resources such as labour, staff (including that which relates to design where relevant), tradesmen, major plant items, dedicated resources, major materials and work rates should be indicated for major activities (or otherwise explained in the programme narrative).
- 1.49 When works are production (output) driven, supplemental tools such as line of balance schedules, time location diagrams, and S-curves should be developed and utilised to understand progress of the activities reported in the Updated Programmes.

Interaction with method statements

- 1.50 For it to be fully understood, the Contractor’s proposed programme should be read in conjunction with the Contractor’s method statements describing in detail how the Contractor intends to carry out the works, the key interfaces, and the resources it intends to use (which may be those of its sub-contractors). The Protocol recommends that the contract require the Contractor to provide such method statements, and that the Contractor’s proposed programme and the method statements are fully cross-referenced.
- 1.51 A programme narrative should also be prepared by the Contractor to describe how the proposed programme reflects the method statements.

Time within which to submit a proposed programme for acceptance

- 1.52 It is recommended that the parties agree in the contract a fixed time period for the Contractor's submission of the proposed programme for acceptance. This should be a reasonable time after the contract award or the commencement date, whichever is the earlier. For projects with a long duration and depending upon the circumstances, it may be appropriate for the Contractor to submit, shortly after the contract has been awarded, an initial proposed programme showing only the first three months of the works in detail, to be followed up by a proposed programme for the entirety of the works. See also paragraph 1.46 above regarding rolling wave programming.
- 1.53 The proposed programme should not encompass any changes or delays that have occurred since the contract commencement date. Any such post-commencement changes or delays should be dealt with in accordance with the EOT procedure in the guidance to Core Principle 5 in Part B after the proposed programme has been accepted.

Mechanism for obtaining the CA's acceptance of the proposed programme

- 1.54 The Contractor (not the CA) controls the method and sequence of the works (and bases its tender price on its ability to do so). Therefore, provided the Contractor complies with the contract and all applicable laws, the Contractor may perform the works in the manner it thinks appropriate. The contract provisions for accepting the Contractor's proposed programme should reflect that fact, subject to any Employer constraints identified in the contract.
- 1.55 Also, to avoid uncertainty, the contract should contain wording to the effect that if the CA does not respond to the Contractor regarding the proposed programme within a specified time, it is deemed accepted and becomes the 'Accepted Programme'. The parties should consider at the outset whether to incorporate a provision into the contract which incentivises the Contractor to submit a proposed programme that complies with the contractual requirements (such as a portion of the contract sum being withheld pending the submission of a compliant programme). Otherwise, if the Contractor fails to meet its contractual obligations with respect to programming, the CA may consider invoking the contract provisions for dealing with general defaults by the Contractor. In this situation, the CA should also (to the extent possible) maintain and update a programme with actual progress based on its own knowledge.
- 1.56 The Protocol regards the agreement of the Accepted Programme as being very important both for managing progress of the works and assessing any EOT applications. Disagreements over what constitutes the Accepted Programme should be resolved straight away and not be allowed to continue through the works. An unaccepted Contractor's proposed programme or update can become the source for disputes. Accordingly, the CA should specify what contractual requirements are not met before determining that a proposed programme or an update is inadequate.
- 1.57 Acceptance by the CA constitutes an acknowledgement that the Accepted Programme represents a reasonable, realistic and achievable depiction of the sequence and timing for carrying out the works. Acceptance does not turn the

Contractor's proposed programme into a contract document, or mandate that the works should be constructed exactly as set out in the Accepted Programme. Nor does it amount to a warranty by the CA to the Contractor or the Employer that the Accepted Programme can be achieved.

Requirements for updating and saving the Accepted Programme/Updated Programme

- 1.58 The contract should require that the Accepted Programme be updated with actual progress using the agreed CPM programming software at intervals of no longer than one month (or at agreed more frequent intervals on complex projects). The Contractor should enter the actual progress on the Accepted Programme as it proceeds with the works, to create the Updated Programme, the latter of which is then updated with further progress in creating the subsequent Updated Programme at the agreed interval, and so forth. Actual progress should be recorded by means of actual start and actual finish dates for activities, together with percentage completion of currently incomplete activities and the extent of remaining activity durations. In addition, the Contractor should include in each Updated Programme any new or modified activities, logic and sequences. Any periods when an activity is suspended should be noted in the Updated Programmes. The parties should consider at the outset of the project establishing rules for measuring progress to ensure consistency of understanding.
- 1.59 The Updated Programmes should be archived as separate electronic files and the saved versions should be copied electronically to the CA (again, in native format, not as a PDF), along with a report describing revisions made to activity durations or logic as compared to the Accepted Programme (or a previous Updated Programme) and the reasons for the revisions. The purpose of saving Updated Programmes is to provide a contemporaneous record of revisions to the Contractor's intended work sequences and activities. No version of any programme should be overwritten – all versions need to be saved separately.
- 1.60 The Updated Programmes demonstrate actual progress against planned progress, and (as explained below) are used for determining any EOT claims. If the CA disagrees with the progress the Contractor considers it has achieved, it should notify the Contractor, and the CA and Contractor should then attempt to reach agreement. If they do not agree, the CA's view should prevail (unless and until it is reviewed and replaced under the contract dispute resolution procedures), and the CA's view on progress should be reflected in the Updated Programmes. The Contractor's position on the areas of disagreement should be recorded and submitted with the Updated Programmes.
- 1.61 From time to time, the Contractor may wish to revise its plan for carrying out the remainder of the works. If rolling wave programming is utilised, subsequently detailing later summary activities is not a revision to the Contractor's plan.
- 1.62 Specifically, the Contractor should attempt to reasonably revise its planned logic, sequence, and activity durations for the remainder of the works whenever there is or may be Contractor Delay to Completion or variations so as to ensure the contract completion date will be achieved. The contract should contain

provisions allowing the CA to require the Contractor to produce a proposed revised programme in such circumstances. These revisions should be made to the most recent Updated Programme (or the Accepted Programme if no Updated Programme has yet been produced).

- 1.63 The Contractor should notify the CA of any proposed revisions and provide an electronic copy of the proposed revised programme, together with any consequential revision to the Contractor's method statements and a programme narrative that reflects the proposed revised programme. The CA should review and if appropriate accept the proposed revised programme. Once a revised programme is accepted by the CA it replaces the former Accepted Programme as the tool for monitoring actual progress.
- 1.64 Acceptance by the CA of such a proposed revised programme does not constitute acceptance or waiver of the Contractor Delay, and requiring the Contractor to propose measures to recover delay is not an instruction or a deemed instruction to accelerate the works at the Employer's cost. Acceptance merely acknowledges that the revised programme reasonably reflects the current situation and the Contractor's current intention to carry out the remainder of the works.

2. Purpose of EOT

The benefit to the Contractor of an EOT is to relieve the Contractor of liability for damages for delay (usually LDs) for any period prior to the extended contract completion date and allows for reprogramming of the works to completion. The benefit of an EOT for the Employer is that it establishes a new contract completion date, prevents time for completion of the works becoming 'at large' and allows for coordination / planning of its own activities.

- 2.1 It is often incorrectly thought that an entitlement to an EOT automatically carries with it an entitlement to compensation for prolongation costs during the period of the EOT. The main effect of an EOT is that the Contractor is relieved of its liability for liquidated damages during the period of the extension and is able to reprogramme its works to completion. Its entitlement to compensation is usually to be found in other provisions of the contract or at law. The benefit of an EOT for the Employer is that it establishes a new contract completion date, prevents time for completion of the works becoming 'at large' and allows for coordination / planning of its own activities, such as training operational staff.
- 2.2 If the good practice promoted in the guidance to Core Principle 1 with regard to the keeping of records and preparation, acceptance and updating of programmes is followed, then the scope for factual disagreement about a claimed entitlement to an EOT will be reduced.

3. Contractual procedural requirements

The parties and the CA should comply with the contractual procedural requirements relating to notices, particulars, substantiation and assessment in relation to delay events.

- 3.1 Most if not all the standard forms of contract contain obligations on the part of the Contractor to give notice to the CA as soon as an Employer Risk Event occurs that the Contractor considers entitles it to an EOT. Some require notice of the occurrence of an Employer Risk Event irrespective of whether it is likely to affect the contract completion date (i.e. the latter of which the Protocol refers to as Employer Delay to Completion), and some require notice of all events that adversely affect progress irrespective of liability or consequence. In some standard forms these notices are expressed to be conditions precedent (i.e. pre-conditions) to entitlement.
- 3.2 The Contractor should comply with the contractual procedural requirements relating to notices, particulars and substantiation in relation to delay events. However, whatever the contract says, the Contractor should give notice to the CA of any Employer Delays as soon as possible. The CA should also notify the Contractor as early as possible of any Employer Delays of which it is aware.
- 3.3 This allows appropriate mitigation measures to be considered by the project participants so as to limit the impact of the delay event.

4. Do not ‘wait and see’ regarding impact of delay events (contemporaneous analysis)

The parties should attempt so far as possible to deal with the time impact of Employer Risk Events as the work proceeds (both in terms of EOT and compensation). Applications for an EOT should be made and dealt with as close in time as possible to the delay event that gives rise to the application. A ‘wait and see’ approach to assessing EOT is discouraged. Where the Contractor has complied with its contractual obligations regarding delay events and EOT applications, the Contractor should not be prejudiced in any dispute with the Employer as a result of the CA failing to assess EOT applications. EOT entitlement should be assessed by the CA within a reasonable time after submission of an EOT application by the Contractor. The Contractor potentially will be entitled to an EOT only for those events or causes of delay in respect of which the Employer has assumed risk and responsibility (called in the Protocol Employer Risk Events) that impact the critical path.

- 4.1 Each EOT application should be assessed as soon as possible, and in any event not later than one month after the application has been received by the CA. A ‘wait and see’ approach to assessing EOT is discouraged. This allows appropriate mitigation measures to be considered by the project participants so as to limit the impact of the delay event. It also provides the Employer and the Contractor with clarity around the contract completion date so that they can understand their risks and obligations and act accordingly.

Contemporaneous analysis of delay

- 4.2 This section sets out a recommended procedure to be followed in order to deal efficiently and accurately with EOT applications during the course of the project. It assumes that the parties to the contract have followed the recommended good practice on programmes and records set out in the guidance

to Core Principle 1 in Part B. It is not intended that this guidance should be incorporated into a contract.

- 4.3 The Contractor should generally submit a sub-network (sometimes called a ‘fragnet’) showing the actual or anticipated effect of the Employer Risk Event and its linkage into the Updated Programme. This sub-network is inserted into that Updated Programme which was submitted by the Contractor as close as possible to the date of the Employer Risk Event. Further guidance on the form of the sub-network is given in paragraph 4.10 below. It should also be accompanied by such documents and records as are necessary to demonstrate the entitlement in principle to an EOT. Simply stating that Employer Risk Events have occurred and claiming the whole of any delay apparent at the time of the events is not a proper demonstration of entitlement.
- 4.4 Before doing anything else, the CA should consider whether or not the claimed event or cause of delay is in fact one in respect of which the Employer has assumed risk and responsibility (i.e. that it is an Employer Risk Event). The Contractor will potentially be entitled to an EOT only for those events or causes listed in the contract as being at the Employer’s risk as to time that impact the critical path. These events vary between the different standard forms of contract, and care is needed when reading them. If the CA concludes that the event or cause of delay is not an Employer Risk Event, the CA should so notify the Contractor. Without prejudice to that, the CA may wish to comment on other aspects of the Contractor’s submission. When granting or refusing an EOT, the CA should provide sufficient information to allow the Contractor to understand the reasons for the CA’s decision.
- 4.5 In the absence of a submission that complies with this section, the CA (unless the contract otherwise provides) should make its own determination of the EOT (if any) that is due, based on such information as is available to it. Given that it is difficult if not impossible to withdraw an EOT once granted, it is reasonably to be expected that, where the CA has not been presented with the information on which to base its decision, the CA will award only the minimum EOT that can be justified at the time.
- 4.6 If the Contractor does not agree with the CA’s decision, it should so inform the CA immediately. Disagreements on EOT matters should not be left to be resolved at the end of the project. If no agreement can be reached quickly, steps should be taken by either party to have the dispute or difference resolved in accordance with the contract dispute resolution provisions.
- 4.7 The Protocol recommends that the most recent Updated Programme (or, if there is none, the Accepted Programme) should be the primary tool used to guide the CA in assessing an EOT application. The EOT should be granted to the extent that the Employer Risk Event is predicted to prevent the works being completed by the then prevailing contract completion date.
- 4.8 A guide to the amount of the EOT is obtained by using the Updated Programme. The steps to be taken are as follows:
 - (a) the Programme should be brought fully up to date (as to progress and the effect of all delays that have occurred up to that date, whether

Employer Delays or Contractor Delays) to the point immediately before the occurrence of the Employer Risk Event;

- (b) the Programme should then be modified to reflect the Contractor's reasonable, realistic and achievable plans to recover any delays that have occurred, including any changes in the logic of the Updated Programme proposed for that purpose (subject to CA review and acceptance as provided in paragraph 1.63 of Part B);
 - (c) the sub-network representing the Employer Risk Event should then be entered into the programme; and
 - (d) the impact on the contract completion dates should be noted.
- 4.9 Prior to determining the effect of an Employer Risk Event on the Updated Programme, any patently unreasonable or unrealistic logic, constraints or durations should be corrected by agreement, failing which the CA's view should prevail unless and until overturned under the contract dispute resolution provisions.
- 4.10 The sub-network referred to above should be prepared by the Contractor in the same manner and using the same software as the Accepted Programme. It should comprise the activities and durations resulting from the Employer Risk Event. For example, the sub-network for a variation would comprise the instruction for the variation, the activities required to carry out that variation and its linkage to the activities in the Updated Programme. For a breach of contract, the sub-network would represent the consequences of that breach. The Contractor should submit the sub-network to the CA for agreement. The CA should consider the sub-network and, if agreed, the sub-network should be inserted into the Contractor's Updated Programme. Any disagreement about the sub-network should be resolved quickly and (like all delay issues) not left until after completion.
- 4.11 The assessment of the impact of delays (whether Contractor Delays or Employer Delays) should be at a level appropriate to the level of detail included in the Updated Programme and taking into account the size and complexity of the works and the delays being analysed.
- 4.12 The methodology described in this section is known as '**time impact analysis**'. This methodology requires a logic linked baseline programme (which ordinarily would be the Accepted Programme), updated programmes (which ordinarily would be the Updated Programmes) or progress information with which to update the baseline programme and the selection of delay events to be modelled. If the parties have not followed the guidance to Core Principle 1 in Part B, such that there is no Accepted Programme and/or Updated Programmes, this is likely to lead to more disputes regarding the contemporaneous assessment of EOT applications.
- 4.13 As noted in the guidance to Core Principle 10 in Part B, where Employer Risk Events and Contractor Risk Events occur sequentially but have concurrent effects, the delay analysis should determine whether there is concurrent delay and, if so, that an EOT is due for the period of that concurrency. In this situation

any Contractor Delay should not reduce the amount of EOT due to the Contractor as a result of the Employer Delay. Analyses should be carried out for each event separately and strictly in the sequence in which they arose.

- 4.14 Although the Updated Programme should be the primary tool for guiding the CA in its determination of an EOT, it should be used in conjunction with the contemporary evidence, to ensure that any resulting EOT is both reasonable and consistent with the factual circumstances. It will also be necessary for the parties to apply common sense and experience to the process to ensure that all relevant factors are taken into account, and that any anomalous results generated by the delay analysis are properly managed. Overarching these considerations, any resulting EOT must be consistent with the contractual requirements regarding entitlement.
- 4.15 Where the Contractor has complied with its contractual obligations regarding delay events and EOT applications, the Contractor should not be prejudiced in any dispute with the Employer as a result of the CA failing to assess EOT applications within a reasonable time after submission.

5. Procedure for granting EOT

Subject to the contract requirements, the EOT should be granted to the extent that the Employer Risk Event is reasonably predicted to prevent the works being completed by the then prevailing contract completion date. In general, this will be where the Employer Risk Event impacts the critical path of the works and thus extends the contract completion date. This assessment should be based upon an appropriate delay analysis, the conclusions derived from which must be sound from a common sense perspective. The goal of the EOT procedure is the ascertainment of the appropriate contractual entitlement to an EOT; the analysis should not start from a position of considering whether the Contractor needs an EOT in order not to be liable for liquidated damages.

- 5.1 If the CA does not make a determination of the EOT entitlement resulting from an Employer Risk Event when an EOT is in fact due, there is a danger that the EOT mechanism may fail, leaving the Contractor only obliged to finish the works within a reasonable time, having regard to the parties' rights and obligations under the contract (with the uncertainty which that creates). For this reason, construction contracts should contain provisions entitling the CA on its own initiative to determine an EOT, even if the Contractor has not applied for one, or has applied with insufficient information.
- 5.2 A properly drafted EOT clause will contain general wording to allow an EOT to be granted in respect of acts (or omissions) of prevention or breach of contract by the Employer. Such wording is needed because the English courts have held that wording such as 'any other special circumstances' does not cover breaches by the Employer. Such an EOT clause should also explain the consequences of the Contractor's failure to comply with any procedural requirements in applying for an EOT.
- 5.3 Generally, an EOT should be granted to the extent that the Employer Risk Event is predicted to prevent the works being completed by the then prevailing

contract completion date. This process requires consideration of whether the Employer Risk Event impacts the critical path and thus extends the contract completion date (see guidance to Core Principle 8 in Part B).

6. Effect of delay

For an EOT to be granted, it is not necessary for the Employer Risk Event already to have begun to affect the Contractor's progress with the works, or for the effect of the Employer Risk Event to have ended.

- 6.1 As explained in the guidance to Core Principle 4 in Part B, the practice of some CAs of waiting to see what the full effect an Employer Risk Event has on the works before dealing with the Contractor's application for EOT is discouraged. If the Contractor is entitled to an EOT it should receive it, and the CA should not wait to see if the Contractor actually needs the EOT, in order not to be liable for liquidated damages.

7. Incremental review of EOT

Where the full effect of an Employer Risk Event cannot be predicted with certainty at the time of initial assessment by the CA, the CA should grant an EOT for the then predictable effect. The EOT should be considered by the CA at intervals as the actual impact of the Employer Risk Event unfolds and the EOT increased (but not decreased, unless there are express contract terms permitting this) if appropriate.

- 7.1 CAs should bear in mind that it is permissible to deal with EOT incrementally. The Protocol's recommended procedure for assessing EOT during the course of the project is set out in the guidance to Core Principle 4 in Part B.
- 7.2 The CA should not, however, use an incremental approach to 'wait and see' the outcome of an Employer Risk Event as that would contravene Core Principle 4. Rather, the CA should grant an EOT for the then predictable effect of the Employer Risk Event. That then allows the Contractor to reprogramme the works to completion.

8. Float as it relates to time

Float values in a programme are an indication of the relative criticality of activities and, generally, when float is exhausted, the completion date will be impacted. Unless there is express provision to the contrary in the contract, where there is remaining total float in the programme at the time of an Employer Risk Event, an EOT should only be granted to the extent that the Employer Delay is predicted to reduce to below zero the total float on the critical path affected by the Employer Delay to Completion (i.e. if the Employer Delay is predicted to extend the critical path to completion).

- 8.1 Float is the amount of time by which an activity or group of activities may be shifted in time without causing Delay to Completion. Activities with the least float are generally considered to be on the critical path of the works. Appendix A explains the different types of float. The date in question may be a sectional completion date, the overall completion of the works or an interim milestone.

The ‘ownership’ of float causes particular arguments in disputes over entitlement to an EOT. A Contractor may argue that it ‘owns’ the float, because, in planning how it proposes to carry out the works, it has allowed additional or float time to give itself some flexibility in the event that it is not able to carry out the works as quickly as it planned. If, therefore, there is any delay to the Contractor’s progress for which the Contractor is not responsible, it may contend that it is entitled to an EOT, even if the delay to progress will not result in the contract completion date being missed, but merely in erosion of its float. On the other hand, an Employer may typically say that the Contractor has no EOT entitlement unless the delay to progress will result in a contract completion date being missed. So (the Employer may say) the project owns the float.

- 8.2 Parties should ensure that this issue is addressed in their contracts. The expression ‘float’ rarely, if ever, appears in standard form conditions of contract. Where the wording of the EOT clause in a contract is such that an EOT is only to be granted if the Employer Delay delays completion beyond the contract completion date, then the likely effect of that wording is that total float has to be used up before an EOT will be due. If the wording of the EOT clause is such that an EOT will be due whenever the Employer Delay makes the Contractor’s planned completion date later than it would have been if it were not for that delay, then total float will probably not be available for the benefit of the Employer in the event of Employer Delay. Some conditions of contract give no indication as to whether an Employer Delay has to affect the contract completion date or merely the Contractor’s planned completion date before an EOT is due.
- 8.3 It is important that, when entering the contract, the parties appreciate the practical effects of the permutations described above. Under contracts where the Employer Delay has to affect the contract completion date, if an Employer Delay occurs first and uses up all the total float, then the Contractor can find itself in delay and paying liquidated damages as a result of a subsequent Contractor Delay which would not have been critical if the Employer Delay had not occurred first. Under contracts where the Employer Delay only has to affect the Contractor’s planned completion date, the Contractor is potentially entitled to an EOT every time the Employer or CA delays any of its activities, irrespective of their criticality to meeting the contract completion date. Under the type of contract that is silent or ambiguous about float, uncertainty exists and disputes are likely to follow.
- 8.4 Many conditions of contract have a provision that allows a final review of any EOT granted or not granted, reflecting what is perceived to be fair or reasonable. But reliance on what a CA perceives to be fair or reasonable is not always a good recipe for certainty. Where EOTs are granted retrospectively, it is possible to review separately the effect of different types of delay and make decisions on EOT entitlement, again based on fairness or reasonableness. But it is a very important principle of this Protocol that applications for EOT should be made and dealt with as close in time to the delay event that gives rise to them, and the ‘wait and see’ approach is discouraged (see the guidance to Core Principle 4 in Part B).

- 8.5 Core Principle 8 (and 9) set out the Protocol's position on float where the parties in their contract have not made clear provision for how float should be dealt with. This is consistent with current judicial thinking, which is that an Employer Delay has to be critical (to meeting the contract completion date) before an EOT will be due. It has the effect that float is not time for the exclusive use or benefit of either the Employer or the Contractor (unless there is an express provision in the contract).
- 8.6 It follows from this approach that a Contractor has no entitlement to an EOT merely because an Employer Risk Event prevents the Contractor from completing the works earlier than the contract completion date or because an Employer Delay to Progress takes away the Contractor's float on any particular activity (unless there is an express provision in the contract).
- 8.7 If the Contractor wants to make allowance for the possibility of Contractor Delays (sometimes referred to as 'Time Risk Allowance'), then it should include in the activity durations in its programme such additional time as the Contractor believes is necessary to reflect the risk of such delays to those activities. Alternatively, it may identify such allowances as separate activities in the programme entitled 'Contingency for ... [e.g., groundwork]'. Either is perfectly acceptable and prudent planning practice.
- 8.8 When programming software utilises multiple work day calendars, reliance on float values is cautioned and must be combined with other measures to determine the critical path.

9. Identification of float

The identification of float is greatly assisted where there is a properly prepared and regularly updated programme, the Accepted/Updated Programmes.

- 9.1 Recommendations for the preparation of the Accepted/Updated Programmes are set out as part of the guidance to Core Principle 1 in Part B.

10. Concurrent delay – effect on entitlement to EOT

True concurrent delay is the occurrence of two or more delay events at the same time, one an Employer Risk Event, the other a Contractor Risk Event, and the effects of which are felt at the same time. For concurrent delay to exist, each of the Employer Risk Event and the Contractor Risk Event must be an effective cause of Delay to Completion (i.e. the delays must both affect the critical path). Where Contractor Delay to Completion occurs or has an effect concurrently with Employer Delay to Completion, the Contractor's concurrent delay should not reduce any EOT due.

- 10.1 Concurrency is a contentious issue, both because there are differing views on the correct approach to dealing with concurrent delay when analysing entitlement to EOT and because there are differences about the meaning of concurrent delay itself.
- 10.2 The Protocol therefore provides guidance in order that issues of concurrency can be recognised and resolved in an agreed manner as part of the overall delay

analysis. This guidance is a compromise, taking account of the different competing arguments, but represents what the Protocol considers to be the most appropriate solution.

Meaning of concurrent delay

- 10.3 True concurrent delay is the occurrence of two or more delay events at the same time, one an Employer Risk Event, the other a Contractor Risk Event, and the effects of which are felt at the same time. True concurrent delay will be a rare occurrence. A time when it can occur is at the commencement date (where for example, the Employer fails to give access to the site, but the Contractor has no resources mobilised to carry out any work), but it can arise at any time.
- 10.4 In contrast, a more common usage of the term ‘concurrent delay’ concerns the situation where two or more delay events arise at different times, but the effects of them are felt at the same time.
- 10.5 In both cases, concurrent delay does not become an issue unless each of an Employer Risk Event and a Contractor Risk Event lead or will lead to Delay to Completion. Hence, for concurrent delay to exist, each of the Employer Risk Event and the Contractor Risk Event must be an effective cause of Delay to Completion (not merely incidental to the Delay to Completion).
- 10.6 This issue has both practical and legal implications. From a practical perspective, the analysis of the effects of the delay events is simpler if it considers only those events that will result in Delay to Completion (rather than a consideration of all events in the programme) so that the grant of an EOT follows the outcome of the critical path analysis. The Protocol recommends this approach during the currency of the project to allow the timely application for, and assessment of, EOT.
- 10.7 From a legal perspective, there are two competing views as to whether an Employer Delay is an effective cause of Delay to Completion where it occurs after the commencement of the Contractor Delay to Completion but continues in parallel with the Contractor Delay. This can be illustrated by the following example: a Contractor Risk Event will result in five weeks Contractor Delay to Completion, delaying the contract completion date from 21 January to 25 February. Independently and a few weeks later, a variation is instructed on behalf of the Employer which, in the absence of the preceding Contractor Delay to Completion, would result in Employer Delay to Completion from 1 February to 14 February.
- 10.8 On one view, the two events are both effective causes of Delay to Completion for the two week period from 1 to 14 February because they each would have caused Delay to Completion in the absence of the other (with the subsequent delay from 15 February to 25 February caused by the Contractor Risk Event alone). This view may be supported by older English appeal court cases (no doubt predating critical path analysis) which provide that if the failure to complete the works is due in part to the fault of both the Employer and the Contractor, liquidated damages will not be payable. In a situation like the example described in paragraph 10.7 above, it can be argued that both the

Employer Risk Event and the Contractor Risk Event are in part the cause of the Delay to Completion.

- 10.9 On the other view, the Employer Delay will not result in the works being completed later than would otherwise have been the case because the works were already going to be delayed by a greater period because of the Contractor Delay to Completion. Thus, the only effective cause of the Delay to Completion is the Contractor Risk Event. This is the consistent position taken in recent lower level English court decisions.
- 10.10 The Protocol recommends the latter of these two views, i.e. that where an EOT application relating to the situation referred to in paragraph 10.7 above is being assessed, the Employer Risk Event should be seen as not causing Delay to Completion (and therefore there is no concurrency). Concurrent delay only arises where the Employer Risk Event is shown to have caused Delay to Completion or, in other words, caused critical delay (i.e. it is on the longest path) to completion. The Protocol cautions that this recommendation would have to be re-considered were an appeal court to take a different approach to this issue.
- 10.11 In considering whether concurrent delay exists, the Protocol recommends a common sense approach to delay analysis. In particular, the Protocol recognises that delay analysis is rarely precise down to the day (or even few days). The application of common sense requires that the margin for imprecision should be taken into account in reaching a conclusion on concurrency.

Dealing with concurrent delay

- 10.12 Where concurrent delay has been established, the Contractor should be entitled to an EOT for the Employer Delay to Completion, dealt with in accordance with Core Principle 5. The Contractor Delay should not reduce the amount of EOT due to the Contractor as a result of the Employer Delay.
- 10.13 An Employer should be aware that if it instructs a variation after the contract completion date where the failure to complete by the contract completion date has been caused by Contractor Delay, the Employer may lose its entitlement to liquidated damages if the Contractor then accelerates to recover the Contractor Delay to Completion at its own cost and that results in the variation (an Employer Risk Event) becoming the effective cause of Delay to Completion.
- 10.14 Employer Delay to Completion does not exonerate the Contractor for all its delays prior to that Employer Delay to Completion occurring. The effect of the Employer Delay should be assessed as described in Core Principle 5 and any EOT determined due should simply be added to the contract completion date.
- 10.15 The Protocol's approach to dealing with concurrent delay aims to provide contracting parties with clarity and certainty about entitlement to EOT.
- 10.16 The Protocol's position on concurrent delay is influenced by the English law 'prevention principle', by virtue of which an Employer cannot take advantage of the non-fulfilment of a condition (for example, to complete the works by a certain date), the performance of which the Employer has hindered. The Protocol's approach to the treatment of concurrent delay (once established)

prevents arguments about whether an Employer Delay acting concurrently with a Contractor Delay actually hinders the progress of the Contractor in any way.

11. Analysis time-distant from the delay event

Where an EOT application is assessed after completion of the works, or significantly after the effect of an Employer Risk Event, then the prospective analysis of delay referred to in the guidance to Core Principle 4 may no longer be appropriate.

- 11.1 This section addresses the consideration of EOT applications after completion of the works, or considerably after the occurrence of the delay event or its impact. In those circumstances, the prospective analysis of delay referred to in the guidance to Core Principle 4 in Part B may no longer be relevant or appropriate.
- 11.2 Irrespective of which method of delay analysis is deployed, there is an overriding objective of ensuring that the conclusions derived from that analysis are sound from a common sense perspective. This is particularly relevant where there is a significant risk that the remaining duration projections, logic links, calendars and constraints within the baseline programme (preferably the Accepted/Updated Programme) might produce anomalous results.
- 11.3 The choice of method of delay analysis to be deployed should be determined by reference to the following criteria:
 - (a) the relevant conditions of contract;
 - (b) the nature of the causative events;
 - (c) the nature of the project;
 - (d) to ensure a proportionate approach, the value of the project or dispute;
 - (e) the time available;
 - (f) the nature, extent and quality of the records available;
 - (g) the nature, extent and quality of the programme information available;
and
 - (h) the forum in which the assessment is being made.

Different methods of delay analysis

- 11.4 There are six commonly used methods of delay analysis, and these are described more particularly below. By way of general explanation:
 - (a) Certain methods start with the identification and description of an event (a cause) and thereafter seek to establish its impact (the effect) – these are cause and effect type analyses. Other methods start with identifying critical delay (an effect) and thereafter seek to establish what might have caused that delay – these are effect and cause type analyses. Where the EOT application is assessed after completion of the works, or significantly after the effect of an Employer Risk Event, then the effect

and cause methods are generally considered to be more forensically reliable because they consider any and all potential causes of the delay incurred.

(In contrast, when there is a discrete Employer Risk Event and the EOT application is being made contemporaneously, then the cause and effect methods are generally employed, as to do otherwise would require the CA to ‘wait and see’ (which is discouraged). This is one of the key reasons the time impact analysis method is recommended for a contemporaneous analysis of delay as explained in the guidance to Core Principle 4).

- (b) Typically delay analysis requires the identification of the critical path(s) to the completion date because delays which impact the completion date must, by definition, reside on the critical path. Oftentimes the critical path is a sequence or chain of activities through the remaining works. However, on some projects the critical path that is driving or determining the completion date can proceed through a collection of related work activities (such as when completion is being driven/determined by the rate of pipe welding across the works).
- (c) Critical path analysis is not limited to analysis conducted through the use of specialist programming software. While such software can provide a powerful analytical tool, the critical path to completion may on occasion be more reliably established through a practical analysis of the relevant facts or by analysis of production and/or resource data.
- (d) Criticality is determined in one of three different ways. Purely prospective critical path assessments adopt the perspective evident at the outset of the project only and take no account of progress achieved. Contemporaneous critical path assessments adopt an evolving perspective over the course of the works and take account of the effect that both historical progress and changes in the strategy for the future prosecution of the works have on predicted criticality. Retrospective critical path assessments adopt the perspective evident at the end of the project (or window of time).
- (e) Delay impact is determined in one of two different ways. A prospective delay analysis identifies the likely impact of historical progress or delay events on a completion date. The conclusions of a prospective delay analysis may not match the as-built programme because the Contractor’s actual performance may well have been influenced by the effects of attempted acceleration, re-sequencing or redeployment of resources in order to try to avoid liability for liquidated damages or due to other Employer and Contractor Risk Events. A retrospective delay analysis identifies the actual impact of the delay events on the identified actual or as-built critical path.
- (f) As identified above, the Protocol distinguishes between the determination of the critical path and the determination of the delay impact. For example, in both the time impact analysis and time slice

windows analysis methods (which are explained below), the critical path is determined on a contemporaneous basis. However, in the former method the delay impact is determined on a prospective basis, being the modelled incremental impact of the delay event on the future and remaining programme for the works from the data date of the particular time impact analysis. Conversely, in the latter method the delay impact is determined on a retrospective basis, being the historic impact of the delay event on the critical path during the time slice up to the data date of the particular analysis.

11.5 The following table provides a summary of the methods described below:

Method of Analysis	Analysis Type	Critical Path Determined	Delay Impact Determined	Requires
Impacted As-Planned Analysis	Cause & Effect	Prospectively	Prospectively	<ul style="list-style-type: none"> Logic linked baseline programme. A selection of delay events to be modelled.
Time Impact Analysis	Cause & Effect	Contemporaneously	Prospectively	<ul style="list-style-type: none"> Logic linked baseline programme. Update programmes or progress information with which to update the baseline programme. A selection of delay events to be modelled.
Time Slice Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	<ul style="list-style-type: none"> Logic linked baseline programme. Update programmes or progress information with which to update the baseline programme.
As-Planned versus As-Built Windows Analysis	Effect & Cause	Contemporaneously	Retrospectively	<ul style="list-style-type: none"> Baseline programme. As-built data.
Retrospective Longest Path Analysis	Effect & Cause	Retrospectively	Retrospectively	<ul style="list-style-type: none"> Baseline Programme. As-built programme.
Collapsed As-Built Analysis	Cause & Effect	Retrospectively	Retrospectively	<ul style="list-style-type: none"> Logic linked as-built programme. A selection of delay events to be modelled.

11.6 Some of these methods require a baseline programme. If the parties have followed the guidance to Core Principle 1 in Part B, that will be the Accepted/Updated Programmes. If the parties have not followed the guidance to Core Principle 1 in Part B and one of those methods is adopted in carrying out the delay analysis, this could lead to greater scope for disagreement on the assessment of delay.

- (a) The **impacted as-planned analysis** method involves introducing delay event sub-networks into a logic-linked baseline programme and its

recalculation using CPM programming software in order to determine the prospective impact these events have on the predicted contract completion dates shown within the baseline programme. Before embarking upon the analysis, the analyst needs to confirm that the sequences and durations for the works shown in the programme are reasonable, realistic and achievable and properly logically linked within the software, to deal with the risk that the baseline programme contains fundamental flaws which cannot be overcome. In general, this is thought to be the simplest and least expensive form of delay analysis, but has material limitations, principally because it does not consider actual progress and changes to the original planned intent. The product of this method of analysis is a conclusion as to the likely effect of the modelled delay events on the baseline programme. In limited circumstances this analysis may be deemed sufficient for assessing EOT entitlement. Such circumstances include where the impacted as-planned method is dictated by the terms of the contract and/or where the delay events being considered occurs right at the outset of the works.

- (b) The **time impact analysis** involves introducing delay event sub-networks into a logic-linked baseline programme and recalculation of this updated programme using CPM programming software in order to determine the prospective impact the delay event would have on the then predicted completion dates. The baseline programme for each analysis can be either a contemporaneous programme or a contemporaneously updated baseline programme (i.e. an Updated Programme), the difference being the revised contemporaneous programme may have logic changes / activity / resource changes from the original baseline programme. In either case, the analyst needs to verify that the baseline programme's historical components reflect the actual progress of the works and its future sequences and durations for the works are reasonable, realistic and achievable and properly logically linked within the software. Mitigation and acceleration already incorporated into the updated baseline programme need to be considered as these can conceal or distort the projected impact of the delay events. The number of delay events being modelled has a significant impact on the complexity and cost of deploying this method. The product of this method of analysis is a conclusion as to the likely delay of the modelled delay events on the programme/critical path that is most reflective of the contemporaneous position when the delay events arose. This method usually does not capture the eventual actual delay caused by the delay events as subsequent project progress is not considered. This method is also described in the guidance to Core Principle 4 in the context of a contemporaneous assessment of an EOT application.
- (c) The **time slice analysis** method is the first of two 'windows' analysis methods. This method requires the analyst to verify (or develop) a reliable series of contemporaneously updated baseline programmes or revised contemporaneous programmes reflecting an accurate status of the works at various snapshots (being the time slices) throughout the course of the works. Through this process, the progress of the works is

divided into time slices. The time slices are typically carried out at monthly intervals. The series of time slice programmes reveals the contemporaneous or actual critical path in each time slice period as the works progressed and the critical delay status at the end of each time slice, thus allowing the analyst to conclude the extent of actual critical delay incurred within each window. Thereafter, the analyst investigates the project records to determine what events might have caused the identified critical delay in each time slice period. For each time slice programme the analyst needs to verify that the historical components reflect the actual progress of the works and that its future sequences and durations for the works are reasonable, realistic and achievable and properly logically linked within the software.

- (d) The **as-planned versus as-built windows** analysis method is the second of the ‘windows’ analysis methods. As distinct from a time slice analysis, it is less reliant on programming software and usually applied when there is concern over the validity or reasonableness of the baseline programme and/or contemporaneously updated programmes and/or where there are too few contemporaneously updated programmes. In this method, the duration of the works is broken down into windows. Those windows are framed by revised contemporaneous programmes, contemporaneously updated programmes, milestones or significant events. The analyst determines the contemporaneous or actual critical path in each window by a common-sense and practical analysis of the available facts. As this task does not substantially rely on programming software, it is important that the analyst sets out the rationale and reasoning by which criticality has been determined. The incidence and extent of critical delay in each window is then determined by comparing key dates along the contemporaneous or actual critical path against corresponding planned dates in the baseline programme. Thereafter, the analyst investigates the project records to determine what delay events might have caused the identified critical delay. The critical delay incurred and the mitigation or acceleration achieved in each window is accumulated to identify critical delay over the duration of the works.
- (e) The **retrospective longest path analysis** method involves the determination of the retrospective as-built critical path (which should not be confused with the contemporaneous or actual critical path identified in the windows methods above). In this method, the analyst must first verify or develop a detailed as-built programme. Once completed, the analyst then traces the longest continuous path backwards from the actual completion date to determine the as-built critical path. The incidence and extent of critical delay is then determined by comparing key dates along the as-built critical path against corresponding planned dates in the baseline programme. Thereafter, the analyst investigates the project records to determine what events might have caused the identified critical delay. A limitation to this method is its more limited capacity to recognise and allow for switches in the critical path during the course of the works.

- (f) The **collapsed as-built** (or but-for) analysis method involves the extraction of delay events from the as-built programme to provide a hypothesis of what might have happened had the delay events not occurred. This method does not require a baseline programme. This method requires a detailed logic-linked as-built programme. It is rare that such a programme would exist on the project and therefore the analyst is usually required to introduce logic to a verified as-built programme. This can be a time consuming and complex endeavour. Once completed, the sub-networks for the delay events within the as-built programme are identified and they are ‘collapsed’ or extracted in order to determine the net impact of the delay events. This method is sometimes done in windows, using interim or contemporaneous programmes which contain detailed and comprehensive as-built data. A limitation to this method is that it measures only incremental delay to the critical path, because the completion date will not collapse further than the closest near critical path.
- 11.7 Other methods, which may be reasonably deployed in particular circumstances having considered the criteria in paragraph 11.3 above, include: project wide retrospective as-planned versus as-built analysis (i.e. not in windows), time chainage analysis, line of balance analysis, resource curve analysis, and earned value analysis.
- 11.8 In order to avoid or at least minimise disputes over methodology, it is recommended that the parties try to agree an appropriate method of delay analysis before each embarks upon significant work on an after the event delay analysis. Failure to consult the other party on delay analysis methodology is a matter that the Protocol considers might be taken into account by the adjudicator, judge or arbitrator in awarding and allocating recoverable costs of the dispute.

12. Link between EOT and compensation

Entitlement to an EOT does not automatically lead to entitlement to compensation (and vice versa).

- 12.1 It is a common misconception in the construction industry that if the Contractor is entitled to an EOT, then it is also automatically entitled to be compensated for the additional time that it has taken to complete the contract.
- 12.2 Under the common standard forms of contract, the Contractor is nearly always required to claim its entitlement to an EOT under one provision of the contract and its entitlement to compensation for that prolongation under another provision. Further, some kinds of delay events which are at the risk of the Employer so far as time for completion is concerned carry no entitlement to compensation for prolongation; delay resulting from adverse weather conditions being the most common example. They are sometimes misleadingly called ‘neutral events’; in fact, they are only neutral in the sense that one party bears the time risk and the other party bears the cost risk. The Protocol calls them ‘non-compensable Employer Risk Events’. There is thus no absolute linkage

between entitlement to an EOT and the entitlement to compensation for the additional time spent on completing the contract.

- 12.3 If the method used to assess the amount of an EOT is prospective, i.e. based on the likely Employer Delay to Completion, and the method used to assess time for prolongation compensation is retrospective, i.e. is based on the loss and/or expense actually incurred, then the two assessments of time may produce different results. This is only to be expected, and does not necessarily indicate errors in either method.

13. Early completion as it relates to compensation

If as a result of an Employer Delay, the Contractor is prevented from completing the works by the Contractor's planned completion date (being a date earlier than the contract completion date), the Contractor should in principle be entitled to be paid the costs directly caused by the Employer Delay, notwithstanding that there is no delay to the contract completion date (and therefore no entitlement to an EOT). However, this outcome will ensue only if at the time they enter into the contract, the Employer is aware of the Contractor's intention to complete the works prior to the contract completion date, and that intention is realistic and achievable.

- 13.1 It is important to understand the significance of the statement above, and to contrast it with the position taken in the Protocol on the effect of total float on EOT (see Core Principle 8). In relation to EOT, the Protocol takes the position that an Employer Delay should not result in an EOT unless it is predicted to delay the activities on the longest path to completion. When it comes to compensation, the Protocol considers that, unless there is agreement to the contrary, the Contractor should be entitled to compensation for the delay, even if the delay does not result in an EOT. As with the effect of float on entitlement to EOT, the Protocol recommends that contracting parties expressly address this issue in their contract. They should ask themselves the question: if the Contractor is prevented by the Employer from completing on a date earlier than the contract completion date, should it have a remedy? If so, in precisely what circumstances? If not, then the contract should say so expressly.
- 13.2 Where the parties have not addressed this issue in their contract, for the Contractor to have a valid claim, the Employer must be aware at the time the contract is entered into of the Contractor's intention to complete prior to the contract completion date. It is not permissible for the Contractor, after the contract has been entered into, to state that it intends to complete early, and claim additional costs for being prevented from doing so.
- 13.3 It is recognised that the Protocol's position on this issue might be thought to conflict with at least one first instance English court decision. Nevertheless, the Protocol considers that, as a matter of policy, contractors ought not to be discouraged from planning to achieve early completion, because of the price advantage that being able to complete early is likely to have for the Employer. But the potential for conflict reinforces why the issue should be addressed directly in every contract.

- 13.4 The recoverable compensation in the situation described in this guidance to Core Principle 20 will normally only comprise the increased costs of the time-related resources directly affected by the Employer Delay to Progress. Recovery of such compensation will also be subject to considerations of concurrency, as described in the guidance to Core Principle 14 in Part B.

14. Concurrent delay – effect on entitlement to compensation for prolongation

Where Employer Delay to Completion and Contractor Delay to Completion are concurrent and, as a result of that delay the Contractor incurs additional costs, then the Contractor should only recover compensation if it is able to separate the additional costs caused by the Employer Delay from those caused by the Contractor Delay. If it would have incurred the additional costs in any event as a result of Contractor Delay, the Contractor will not be entitled to recover those additional costs.

- 14.1 As it is in relation to EOT, concurrency is one of the most contentious issues in the determination of recoverable prolongation compensation. Contention arises when the Employer would be liable to compensate the Contractor for being kept on site longer than expected, but the Contractor was late in carrying out the works of its own, and so would have been late completing the works anyway. Should the Employer be obliged to compensate the Contractor in these circumstances?
- 14.2 Answering this question does not always prove difficult in practice. The prolongation compensation will be recoverable if the Contractor can prove that its losses result from the Employer Delay. Proper analysis of the facts may reveal the true cause without argument.
- 14.3 Where an Employer Delay to Completion and a Contractor Delay to Completion are concurrent, the Contractor may not recover compensation in respect of the Employer Risk Event unless it can separate the loss and/or expense that flows from the Employer Risk Event from that which flows from the Contractor Risk Event. If it would have incurred the additional costs in any event as a result of concurrent Contractor Delay, the Contractor will not be entitled to recover those additional costs. In most cases this will mean that the Contractor will be entitled to compensation only for any period by which the Employer Delay exceeds the duration of the Contractor Delay.
- 14.4 The loss and/or expense flowing from an Employer Delay cannot usually be distinguished from that flowing from Contractor Delay without the following:
- (a) an as-planned programme showing how the Contractor reasonably intended to carry out the works and the as-planned critical path;
 - (b) an as-built programme demonstrating the works and sequence actually carried out and the as-built critical path;
 - (c) the identification of activities and periods of time that were not part of the original scope;

- (d) the identification of those activities and periods of time that were not part of the original scope and that are also at the Contractor's risk as to cost; and
 - (e) the identification of costs attributable to the two preceding sub-sections.
- 14.5 This analysis should be co-ordinated with any analysis carried out by the Contractor to establish its rights to an EOT, while remembering that the entitlement to an EOT and the entitlement to compensation may not be co-extensive.

15. Mitigation of delay and mitigation of loss

The Contractor has a general duty to mitigate the effect on its works of Employer Risk Events. Subject to express contract wording or agreement to the contrary, the duty to mitigate does not extend to requiring the Contractor to add extra resources or to work outside its planned working hours.

- 15.1 Note that the requirement in the UK Joint Contracts Tribunal (JCT) contracts for the Contractor to use 'best endeavours' to prevent delay in the progress of the works and prevent completion of the works being delayed beyond the completion date may place a higher burden on the Contractor than the normal duty to mitigate. In the event of Employer Delay, it is of course open to the Employer to agree to pay the Contractor for measures, which go above and beyond the Contractor's general duty to mitigate. See the remainder of the guidance to Core Principle 15 below regarding mitigation of loss.
- 15.2 A Contractor may consider pacing activities that are not on the critical path (i.e. slowing down non-critical activities so that they proceed at the same relative pace as the delayed activities on the critical path). The Protocol recommends that if the Contractor intends to pace non-critical activities, then it should notify the Employer and the CA of its intention in this regard, along with its reasons for doing so.

The Contractor's duty to mitigate its loss has two aspects: first, the Contractor must take reasonable steps to minimise its loss; and secondly, the Contractor must not take unreasonable steps that increase its loss.

- 15.3 The Contractor should do all it reasonably can to avoid the financial consequences of Employer Delay.
- 15.4 Most construction contracts include a requirement to the effect that the Contractor must do all it can to avoid, overcome or reduce delay. Some forms actually make compliance with such provisions a condition precedent to the recovery of compensation or relief from liquidated damages.
- 15.5 The limitations on the Contractor's obligations to mitigate Employer Delay are set out in this guidance to Core Principle 15. The Contractor does not have a duty to carry out any change in scope any more efficiently than the original scope. Neither is the Contractor obliged to expend money in order to attempt to mitigate the effect of an Employer Risk Event. If the Employer wishes the Contractor to take measures to mitigate the Employer Delay (whether by adding

extra resources, by working outside its planned working hours or otherwise), the Employer should agree to pay the Contractor for the costs of those efforts.

- 15.6 It is the obligation of the Contractor to proceed with the works so as to complete on or before the completion date. However, the method, speed and timing of the activities forming the contract scope are generally left to the Contractor's discretion, subject to any stipulated prior process of acceptance of method and/or programme.
- 15.7 In the event that changes are made to the scope of the works, the Contractor has a similar obligation as to efficiency in relation to the changed scope as it has to the original scope.

16. Acceleration

Where the contract provides for acceleration, payment for the acceleration should be based on the terms of the contract. Where the contract does not provide for acceleration but the Contractor and the Employer agree that accelerative measures should be undertaken, the basis of payment should be agreed before the acceleration is commenced. Contracting parties should seek to agree on the records to be kept when acceleration measures are employed.

- 16.1 Some forms of contract provide for acceleration by instruction or by collateral agreement. In other forms, acceleration may be instructed by reference to hours of working and sequence. The Contractor cannot be instructed to accelerate to reduce Employer Delay, unless the contract allows for this.
- 16.2 Where the contract provides for acceleration, payment for the acceleration should be based on the terms of the contract.
- 16.3 Where the contract does not provide for acceleration but the Contractor and the Employer agree that accelerative measures should be undertaken, the basis of payment should be agreed before the acceleration is commenced.
- 16.4 Where acceleration is instructed and/or agreed, the Contractor is not entitled to claim prolongation compensation for the period of Employer Delay avoided by the acceleration measures.

Where the Contractor is considering implementing acceleration measures to avoid the risk of liquidated damages as a result of not receiving an EOT that it considers is due, and then pursuing a constructive acceleration claim, the Contractor should first take steps to have the dispute or difference about entitlement to an EOT resolved in accordance with the contract dispute resolution provisions.

- 16.5 Where the Contractor is considering implementing acceleration measures to avoid the risk of liquidated damages as a result of not receiving an EOT that it considers is due to it, and then pursuing a constructive acceleration claim, the Contractor should first take steps to have the dispute or difference about entitlement to EOT resolved in accordance with the contract dispute resolution provisions. Otherwise, there is the risk that it will not be entitled to compensation for those acceleration measures. In any event, before pursuing any such acceleration measures, the Contractor should provide notice with

particulars of the intended acceleration measures to the CA. The Contractor should then include such measures in a revised programme.

- 16.6 Just because the Contractor implements measures to recover Employer Delay does not necessarily mean that the full costs of those measures were caused by the Employer Delay. For example, the addition of a second labour gang may permit the relevant work activities to be completed in a shorter period of time but, overall, the Contractor may have incurred the costs of the same number of man-hours as it planned to do. Of course, the Contractor may incur higher rates in engaging the two labour gangs later in time because of the Employer Delay. Any such incremental costs therefore should be compared with prolongation costs that would otherwise have arisen to identify whether those incremental costs are reasonable. Further, any resulting crowding of labour may lead to loss of productivity which could then form the basis of a disruption claim.

17. Global claims

The not uncommon practice of contractors making composite or global claims without attempting to substantiate cause and effect is discouraged by the Protocol, despite an apparent trend for the courts to take a more lenient approach when considering global claims.

- 17.1 If the Contractor has made and maintained accurate and complete records proportionate to the project, in most cases the Contractor should be able to establish the causal link between the Employer Risk Event and the resultant costs and/or loss, without the need to make a global claim. The failure to maintain such records is unlikely to justify the Contractor in making a global claim. The Protocol's guidance as to the keeping of records is set out in the guidance to Core Principle 1 in Part B.
- 17.2 In what should only be rare cases where the financial consequences of the various causes of compensation are impossible or impracticable to distinguish, so that an accurate or reasonable allocation of the compensation claimed cannot be made between the several causative events, then in this rare situation it is acceptable to proceed in two stages: (a) quantify individually those items of the claim for which the causal link can be established between the Employer Risk Event and the resultant costs and/or loss claimed; and (b) claim compensation for the remainder as a composite whole.
- 17.3 For the composite part of the claim (the global claim), the Contractor will nevertheless need to set out the details of the Employer Risk Events relied on and the compensation claimed with sufficient particularity so that the Employer knows the case that is being made against it. It is also advisable for the Contractor to accompany its claim with a statement as to the steps it has taken to try fully to particularise the causal link for each Employer Risk Event in its claim, and the reasons why this has proved impossible or impracticable. The Contractor will also need to demonstrate that it would not have incurred the costs or suffered the loss included in the composite claim in any event.
- 17.4 In assessing a claim advanced on a global basis, the CA, adjudicator, judge or arbitrator is not obliged to dismiss it out of hand simply because of its global

nature. Rather, they should consider whether, subject to any additional contractual restrictions or procedural requirements: (a) Employer Risk Events occurred which caused delay and/or disruption to the Contractor; and (b) such delay or disruption caused the Contractor to incur additional cost. However, it is not the responsibility of the CA, adjudicator, judge or arbitrator to identify such events and quantify their effect in circumstances where the Contractor has failed to do so.

- 17.5 The Contractor must be aware that there is a risk that a global claim will fail entirely if any material part of the global loss can be shown to have been caused by a factor or factors for which the Employer bears no responsibility and it is not possible for the CA, adjudicator, judge or arbitrator to assess the value of that non-recoverable portion on the available evidence.
- 17.6 The guidance in this section applies equally to claims pursued by any other project participant (including a party making a counterclaim).

18. Disruption claims

Compensation may be recovered for disruption only to the extent that the contract permits or there is an available cause of action at law. The objective of a disruption analysis is to demonstrate the loss of productivity and hence additional loss and expense over and above that which would have been incurred were it not for the disruption events for which the Employer is responsible.

- 18.1 Disruption (as distinct from delay) is a disturbance, hindrance or interruption to a Contractor's normal working methods, resulting in lower efficiency. Disruption claims relate to loss of productivity in the execution of particular work activities. Because of the disruption, these work activities are not able to be carried out as efficiently as reasonably planned (or as possible). The loss and expense resulting from that loss of productivity may be compensable where it was caused by disruption events for which the other party is contractually responsible.
- 18.2 Disruption events can have a direct effect on the works by reducing productivity (such as piecemeal site access different from that planned, out of sequence works or design changes). They can also lead to secondary consequences on the execution of the works, for example through crowding of labour or stacking of trades, dilution of supervision through fragmented work gangs, excessive overtime (which can lead to fatigue), repeated learning cycles and poor morale of labour which can further reduce productivity.
- 18.3 That lost productivity will result in financial loss in carrying out the impacted work activities. However, not all lost productivity is subject to compensation. The Contractor may recover compensation for disruption (whether under the contract or for breach of contract) only to the extent that the contract permits or there is an available cause of action at law.
- 18.4 As regards a claim for disruption under the contract, most standard forms do not expressly address recovery for disruption, although they do address some of the specific events that could lead to disruption, such as unforeseen ground conditions and untimely approvals or instructions from the CA. Disruption is

also not a cause of action at law in its own right. The Contractor must therefore explain in its claim document the legal basis of its entitlement.

- 18.5 When it comes to explaining the cause of disruption, it is often the case that the Contractor will rely upon multiple and intermingled disruption events to explain its loss of productivity and to support its claimed entitlement to loss and expense relating to the impacted work activities. Depending upon the circumstances, it may not be possible or practicable to identify the loss of productivity, and hence loss and expense, relating to individual disruption events. Hence, once the Contractor has excluded the costs and/or loss relating to specific Employer Risk Events for which the causal link can be established, the remaining disruption claim may present the rare situation in which it is acceptable to claim compensation as a composite whole (i.e. a global claim). The risks associated with proceeding with a global claim are explained in the guidance to Core Principle 17 in Part B.

Disruption analysis

- 18.6 Disruption is demonstrated by applying analytical methods and techniques to establish the loss of productivity arising out of the disruption events and the resulting financial loss. Disruption is not merely the difference between what actually happened and what the Contractor planned. From the Contractor's perspective, the objective of a disruption analysis is to demonstrate the lost productivity and hence additional loss and expense over and above that which would have been incurred were it not for the disruption events for which the Employer is responsible. Many of the causes of lower than anticipated productivity (such as poor supervision or planning, re-work due to defects, inadequate coordination of subcontractors, or over-optimistic tendering or tendering errors) will not justify compensation for disruption. It is only the consequences of disruption events that are the responsibility of the Employer for which compensation might be payable to the Contractor. The productivity loss caused by all other events must be excluded from the claim.
- 18.7 The starting point of a disruption analysis is a review of productivity in carrying out the works over time in order to determine when lower productivity was achieved and what work activities were impacted. The analysis should then continue with development of an understanding of what works were carried out, when the works were carried out and what resources were used, followed by a review of the financial loss incurred. Maintaining accurate project records is therefore equally as important for a disruption analysis as it is for a delay analysis.
- 18.8 The Protocol does not recommend the use of percentage additions to tender productivity assumptions, where these are unsupported by analysis. Where the Contractor has demonstrated disruption events for which the Employer is contractually responsible, even on very simple projects the Contractor should be capable of carrying out some analysis (albeit a limited analysis in the case of simple projects) in estimating the lost productivity and hence loss and expense caused by those disruption events. The onus of proof of the fact that disruption has led to financial loss remains with the Contractor.

- 18.9 The Contractor seeking to be compensated for disruption must demonstrate the quantum of its claim to the level of certainty reasonably required by the CA, adjudicator, judge or arbitrator pursuant to the applicable law. That quantum is the cost of the productivity loss, which will be the difference between realistic and achievable productivity and that which was actually achieved in carrying out the impacted work activities as a result of the disruption events for which the Employer is responsible. Original tender assumptions should not automatically be considered as a ‘realistic and achievable’ baseline. As discussed further below, there are several methods of deriving a baseline against which to measure actual levels of productivity achieved as a result of the disruption events for which the Employer is responsible.
- 18.10 It is recommended that compensation for disruption caused by variations be agreed in advance of carrying out the variations or, where this is not practicable, as soon as possible after completion of the variations (see the guidance to Core Principle 19 in Part B).
- 18.11 It is recommended that disruption caused by other events for which the Employer is responsible are compensated by the actual reasonable costs incurred, plus a reasonable allowance for profit if allowed by the contract.

Methods of disruption analysis

- 18.12 There are several methods for the calculation of lost productivity resulting from disruption events, each with varying accuracy and general acceptance. A broad distinction may be made between those methods that rely on actual or theoretical measurements of comparative productivity (productivity-based methods), and those which rely on analysis of planned and actual expenditure of resource or costs (cost-based methods). The former seek to measure the loss of productivity in the utilised resources and then to price that loss; the latter seek more directly to ascertain the difference between actual cost and planned cost without first measuring productivity losses in the utilised resources.
- 18.13 Set out below is an explanation of each of the following more common methods:

Productivity-based methods	Cost-based methods
1. Project-specific studies:	1. Estimated v incurred labour
(a) Measured mile analysis	2. Estimated v used cost
(b) Earned value analysis	
(c) Programme analysis	
(d) Work or trade sampling	
(e) System dynamics modelling	
2. Project-comparison studies	
3. Industry studies	

- 18.14 The primary focus of a disruption analysis will be on the direct labour and task-specific plant resources said to have been disrupted. However, there may also be an impact on indirect resources, such as supervision staff or standing plant (i.e. where such resources are increased rather than merely extended), leading to additional costs. In demonstrating that the disruption events also caused additional costs for indirect resources, the Contractor will need to demonstrate the correlation between those costs and the loss of productivity in the direct resources.

Productivity-based methods

- 18.15 There are three general categories of productivity-based methods, listed below by order of preference because of their decreasing reliability and general acceptance:

- (a) project-specific studies;
- (b) project-comparison studies; and
- (c) industry studies.

Project-specific studies

- 18.16 Project-specific studies include the measured mile analysis, earned value analysis, programme analysis, work or trade sampling, and system dynamics modelling. Of these, and subject to the availability of the necessary records, the measured mile analysis is the most widely accepted method of calculating lost productivity. This is because it considers only actual effects of the disruption events for which the Employer is responsible thereby eliminating disputes over the validity of original tender stage productivity assumptions and the Contractor's own performance.

- (a) **Measured mile analysis:** This compares the level of productivity achieved in areas or periods of the works impacted by identified disruption events with productivity achieved on identical or like activities in areas or periods of the works not impacted by those identified disruption events. Care must be exercised to compare like with like. For example, it would not be correct to compare work carried out in the learning curve part of a project with work executed after that period. In addition, the baseline period selected must be sufficiently long to serve as a reliable sample of non-impacted performance. While widely accepted, the measured mile analysis can be complex and document-intensive. It may be particularly problematic where: (a) there is no completely unimpacted period or area of the same or a similar work activity to act as the baseline with which to compare the impacted work activity; or (b) the impacted work activity in respect of which the loss of productivity is being measured was also impacted by matters not giving rise to entitlement to compensation, leading to the need to calculate productivity adjustments. In this regard, whilst adjustments might be helpful, the more that are applied, the more theoretical and unreliable the analysis will become. It may be preferable instead to identify a period of least disruption and, using this as the measured mile, to show

minimum likely additional loss and expense during periods of greater disruption. This analysis will not of itself, however, capture the initial lost productivity inherent in the measured mile.

- (b) **Earned value analysis:** This identifies the amount of man-hours reasonably included in the tender allowance for completing certain work activities and compares this with the actual man-hours for completing those work activities. As the work activities are progressed and the tender allowance is expended, the man-hours are 'earned'. For example, if the Contractor assumed in its tender allowance that it would take 20 man-hours to pour 10 m³ of concrete, when 10 man-hours have been expended, those man-hours have been 'earned' and, excluding any flawed or over-optimistic tender assumptions and disruption events, the Contractor ought to have achieved 50% of the concrete pour work activities. If in fact the Contractor ultimately expended 35 hours to pour the full 10 m³ of concrete, again, excluding any flawed or over-optimistic tender assumptions and disruption events which are the Contractor's responsibility, the additional 15 man-hours above the assumed 20 man-hours is the consequence of the productivity loss. The analysis can also assess the man-hours expended in particular periods of time. Where details of planned and actual man-hours are not available, an earned value analysis might focus upon cost. See paragraph 18.9 above against automatically applying original tender assumptions.
- (c) **Programme Analysis:** This utilises resource-loaded programmes created using specialist software, which provide the means to allocate and track resources including labour, plant, cost and quantities over the life of the project. Based upon the inputs provided, the specialist programme software assists in calculating periodic percentage completion and earned value for impacted activities. It is therefore a variant of earned value analysis.
- (d) **Work or trade sampling:** This relies upon contemporaneous records of direct works observations to determine productivity. If these records are not available, this method is unlikely to be persuasive, although factual witness evidence may assist. These observations, along with adjustments to construction methods and crews, might be recorded in tradesman questionnaires.
- (e) **System dynamics modelling:** This is a computer simulation approach using specialist software to produce a model of the disrupted project. That model replicates the complex network of relationships and interactions that influence labour productivity and rework including the various stages of the project (design, approvals, procurement or manufacturing, installation, construction, commissioning and taking over), the different parts of the works, workflows and project participants, and the direct effects of the claim events. The model reproduces the actual labour hour expenditures (including the as-built programme and added variations and other changes). The project is then re-simulated in the absence of the claim items resulting in a 'but-for' model. The robustness of the conclusions derived from this analysis is

dependent upon: (a) the accuracy and completeness of the source input data and hence the quality and availability of project records; (b) the reasonableness of the analyst's judgements in establishing the model; and (c) the transparency of the analytical process carried out by the specialist software. Given these challenges and the complexity and cost involved in carrying out this analysis, it is not as commonly used as other methods in calculating loss of productivity.

Project-comparison studies

18.17 Project-comparison studies may be relied upon when there are insufficient records available to carry out a project-specific study. With this approach, productivity on the disrupted project is compared to similar or analogous projects (or similar or analogous work activities on other projects) within the same industry where the disruption events (and hence the productivity losses) did not occur. This approach depends on the availability of sufficient data from the comparator projects to ensure that the comparison is on a like-for-like basis, and to allow proper testing of alleged comparability. This approach will not be persuasive without transparency on the data from the comparator projects.

Industry studies

18.18 Where there is insufficient contemporaneous documentation to support a project-specific study or project-comparison studies are not available, a productivity-loss estimate using data developed from studies based on industry-wide research may be of assistance, though only if these studies are relevant to the working conditions and types of construction that applies to the disrupted project.

18.19 Here, factors generated from industry studies (some based on empirical data; some on non-empirical data) are relied upon to estimate lost productivity. These factors are applied to the disrupted project's actual resource losses in order to determine whether the level of loss measured on the disrupted project is consistent with the factors determined in those studies. For example, for projects that are disrupted by severe weather, these studies can provide factors which account for changes in temperature and their effects on tradesmen practices and productivity. Other studies address the consequences of different project or geographical characteristics on productivity. Examples of these industry studies are those developed by the Mechanical Contractors Association of America (MCAA), which give different percentages applicable for various types of disruption events according to severity, 'Effects of Accelerated Working, Delays and Disruption on Labour Productivity' produced by The Chartered Institute of Building, and studies produced by the National Electrical Contractors of America (NECA) and the U.S. Army Corps of Engineers. Academic studies developed by university research, and available in specialist literature, may provide further assistance.

18.20 Industry studies of these kinds, particularly where unsupported by corroborating data from the project in question, are however liable to be criticised as being theoretical and so should be used with caution.

Cost-based methods

- 18.21 Cost-based methods provide the least robust support for a disruption claim and are often applied when lost productivity cannot be reliably calculated utilising a productivity-based approach. These methods focus on project cost records and seek to provide a comparison between either incurred and estimated cost, or labour used and estimated labour, for those activities impacted by disruption events for which the Employer is responsible.
- 18.22 Several formulae are available, the simplest being total labour cost expended (by the Contractor) less total labour cost paid (by the Employer to the Contractor), which equals total labour cost lost. However, for the reasons in paragraph 18.6 above, this approach is unlikely to be persuasive without further analysis. Modified formulae which exclude from the claimable costs calculation the costs of the Contractor's tender errors and any disruption events for which the Contractor is responsible will be more persuasive. Even if this is done, that will still leave the Contractor advancing a global claim; the risks associated with proceeding with a global claim are explained in the guidance to Core Principle 17 in Part B.
- 18.23 Overall, cost-based methods may provide some assistance if there is sufficient documentation and supporting particulars to demonstrate the reasonableness of tender assumptions (specifically that the estimated labour man-hours were realistic and achievable), that the actual costs incurred were reasonable and that the costs of any events for which the Contractor is responsible have been excluded.
- 18.24 Costs-based methods are unlikely to be persuasive where there are productivity-based methods that can reasonably be deployed in the circumstances.

Further guidance

- 18.25 Under appropriate circumstances, and in varying degrees, all of the methods introduced above may support a disruption claim. The most reliable and accurate are project-specific studies, particularly a properly implemented measured mile analysis. An analysis which combines a productivity-based method and a cost-based method may provide useful cross-checking where it is proportionate to carry out two analyses. Whichever method is used for identifying and establishing disruption and the resulting loss and expense, it is necessary to isolate issues that are likely to have impacted productivity but which are unrelated to the Employer's liability.
- 18.26 The Contractor should have regard to the guidance to Core Principle 1 in Part B in relation to records in ensuring it maintains appropriate records which, if necessary, can be relied upon to support a disruption claim.
- 18.27 Contractors sometimes assert claims for the cumulative impact of disruption events on the basis of exponential lost productivity resulting from the combination of individual disruption events over and above that apparently accounted for by aggregating the lost productivity caused by each disruption event. It is often the case that the greater the number of disruption events, the harder it is to quantify losses with precision because of the record-keeping

challenges imposed through no fault of the Contractor, who would not have expected these challenges when the contract was entered into.

- 18.28 This is an area where particular care has to be taken to address the risks associated with global claims. However, if all causes of disruption can genuinely be said to be the Employer's responsibility, and if the financial consequences of those disruption events are impossible or impracticable to distinguish, then such an approach may be valid and indeed persuasive. In effect, the proposition being put is that the Contractor's analysis is not capable of explaining the full extent of financial loss that has actually occurred by reference to the individual disruption events, but that the loss, despite the absence of any more proof, must be fully the responsibility of the Employer.
- 18.29 Where disruption events have caused delay or delay has caused disruption, the Contractor may also carry out a delay analysis to support its claims. Delay analyses are addressed in the guidance to Core Principles 4 and 11 in Part B.

19. Valuation of variations

Where practicable, the total likely effect of variations should be pre-agreed between the Employer/CA and the Contractor to arrive at, if possible, a fixed price of a variation, to include not only the direct costs (labour, plant and materials) but also the time-related and disruption costs, an agreed EOT and the necessary revisions to the programme.

- 19.1 Every competently drafted construction contract contains a mechanism entitling the Employer to vary the works by addition or deletion, with a mechanism for determining the price of the variation. The standard forms sometimes, but not always, contain wording enabling the parties to agree in advance of the execution of the variation, what its fixed price will be. This practice is supported by the Protocol.
- 19.2 Users of design and construct forms of contract are reminded that it is essential to have a list of rates and prices to be used in the event of change in the Employer's requirements.
- 19.3 Typically, variation clauses provide that where the varied work is of a similar character and executed under similar conditions to the original work, the tendered contract rates should be used. Where the work is either not of a similar character or not executed under similar conditions, the tendered contract rates can be used, but adjusted to take account of the different circumstances. If the work is quite dissimilar, reasonable or fair rates and prices are to be determined. Fair or reasonable rates will generally be reasonable direct costs plus a reasonable allowance for overheads (on and off-site) and profit.
- 19.4 Under the JCT standard forms of building contract, any loss and/or expense caused by an adverse effect on the progress of the works as a result of acts or omissions of the Employer is to be ascertained separately from the direct cost and associated preliminaries/overheads of an instructed variation.
- 19.5 Under other standard forms, prolongation compensation arising from variations is to be valued if possible as part of the variation at or on the basis of the rates

and prices in the bill of quantities or schedule of rates, or on the basis of a fair valuation.

- 19.6 It is not good practice to leave to be compensated separately at the end of the contract the prolongation and disruption element of a number of different variations and/or changes. This is likely to result in the Contractor presenting a global claim, which is a practice that is to be discouraged. Where it is not practicable to agree in advance the amounts for prolongation and disruption to be included in variations and sums for changed circumstances, then it is recommended that the parties to the contract do their best to agree the total amount payable as the consequence of the variations and/or changes separately as soon as possible after the variations are completed.
- 19.7 Though some standard forms of contract have a provision that where a variation affects unvaried work, the affected unvaried work may be treated as varied, these provisions are rarely used. The use of these provisions is encouraged, in order to promote early agreement on the complete effect of the variation.

20. Basis of calculation of compensation for prolongation

Unless expressly provided for otherwise in the contract, compensation for prolongation should not be paid for anything other than work actually done, time actually taken up or loss and/or expense actually suffered. In other words, the compensation for prolongation caused other than by variations is based on the actual additional cost incurred by the Contractor. The objective is to put the Contractor in the same financial position it would have been if the Employer Risk Event had not occurred.

- 20.1 Delay causes prolongation. Prolongation causes increased cost. The recoverability of compensation for prolongation depends on the terms of the contract and the cause of the prolongation. Obviously, any prolongation costs resulting from Contractor Risk Events must be borne by the Contractor. Compensation for prolongation resulting from Employer Risk Events will primarily comprise the Contractor's extended use of time-related resources, notably its site overheads. It is, however, not possible to say that compensation for prolongation comprises exclusively additional time-related resources because other types of recoverable loss may result from Employer Risk Events.
- 20.2 The recovery of prolongation compensation depends on the terms of the contract and the cause of the prolongation. Prolongation costs may be caused by any kind of Employer Risk Event – a variation, a breach of contract, or other identified provision in the contract – for example, unforeseen ground conditions.
- 20.3 Whether the cause of the prolongation is governed by a provision in the contract or a breach of contract, it is up to the Contractor to demonstrate that it has actually suffered loss and/or expense before it becomes entitled to compensation, unless the contract provides otherwise.
- 20.4 Arguments about proof of loss could be reduced or avoided altogether if the contract contained an agreed amount per day that can be applied to each day of prolongation. This is the reverse of the normal Employer's liquidated damages provision. It may be necessary to have a number of different agreed amounts to

be applied depending on the stage in the project where the delay occurs. One method of fixing the figure(s) would be for the Contractor to price a schedule of rates with indicative quantities at tender stage.

- 20.5 If the prolongation is caused by a variation, then it is recommended that the compensation for prolongation should be agreed as soon as possible after completion of the variation and where practicable included in the valuation of the variation (see the guidance to Core Principle 19 in Part B).

21. Relevance of tender allowances

The tender allowances have limited relevance to the evaluation of the cost of prolongation and disruption caused by breach of contract or any other cause that requires the evaluation of additional costs.

- 21.1 For prolongation or disruption compensation based on actual cost or loss and/or expense, the tender allowances are not relevant because the Contractor is entitled to its actual costs of the prolongation or disruption.
- 21.2 It is a common misunderstanding in the construction industry that if the Contractor has made no or inadequate allowance for site overheads in its tender, then that fact limits or removes its entitlement to compensation for prolongation and/or disruption where the basis of recovery is actual cost incurred. This is not correct. Under these circumstances recoverable compensation requires the ascertainment of the actual cost of remaining on site for the additional time. The tender allowances are therefore of little relevance to the ascertainment of compensation under these circumstances.
- 21.3 The tender allowances may be a useful reference point for the evaluation of prolongation and disruption caused by a variation, but only in those circumstances where the different conditions or circumstances under which the variations are carried out make it inappropriate to apply the contract rates or prices. Notwithstanding the advice of the Protocol, there is nothing to prevent the use of the tender allowances as a rough guide for the agreement of prolongation costs or for checking the recovery of prolongation costs through the value of varied work, if that is what the parties for convenience wish to do.

22. Period for evaluation of compensation

Once it is established that compensation for prolongation is due, the evaluation of the sum due is made by reference to the period when the effect of the Employer Risk Event was felt, not by reference to the extended period at the end of the contract.

- 22.1 Liability for compensation must first be established by showing that the prolongation has been caused by an Employer Risk Event.
- 22.2 Arguments commonly arise as to the time when recoverable prolongation compensation is to be assessed: is it to be assessed by reference to the period when the Employer Delay occurred (when the daily or weekly amount of expenditure and therefore compensation may be high) or by reference to the

extended period at the end of the contract (when the amount of compensation may be much lower)?

- 22.3 The answer to this question is that the period to be evaluated is that in which the effect of the Employer Risk Event was felt.
- 22.4 If amounts of compensation per day for prolongation were pre-agreed, then the point in time when the compensable prolongation occurred would need to be consistent with what has been agreed.

GUIDANCE PART C: OTHER FINANCIAL HEADS OF CLAIM

This Part sets out guidance in relation to further financial heads of claim that often arise in the context of delay and disruption.

1. Claims for payment of interest

- 1.1 Some standard forms of contract make provision for the way interest, as a component of delay and disruption compensation, is payable. Interest may also be a component of damages if it can be shown that the loss (in the form of additional interest paid) was actually suffered as a result of a breach of the contract, and the loss was in the contemplation of the parties at the time of contracting. There are also statutory rights to interest.
- 1.2 The following are legitimate bases for claims for interest under contracts subject to English law, subject to express contractual provisions to the contrary where relevant, and proof where necessary.

Interest pursuant to contract

- 1.3 The parties can agree in the contract the rate of interest and the circumstances in which it will be payable. The rate may not be enforceable if it is penal in nature (out of all proportion to the legitimate interests of the Contractor in receiving the timely payment of compensation that is due for delay and disruption). Various standard forms of contracts contain an express contractual right to interest.

Interest as damages/finance charges

- 1.4 It is the position in most areas of business that interest payable on bank borrowings (to replace the money due) or the lost opportunity to earn interest on bank deposits, is quantifiable as damages where the claimant can show:
 - (a) that such loss has actually been suffered; and
 - (b) that this loss was within the reasonable contemplation of the parties at the time of contracting.
- 1.5 It is recognised that, in the construction industry, it will always be in the contemplation of the parties at the time they enter into their contract that if deprived of money the Contractor will pay interest or lose the ability to earn interest. Contractors therefore need only establish that the loss was actually suffered.

Time when interest starts to run

- 1.6 There are often arguments as to the date on which interest on a Contractor's claim should start to run. Contractors will argue that it should be the date on which they incurred expenditure for which they are entitled to compensation. Employers will say that interest should run only from the date that the

Contractor has provided all information needed to satisfy them that the expenditure has been incurred.

- 1.7 The appropriate starting date will not be the same in all circumstances, but generally the starting date for the payment of interest should be the earliest date on which the principal sum could have become payable, which will be the date for payment of the certificate issued immediately after the date the Contractor applied for payment of the loss and/or expense. This will be subject to any notice requirements in the contract. In contracts where there are no certificates, the Protocol recommends that interest should start to run 30 days after the date the Contractor suffered the loss and/or expense.

Statutory interest on debts

- 1.8 In considering claims for prolongation costs (and any other monetary claims) the parties should be aware of the various statutory rights to interest that may be available to an adjudicator, judge or arbitrator should they not resolve their dispute. These statutory rights include the Late Payment of Commercial Debts (Interest) Act 1998, section 35A of the Senior Court Act 1981, section 49 of the Arbitration Act 1996 and the Judgments Act 1838.

2. Head office overheads and profit

- 2.1 This section applies to claims for compensation other than the valuation of variations on the basis of rates and prices in the bill of quantities or schedule of rates which include provision for head office overheads and profit.
- 2.2 Where there is Employer Delay to Completion, a Contractor will often include a claim for the lost contribution to head office overheads and the lost opportunity to earn profit (either on the project the subject of the claim or on other projects). This is on the basis that its time-related resources have been prolonged on the project, rather than earning revenue (including, importantly, contribution to head office overheads and profit) on other projects from the contract completion date.
- 2.3 Head office overheads can be sub-divided into: ‘dedicated overheads’ which through careful record keeping can be attributed to the specific Employer Delay; and ‘unabsorbed overheads’ (such as rent and some salaries) which are incurred by a Contractor regardless of its volume of work. These costs, if demonstrated, may be recoverable under the contract or, alternatively, may be claimed as damages for a breach of contract.
- 2.4 Regarding the lost opportunity to earn profit, this is generally not recoverable under the standard forms. Instead, Contractors typically frame their claim for the lost opportunity to earn profit as a claim for damages for breach of contract. An appropriate rate may be arrived at from the Contractor’s audited accounts for the three previous financial years closest to the Employer Risk Events for which audited accounts have been published. If the contract does in fact allow the recovery of a profit element in addition to any other compensation for delay to the project the subject of the claim, the amount of profit allowed should reflect the fact that there is no risk involved in the earning of that profit.

- 2.5 Unless the terms of the contract say otherwise, a lost contribution to head office overheads is generally recoverable as a foreseeable loss resulting from prolongation. It may be more difficult for the Contractor to demonstrate that the lost opportunity to earn profit was a foreseeable loss.
- 2.6 Before it can recover unabsorbed overheads and lost profit, the Contractor must be able to demonstrate that it has:
- (a) failed to recover the overheads and earn the profit it could reasonably have expected during the period of prolongation; and
 - (b) been unable to recover such overheads and earn such profit because its resources were tied up by Employer Risk Events.
- 2.7 In order to succeed in such a claim, the Contractor must demonstrate that there was other revenue and profit earning work available which, in the absence of the Employer Delay, would have been secured by the Contractor.
- 2.8 The Contractor should make all reasonable efforts to demonstrate through records the head office overheads that it has failed to recover and the profit it has been deprived of earning. If it is not otherwise feasible to quantify the unabsorbed overheads and lost profit, formulae may be used (with caution) to quantify unabsorbed overheads and lost profit once it has been successfully demonstrated that overheads have remained unabsorbed and there is a lost opportunity to earn profit as a result of an Employer Risk Event. The burden of proving that it has unabsorbed overheads and lost profit always rests with the Contractor. A formula just serves as a tool for the quantification of the loss (also see paragraph 1.28 regarding Core Principle 1 in Part B).
- 2.9 The three most commonly used formulae are Hudson, Emden and Eichleay. They are set out in Appendix A.
- 2.10 The use of the Hudson formula is not supported. This is because it is dependent on the adequacy or otherwise of the tender in question, and because the calculation is derived from a number which in itself contains an element of head office overheads and profit, so there is double counting.
- 2.11 In the limited circumstances where a formula is to be used, the Protocol prefers the use of the Emden and Eichleay formulae. However, in relation to the Eichleay formula, if a significant proportion (more than, say, 10%) of the final contract valuation is made up of the value of variations, then it will be necessary to make an adjustment to the input into the formula, to take account of the fact that the variations themselves are likely to contain a contribution to head office overheads and profit.
- 2.12 The CA or, in the event of a dispute, the person deciding the dispute, should not be absolutely bound by the results of a formula calculation. It is possible that the use of a particular formula will produce an anomalous result because of a particular input into it. It is suggested that the result of the use of one formula be cross-checked using another formula. A spreadsheet to do this is available on the Society website: <https://www.scl.org.uk/resources/delay-disruption-protocol>.

- 2.13 The tender allowance for head office overheads and profit may be used, if that is what the parties for convenience wish to do.

3. Claim preparation costs

- 3.1 Most construction contracts provide that the Contractor may only recover the cost, loss and/or expense it has actually incurred and that this be demonstrated or proved by documentary evidence. The Contractor should not be entitled to additional costs for the preparation of that information, unless it can show that it has been put to additional cost as a result of the unreasonable actions or inactions of the CA in dealing with the Contractor's claim. Similarly, unreasonable actions or inactions by the Contractor in prosecuting its claim should entitle the Employer to recover its costs. The Protocol may be used as a guide as to what is reasonable or unreasonable.

2nd edition of the Protocol

The work involved in reviewing the 1st edition and drafting the 2nd edition of the Protocol was carried out by the following individuals:

Kim Rosenberg (Chair)
David Barry
Richard Bayfield
Chris Ennis
Keith Kirkwood
Marianne Ramey
Jeremy Winter

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APPENDIX A

Definitions and glossary

This Appendix provides explanations for words and expressions used in the Protocol. In order to make the Protocol as easy to read as possible, the use of capitalisation for defined terms has been kept to a minimum.

acceleration

The application of additional resources or alternative construction sequences or methodologies seeking to achieve the planned scope of work in a shorter time than planned or execution of additional scope of work within the original planned duration.

Accepted Programme

The Protocol recommends that the Contractor be required to submit a draft programme for the whole of the works to the CA and that this draft programme be accepted by the CA. Once accepted by the CA, it is known in the Protocol as the Accepted Programme.

Activity

An operation or process consuming time and possibly other resources. An individual or work team can manage an activity. It is a measurable element of the total project programme.

activity float

The duration contingency directly related to a single activity built into the planned duration of that activity. Activity float is established simply by dictating an activity duration that is greater than the actual time needed to complete that activity.

activity-on-the-node network

A network in which the nodes symbolise the activities. A precedence diagram.

as-built programme

The record of the history of the construction project in the form of a programme. The as-built programme does not necessarily have any logic links. It can be merely a bar-chart record of the start and end dates of every activity that actually took place. 'As constructed programme' has the same meaning.

as-planned versus as built windows

See paragraph 11.6(d) in Part B.

change/variation

Any difference between the circumstances and/or content of the contract works as carried out, compared with the circumstances and/or content under which the works are described in the contract documents as required to be or intended to have been carried out. A change or variation may or may not carry with it a right to an EOT and/or additional payment.

collapsed as-built

See paragraph 11.6(f) of Part B.

compensable event

Expression sometimes used to describe what in the Protocol is an Employer Risk Event in respect of which the Contractor is entitled to compensation.

compensation

The recovery or payment of money for work done or time taken up whether by way of valuation, loss and/or expense or damages.

completion date

See contract completion date.

concurrency

See the guidance to Core Principle 10 in Part B.

concurrent delay

See concurrency.

constructive acceleration

Acceleration following failure by the CA to recognise that the Contractor has encountered Employer Delay for which it is entitled to an EOT and which failure required the Contractor to accelerate its progress in order to complete the works by the prevailing contract completion date. This situation may be brought about by the Employer's denial of a valid request for an EOT or by the CA's late granting of an EOT. This is rarely recognised under English law.

Contract Administrator (CA)

The person responsible for administration of the contract, including certifying what extensions of time are due, or what additional costs or loss and expense is to be compensated. Depending on the form of contract the person may be referred to by such terms as Employer's Agent, Employer's Representative, Contract Administrator, Project Manager or Supervising Officer or be specified as a particular professional, such as the Architect or the Engineer. The contract administrator may be one of the Employer's employees or the Employer itself.

contract completion date

The date by which the Contractor is contractually obliged to complete the works, taking account of the award of any EOTs. As well as being an overall date for completion, the contract completion date may be the date for completion of a section of the works or a milestone date. The expression 'completion date' is sometime used by Contractors to describe the date when they plan to complete the works (which may be earlier than the contract completion date). The Protocol avoids this confusion by using the expression 'contract completion date'.

Contractor

The party responsible for carrying out the works is generally referred to as the 'Contractor'. The Protocol is applicable to sub-contracts as well as main contracts, so when it is being applied to a sub-contract, it is the sub-contractor that is being referred to as the 'Contractor' in the Protocol.

Contractor Delay

Expression commonly used to describe any delay caused by a Contractor Risk Event. The Protocol distinguishes between: Contractor Delay to Progress which is a delay which will merely cause delay to the Contractor's progress without causing a contract completion date not to be met; and Contractor Delay to Completion which is a delay which will cause a contract completion date not to be met.

Contractor Delay to Completion

See Contractor Delay.

Contractor Delay to Progress

See Contractor Delay.

Contractor Risk Event

An event or cause of delay or disruption which under the contract is at the risk and responsibility of the Contractor.

Contractor's planned completion date

The date shown on the Contractor's programme as being the date when the Contractor plans to complete the works under the contract.

critical delay

See critical path.

critical path

The longest sequence of activities through a project network from start to finish, the sum of whose durations determines the overall project duration. There may be more than one critical path depending on workflow logic. A delay to progress of any activity on the critical path will, without acceleration or re-sequencing, cause the overall project duration to be extended, and is therefore referred to as a 'critical delay'.

critical path analysis (CPA)

The process of analysing the critical and near critical activities in a CPM programme to manage progress, balance resource allocations and ascertain delays or acceleration to the date for completion or the completion date of the works, a section or a milestone.

critical path method (CPM)

The methodology or management technique that, through the use of calculation rules (usually automatically carried out by programming software), determines the critical path and calculates float.

culpable delay

Expression sometimes used to describe what the Protocol calls Contractor Delay.

date for completion

The date by which the contractor is expected to complete the works, which may be earlier or later than the contract completion date.

delay event

An event or cause of delay, which may be either an Employer Risk Event or a Contractor Risk Event.

Delay to Completion

In common usage, this expression may mean either delay to the date when the contractor planned to complete its works, or a delay to the contract completion date. The Protocol uses the expressions Employer Delay to Completion and Contractor Delay to Completion, both of which mean delay to a contract completion date - see their definitions.

Delay to Progress

In the Protocol, this means a delay which will merely cause delay to the Contractor's progress without causing a contract completion date not to be met. It is either an Employer Delay to Progress or a Contractor Delay to Progress.

disruption

See paragraph 5 in Part A and the guidance to Core Principle 18 in Part B.

disruption event

An event or cause of disruption.

duration

Duration is the length of time needed to complete an activity. The time period can be determined inductively, by determining the start and finish date of an activity or deductively by calculation from the time necessary to expend the resources applied to the activity.

Employer

The Employer is the party under the contract who agrees to pay for the works. In some of the standard forms, the party who agrees to pay for the works is referred to as the Developer, the Owner, the Client or the Authority. The Protocol is applicable to sub-contracts as well as main contracts, so when it is being applied to a sub-contract, it is the main contractor that is being referred to as the Employer in the Protocol.

Employer Delay

Expression commonly used to describe any delay caused by an Employer Risk Event. The Protocol distinguishes between: Employer Delay to Progress which is a delay which will merely cause delay to the Contractor's progress without causing a contract completion date not to be met; and Employer Delay to Completion which is a delay which will cause a contract completion date not to be met.

Employer Delay to Completion

See Employer Delay.

Employer Delay to Progress

See Employer Delay.

Employer Risk Event

An event or cause of delay or disruption which under the contract is at the risk and responsibility of the Employer.

excusable delay

Expression sometimes used to describe what in the Protocol is an Employer Delay in respect of which the Contractor is entitled to an EOT.

extension of time (EOT)

Additional time granted to the Contractor to provide an extended contractual time period or date by which work is to be, or should be completed and to relieve it from liability for damages for delay (usually liquidated damages).

float

The time available for an activity in addition to its planned duration. See free float and total float. Where the word 'float' appears in the Protocol, it means positive not negative float, unless expressly stated otherwise.

free float

The amount of time that an activity can be delayed beyond its early start/early finish dates without delaying the early start or early finish of any immediately following activity.

Gantt chart

Bar chart – named after the originator, Henry Gantt.

global claim

A global claim is one in which the Contractor seeks compensation for a group of Employer Risk Events but does not or cannot demonstrate a direct link between the loss incurred and the individual Employer Risk Events.

hammock

An activity representing the period from the start of an activity to the completion of another. Sometimes used as a way of summarising the duration of a number of activities in a programme as one single duration. See also 'level of effort'.

hanging activity

An activity not linked to any preceding or successor activities. It is the same as dangling activity.

head office overheads

Head office overheads are the incidental costs of running the Contractor's business as a whole and include indirect costs which cannot be directly allocated to production, as opposed to direct costs which are the costs of production. Amongst other things, these overheads may include such things as rent, rates, directors' salaries, pension fund contributions and auditors' fees. In accountancy terms, head office overheads are generally referred to as administrative expenses, whereas the direct costs of production are referred to as costs of sales.

head office overheads & profit formulae

Hudson formula

$$\frac{\text{Overheads \& profit}}{100} \times \frac{\text{contract sum} \times \text{period of delay}}{\text{contract period}}$$

Overheads & profit: head office overheads and profit percentage in tender.

Emden formula

$$\frac{\text{Overheads \& profit}}{100} \times \frac{\text{contract sum} \times \text{period of delay}}{\text{contract period}}$$

Overheads & profit: head office overheads and profit percentage (actual).

Eichleay formula

Step 1: establish the head office overhead costs attributable to the contract as follows: divide the final contract sum (excluding the claim for head office overhead) by the total revenue for the contract period, then multiply the result by the total head office overhead costs incurred during the actual period of performance of the contract.

Step 2: divide the figure resulting from Step 1 by the number of days of actual performance of the contract, to establish a daily rate.

Step 3: Multiply the figure resulting from Step 2 by the number of days compensable delay.

impact

The effect that a change has on an activity or the effect that a change to one activity has on another activity.

impacted as-planned analysis

See paragraph 11.6(a) in Part B.

key date

Expression sometimes used to describe a date by which an identifiable accomplishment must be started or finished. Examples include 'power on', 'weather-tight' or the start or completion of phases of construction or of phases or sections of the contract, or completion of the works.

lag

Lag in a network diagram is the minimum necessary lapse of time between the finish of one activity and the finish of another overlapping activity. It may also be described as the amount of time required between the start or finish of a predecessor task and the start or finish of a successor task. (See logic links)

lead

The opposite of lag, but in practice having the same meaning. A preceding activity may have a lag to a successor activity – from the perspective of the successor activity, that is a lead.

level of effort

A special activity type in programming software with unique qualities for duration. The software calculates the duration of a level of effort activity based on dates from its predecessor(s) and successor(s) rather than having a duration assigned to the particular activity. They are supposed to be used for support work, such as meetings, which occur during the timeframe of the predecessors and successors. In practice, they are sometimes also used in the older context of ‘hammocks’ but are not in fact a hammock.

liquidated and ascertained damages, liquidated damages, LADs, LDs

A fixed sum, usually per week or per day, written into the contract as being payable by the Contractor in the event that the works are not completed by the contract completion date (original or extended).

logic links

The common logic links are as follows:

Finish-to-start

The convention in Figure 1 shows the normal sequential relationship of one activity following another. Activity B cannot start until activity A has finished.

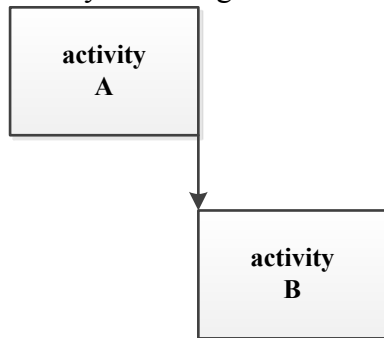


Figure 1 — finish-to-start relationship

Lagged finish-to-start

In Figure 2, below, ‘d’ implies a normal lag relationship between activities A and B; that is, B cannot start until ‘d’ days have elapsed after activity A has finished. An example of this might be the curing time of concrete between completion of the pour and the commencement of further work on the concrete.

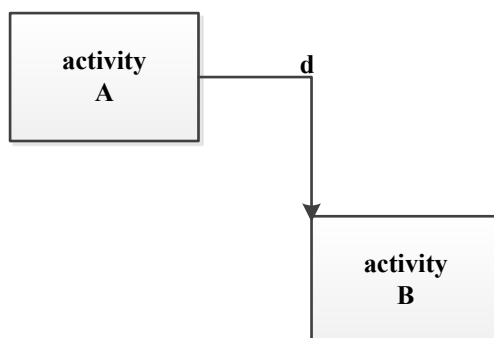


Figure 2 — lagged finish-to-start relationship

Start-to-start

In the relationship at Figure 3, below, activity B cannot start until activity A has started or perhaps, more accurately, activity B can start at the same time as activity A but not before it.

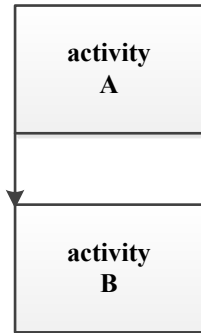


Figure 3 — start-to-start relationship

Lagged start-to-start

In Figure 4, 'd' indicates a start-to-start relationship with the delay imposed showing that activity B cannot start until the period 'd' has elapsed after activity A has started. This convention provides one of the facilities to overlap the execution of activities.

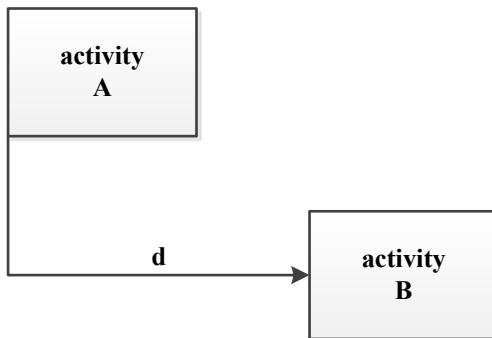


Figure 4 — lagged start-to-start relationship

Finish-to-finish

In the example at Figure 5 of a finish-to-finish relationship, activity B cannot finish until activity A has finished. It implies that B can finish at the same time as A, but not before it.

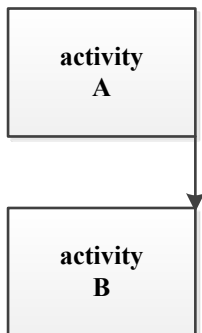


Figure 5 — finish-to-finish relationship

Lagged finish-to-finish

In Figure 6 below, 'd' indicates a finish-to-finish relationship but with a delay, i.e. activity B cannot finish until 'd' days (or whatever time units have been used) have elapsed after activity A has finished. This convention provides a second means of overlapping timing of activities.

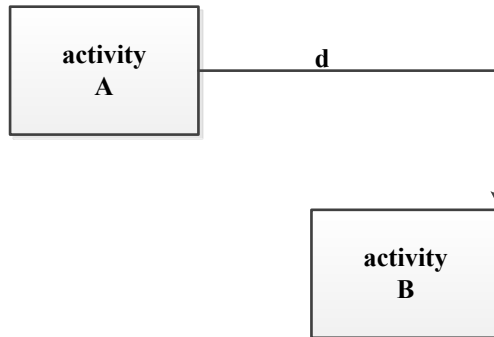


Figure 6 — lagged finish-to-finish relationship

Lagged start and finish

There may be occasions where a lag is required both on the start and finish of related activities. This is achieved by the convention shown below at Figure 7, that is, activity B cannot start until 'd' days after activity A has started and activity B cannot finish until 't' days after activity A has finished.

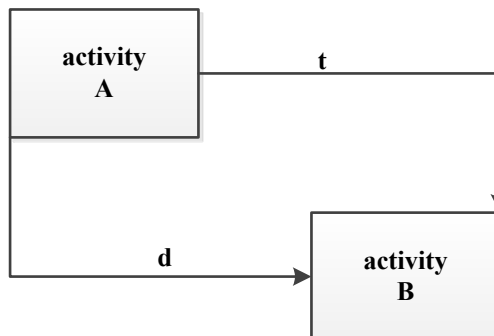


Figure 7 — lagged start and finish relationship

Negative lag

The arrangement or sequence in which the successor activity is allowed to start chronologically before the predecessor activity has been completed. Below, activity B cannot start until 4 days before A is planned to finish.

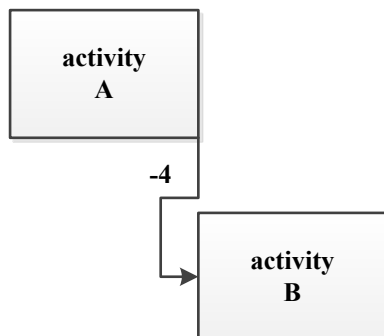


Figure 8 — negative lag

method statement

A written description of the Contractor's proposed manner of safely carrying out the works or parts thereof, setting out assumptions underlying the chosen method and the reasoning behind the approach to the various phases of construction. It should include details of key resources, including labour and plant.

milestone

A key event selected for its importance in the project. Commonly used in relation to progress, a milestone is often used to signify a key date.

mitigation

Mitigate means making less severe or less serious. In connection with Delay to Progress or Delay to Completion, it means minimising the impact of the Risk Event. In relation to disruption or inefficient working, it means minimising the disruption or inefficiency. Failure to mitigate is commonly pleaded as a defence or partial defence to a claim for delay or disruption. Acceleration is a subset of mitigation.

must start / must finish

Most project management software allows the planner to specify that an activity must start or must finish on a specific date. Using the software in this way restricts the ability of the programme to react dynamically to change on the project.

negative lag

See logic links above.

negative total float

Expression sometimes used to describe the time by which the duration of an activity or path has to be reduced in order to permit a limiting imposed date to be achieved. Negative float only occurs when an activity on the critical path is behind programme. It is a programming concept, the manifestation of which is, of course, delay.

non-compensable event

Expression sometimes used to describe what the Protocol calls a Contractor Risk Event.

non-excusable delay

Expression sometimes used to describe what the Protocol calls Contractor Delay.

Path

An activity or an unbroken sequence of activities in a project network.

PERT

Programme Evaluation and Review Technique: a programming technique, similar to critical path analysis, but whereby the probability of completing by the contract completion date is determined and monitored by way of a quantified risk assessment based on optimistic, pessimistic and most likely activity durations.

planned completion date

See Contractor's planned completion date.

Practical Completion

The completion of all the construction work that has to be done, subject only to very minor items of work left incomplete. It is generally the date when the obligation to insure passes from the Contractor to the Employer and the date from which the defects liability period runs. This is the term used under the Joint Contracts Tribunal (JCT) family of contracts. In the International Federation of Consulting Engineers (FIDIC) forms it is referred to as Substantial Completion.

precedence diagram

A multiple dependency, activity-on-node network in which a sequence arrow represents one of four forms of precedence relationship, depending on the positioning of the head and the tail of the sequence arrow. (See logic links)

programme

A tool that divides the works into a series of activities, each with a duration and logic links to preceding and succeeding activities, forming a network of activities. The programme may be depicted in a number of different forms, including a Gantt or bar chart, line-of-balance diagram, pure logic diagram, time-scaled logic diagram or as a time-chainage diagram, depending on the nature of the works. Otherwise known as the schedule. This term should not be confused with ‘program’, being the software used to generate the programme.

programme narrative

A written explanation of the assumptions underlying the Accepted Programme (or the Updated Programme), its key resources, sequencing restraints, critical path, risks, exclusions/exceptions, and execution strategy.

prolongation

The extended duration of the works during which time-related costs are incurred as a result of a delay.

resource

Expression used to describe any variable capable of definition that is required for the completion of an activity and may constrain the project. This may be a person, item of equipment, service or material that is used in accomplishing a project task.

resource levelling

Expression used to describe the process of amending a schedule to reduce the variation between maximum and minimum values of resource requirements. The process removes peaks, troughs and conflicts in resource demands by moving activities within their early and late dates and taking up float. Most project planning software offers an automated resource-levelling routine that will defer the performance of a task within the imposed logical constraints until the resources assigned to the tasks are available.

retrospective longest path analysis

See paragraph 11.6(e) in Part B.

revised programme

A programme that demonstrates how Delay to Completion will be recovered. It should utilise the latest Updated Programme as its starting point. If accepted by the CA, it replaces the former Accepted Programme as the tool for monitoring actual progress.

Risk Event

See Employer Risk Event and Contractor Risk Event.

rolling wave programming

This is a method of planning where details of the programme are elaborated as the project proceeds. This method assumes that the detailed plan for specific activities in the future will be developed closer to the time when those activities are to be executed.

schedule

Another name for the programme.

slack

Another name for total float.

sub-network

A group of activities or durations, logically linked. In the Protocol it is to be used to illustrate the work flowing directly from an Employer Risk Event.

Substantial Completion

See Practical Completion.

time impact analysis

See paragraphs 4.12 and 11.6(b) in Part B.

Time Risk Allowance

The additional time included by the Contractor within the allocated duration for an activity in a programme to allow for risks which are its responsibility under the contract. This is a contingency measure. The allowance can be zero.

time slice analysis

See paragraph 11.6(c) in Part B.

total float

The amount of time that an activity may be delayed beyond its early start/early finish dates without delaying the contract completion date.

Updated Programme

In the Protocol the Updated Programme is the Accepted Programme updated with all progress achieved and any revised logic or constraints. The final Updated Programme should depict the as-built programme.

works

The scope of works to be completed by the Contractor under the contract.

APPENDIX B

Record types and examples

The guidance to Core Principle 1 in Part B of the Protocol concerns record keeping. This Appendix lists the typical records within each of the six categories described (programme, progress, resource, costs, correspondence and administration, and contract and tender documents) and the principal reasons for keeping those records to facilitate managing progress of the works and the resolution of delay and disruption claims.

1. Programme records

1.1 These records set out the Contractor's plan for carrying out the works and, upon being updated, record the progress status of the works at the agreed intervals and upon completion of the works. There are a number of sub-categories of programme records as set out below.

1.2 Programmes: typically there are multiple programmes created and maintained in relation to the works as follows:

- (a) tender programmes;
- (b) Contractor's proposed programmes (submitted for the purposes of acceptance as the Accepted Programme);
- (c) Accepted Programme;
- (d) Updated Programmes (the last of which should be an as-built programme);
- (e) proposed revised programmes submitted by the Contractor;
- (f) detailed short term look ahead programmes; and
- (g) the Contractor's internal target programmes.

1.3 Also, there are supplemental detailed programmes or programming information in a suitable format (such as CPM, line of balance or time location analysis, tabular spreadsheet, or database) for:

- (a) design;
- (b) approvals (including the CA's approvals and public authority approvals);
- (c) procurement or manufacturing;
- (d) delivery;
- (e) installation;
- (f) construction of key aspects of the works; and
- (g) testing and commissioning.

- 1.4 Explanatory records: these explain in words, graphics, and spreadsheets key considerations and assumptions underpinning the programmes (in particular the Accepted Programme). These records are used to establish the Contractor's plan in detail and explain the activities in the programmes and how their durations, logic and sequences were determined. Examples include:
- (a) programme narrative (setting out the assumptions underpinning the Contractor's proposed programme including, at a minimum, key resources, risks, sequencing restraints, and the critical path);
 - (b) narrative of each Updated Programme or proposed revised programme describing key changes to the sequence of the works or as-built data from the last Updated Programme, and the critical path, along with identification of any delay or disruption events impacting progress;
 - (c) progress curves for costs, resources and physical construction;
 - (d) tabular report of milestone dates scheduled, forecast and actual;
 - (e) as-built database for each activity in the Accepted Programme (cross-referenced to the progress records listed under category 2 below);
 - (f) Building Information Modelling (BIM) files where BIM is being utilised for the works; and
 - (g) Marked-up drawings and sketches showing the anticipated completion and as-built dates for parts of the works.

2. Progress records

- 2.1 These records identify the progress of the works at a particular time. There are a number of sub-categories of progress records as set out below.
- 2.2 Raw data records: these are records which ought to be compiled on a regular basis, normally daily for anything other than very small projects, which record how relevant parts of the works are being carried out. They are at the heart of establishing progress achieved before, during, and after periods of delay or disruption. Below are examples of these records:
- (a) reports (for each major work area recording weather conditions, manpower, deliveries of key materials, discovery of adverse site conditions, working hours, major plant and equipment used, and work activities underway);
 - (b) health, safety, environmental and/or security issues log;
 - (c) obstruction data (recording obstructions or impediments to planned progress at specific work fronts, clearly identifying the obstruction start and finish date, daily status at the work front, and the area of the works and programme activities impacted);
 - (d) evidence of area handovers between contractors/others, clearly identifying which contractor/other party is in possession of each work area at what time;

- (e) geological mapping records;
 - (f) inspection requests/inspection reports;
 - (g) site test records;
 - (h) testing and commissioning records (including certificates);
 - (i) web cam footage; and
 - (j) progress photographs (with date taken and if possible GPS coordinates).
- 2.3 Compiled records: these are records prepared from the raw data records and programme records. Compiled records set out a summary and interpretation of the raw data and the conclusions to be drawn. These include:
- (a) detailed monthly progress reports (which are required as a minimum in terms of progress reporting);
 - (b) weekly progress reports setting out the following:
 - (i) overview of progress in the main work areas (including design and procurement or manufacturing);
 - (ii) work status in each area of the works (covering the relevant programme activities underway);
 - (iii) illustrations of progress achieved (such as drawing of pile locations with piles completed colour coded, level and section of concrete cast, and so on); and
 - (iv) weather reports issued from a reliable and relevant source (preferably on site).
- 2.4 Procurement records: these establish the procurement of materials and permanent equipment for the works and are required to demonstrate timely provision of such materials and equipment to support the Accepted Programme. Examples include:
- (a) quotations from sub-contractors and suppliers;
 - (b) supplier contracts (including any amendments);
 - (c) shipment records; and
 - (d) delivery records.

3. Resource records

- 3.1 Resource records document the labour, materials and equipment utilised on the works.
- 3.2 Labour and equipment allocation records set out on a daily basis in which areas specific labour and equipment worked and should correspond to, at least at a high level, the programme activities.

- 3.3 Equipment records should indicate if the equipment was active or inactive. If a piece of equipment was inactive, the records should explain the reason, such as undergoing routine maintenance. Where equipment is shared, this should be noted, along with the available hours.
- 3.4 A log of major materials deliveries should also be kept, which identifies the quantities of key materials available for use in the works.

4. Costs records

- 4.1 Costs records demonstrate the costs incurred in carrying out the works and assist in substantiating amounts claimed in delay and disruption claims. These records should be kept in the normal course of business and should be project specific.
- 4.2 An accounting and cost allocation system for the works should be established from the outset to split costs into the following headings as a minimum:
- (a) management;
 - (b) labour;
 - (c) plant;
 - (d) materials;
 - (e) sub-contractors; and
 - (f) non-staff overheads.
- 4.3 Costs records include:
- (a) internal cost reports;
 - (b) cost value reconciliation reports (or similar);
 - (c) payroll records;
 - (d) time sheets;
 - (e) labour agreements;
 - (f) monthly payment applications;
 - (g) regarding sub-contractors:
 - (i) sub-contract agreements;
 - (ii) sub-contractor correspondence;
 - (iii) claims made by sub-contractors and responses;
 - (iv) sub-contractor applications for payment; and
 - (v) details of all payments made to sub-contractors.
 - (h) regarding suppliers:
 - (i) supply agreements;

- (ii) supplier correspondence;
 - (iii) claims made by suppliers and responses;
 - (iv) supplier invoices; and
 - (v) details of all payments made to suppliers.
- (i) regarding the Contractor specifically, this includes the following head office records:
- (i) financial statements documenting annual head office general and administrative costs and revenue;
 - (ii) business plans for generating profit;
 - (iii) records regarding tendering history;
 - (iv) records regarding tendering opportunities; and
 - (v) internal meeting minutes to review future tendering opportunities and staff availability.

4.4 Any audited accounts should be retained.

4.5 Copies of all invoices should be kept in an easily retrievable filing system preferably with electronic copies.

5. Correspondence and administration records

5.1 This category refers to written communications regarding the management of the works and contract administration, along with registers of material communications. There are a number of sub-categories as set out below.

5.2 **Letters / emails:** this covers:

- (a) letters and material emails between parties involved in the works; and
- (b) other emails (including internal emails).

5.3 **Contract management:** this covers all notices or documents issued under the contract (with the exception of letters/emails and claims related records). Examples include the following:

- (a) CA instructions and confirmation of instructions;
- (b) early warning notices (and their close out);
- (c) variations/change requests or proposals;
- (d) bonds, insurance documents or guarantees; and
- (e) all other documents issued under or required by the contract (other than claims related records).

5.4 **Technical:** these records are the technical documentation submitted during the course of the works, along with the final documentation submitted by the

Contractor. Technical records encompass the design, procurement and manufacturing, and construction methods for the works. Technical documentation is needed to demonstrate compliance by the Contractor with the contract drawings and specifications and the Employer's requirements. They are also needed to document any changes. Examples include the following:

- (a) submission logs (including date of submission, date of response, status, and follow up required) and the underlying documentation for:
 - (i) design drawings and calculations;
 - (ii) method statements;
 - (iii) sub-contractor approval requests;
 - (iv) material submittals;
 - (v) shop drawings; and
 - (vi) requests for information and responses.
- (b) approvals by the CA;
- (c) agendas for and minutes of meetings (including requests for amendments by the party(ies) not issuing the minutes). The types of meetings for which there may be agendas and minutes include the following:
 - (i) design;
 - (ii) construction progress;
 - (iii) programme review;
 - (iv) management;
 - (v) health & safety, environmental and security; and
 - (vi) quality;
- (d) deficiency/non-compliance notices (and their close out);
- (e) as-built drawings/documents; and
- (f) operations and maintenance manuals.

5.5 **Milestones:** these are written communications regarding milestones being achieved and include:

- (a) taking over certificates/snagging lists;
- (b) the Contractor's request for a certificate that the works are complete (and the CA's response including a report on any areas of disagreement with the Contractor's request for a certificate that the works are complete); and
- (c) the CA's certificate that the works are complete.

- 5.6 **Claims:** Examples of these records are as follows:
- (a) EOT claims/responses (including the CA's determinations);
 - (b) claims for additional payment/responses (including the CA's determinations);
 - (c) notices of dissatisfaction with determinations;
 - (d) referrals to further stages of the dispute resolution procedure; and
 - (e) documents produced for the purposes of further stages of the dispute resolution procedure.
- 5.7 Delay and disruption claims should be supported by proper particulars and substantiation so that the CA can understand the claim and how any other delay and disruption events might impact upon the time and costs being claimed. This substantiation should include appropriate programming analyses.

6. Contract and tender documents

- 6.1 The contract and tender documents are key source documents for establishing entitlement and the quantum of compensation for delay and disruption events. They establish the Contractor's requirements in carrying out the works and the assumed baseline in terms of time and costs for carrying out the works.
- 6.2 Contract documents typically include:
- (a) contract agreement (which is the overarching document signed by the parties);
 - (b) correspondence relating to the contract negotiations (including any letter of intent and letter of award);
 - (c) conditions of contract (general conditions and special/particular conditions);
 - (d) specifications and the Employer's requirements;
 - (e) drawings;
 - (f) schedule of prices or bills of quantities; and
 - (g) the Contractor's tender submission and any clarifications to that submission.
- 6.3 The order of priority in case of conflict between the documents should be set out in the contract agreement.
- 6.4 Tender documents consist of documents produced or issued by both the Employer and the Contractor pre-contract and include the following:
- (a) instructions issued by the Employer to tenderers, including a draft copy of the contract;

- (b) any clarifications issued by the Employer regarding those instructions or the draft contract;
- (c) submissions from all tenderers (technical and commercial submissions), including the Contractor's submission, and all clarifications to those submissions;
- (d) the Contractor's tender build-up (including all estimating information);
- (e) the Employer's tender evaluation; and
- (f) the Employer's calculations for any liquidated damages rates in the contract.